

# A Distributional Approach to U.S. Personal Consumption Expenditures: An Overview<sup>1</sup>

Thesia I. Garner, Robert S. Martin, Brett Matsumoto, and Scott Curtin

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## Abstract

We distribute Personal Consumption Expenditures (PCE) across households in the U.S. using microdata from the Consumer Expenditure Surveys (CE) for the period 2017-2021. Since the CE mainly collects data on out-of-pocket spending, we supplement it with imputations based on other survey and administrative data to better match PCE definitions, particularly with respect to health care. Over the study period, out of the total PCE (excluding expenditures by non-profits serving households), the bottom 20% accounted for between 8.4% and 9.5%, while the top 20% accounted for 39.4-41.6%. The 90/10 ratio for equivalized PCE ranged from 3.3 to 3.7, and the Gini coefficient from 0.31 to 0.33.

*Keywords:* Distribution, Personal Consumption Expenditures, Consumer Expenditure Survey

*JEL Codes:* D3 Distribution  
E01 Measurement and Data on National Income and Product Accounts and Wealth & Environmental Accounts  
E21 Consumption, Saving, Wealth

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# 1. Introduction and Related Work

We use microdata from the Consumer Expenditure Surveys [U.S. Bureau of Labor Statistics 2022] to estimate the distribution of Personal Consumption Expenditures, a measure of consumer spending on goods and services which is part of the U.S. National Income and Product Accounts (NIPA) [U.S. Bureau of Economic Analysis 2023b]. Researchers and policy makers have long studied distributions of economic well-being, often based on income, consumption, and wealth. Microeconomists have often studied the population distributions of these outcomes focusing on the household or individual as the unit of analysis and primarily using survey microdata. Macroeconomists, on the other hand, have typically examined economic well-being via national accounting aggregates or derived measures like Gross Domestic Product per capita. Macrodata have certain advantages. For instance, national accounts aggregates leverage a variety of data sources including household surveys, business surveys, economic censuses, and government sources. They are also embedded within a balanced framework which offers a comprehensive and consistent view of income, consumption, and wealth across the different sectors of the economy. However, these aggregates often cannot be directly linked to specific households or demographic groups, precluding any distributional analysis. Household survey microdata, on the other hand, do provide a basis to estimate distributions and inequality but may not capture hard-to-measure concepts which are nonetheless part of the macrodata's scope.

After integrating PCE macro aggregates with CE microdata and augmenting the latter with additional survey and administrative source, we estimate the distribution of PCE for each year of the 2017-2021 period. Out of total PCE (excluding expenditures by non-profits serving

households), we find the bottom 20% of households (as ranked by adult-equivalized PCE) accounted for between 8.4% and 9.5%, while the top 20% accounted for 39.4% to 41.6%. The 90/10 ratio for equivalized PCE ranged from 3.3 to 3.7, and the Gini coefficient from 0.31 to 0.33.

Our project is part of extensive, ongoing efforts to bridge the gap between microdata and macro concepts while studying distributions of economic well-being. We refer interested readers to a previous related paper [Garner, et al. 2022], which reviews this literature in greater detail. Since the work of Stiglitz, et al. [2009], researchers have paid greater attention to the joint distribution of income, consumption, and wealth to better describe the material living standards of households and individuals. A recent example is Fisher, et al. [2022], which uses the U.S. Survey of Consumer Finances (SCF). The SCF captures the tops of the income and wealth distributions better than the CE, but the authors must impute a measure of consumption expenditure based on CE data due to incomplete coverage in the SCF itself. As our project focuses on consumption expenditures, we base our analysis on the CE as it is the most comprehensive and detailed source of expenditure data for the U.S. Our work is part of a broader effort to produce distributional statistics in line with national accounts, currently spearheaded by the Organization for Economic Cooperation and Development (e.g., see Zwijnenburg, et al. [2021]) and involves close collaboration with the BEA, which also produces estimates of the distribution of personal income [U.S. Bureau of Economic Analysis 2023a].

We also build on earlier work which compares or integrates CE and PCE. For instance, the BLS routinely produces comparisons between CE and PCE [U.S. Bureau of Labor Statistics 2019]. Much like Passero et al. [2014], these analyses focus on comparable expenditures only,

while we make additional imputations and adjustments to better reflect PCE definitions using CE data. Similar research distributing national accounts using CE data includes McCully [2014] and Gindelsky [2020]. In addition to using more recent data, we improve upon these earlier works by also integrating the CE Diary (instead of only using the Interview). We also impute the value of health insurance from third party payers (e.g., employers, government) to CE respondents using reported plan participation and additional survey and administrative datasets covering health expenditures. In contrast, Gindelsky [2020] uses only out-of-pocket CE spending, while McCully [2014] uses a mixture of CE data and additional third-party spending variables imputed using the Current Population Survey Annual Social and Economic Supplement. Finally, compared to our earlier work in Garner, et al. [2022], this version uses more extensive and detailed imputation of PCE categories not well-covered by the CE, as well as a Pareto adjustment designed to better represent spending at the upper end of the distribution.

## 2. Data and Methods

For this study, we distribute yearly PCE across households using repeated cross sections from the CE.<sup>2</sup> In this section, we sketch the process of combining CE and PCE data to create distributions of PCE. We refer interested readers to Garner, et al. [2023] for more complete descriptions. We construct our integrated CE-PCE dataset to match the level of detail from NIPA

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<sup>2</sup> Technically, the CE samples “consumer units”, which have a slightly different definition from households (see U.S. Bureau of Labor Statistics [2022] for details). For this paper, we generally refer to “households” for simplicity, but when discussing the CE and our analysis, we mean consumer units. Consumer units correspond one-to-one with households in approximately 97% of observations.

Table 2.3.5 “PCE by Major Type of Product.” These estimates are nominal, without adjustment for inflation or regional price disparities.<sup>3</sup>

The bulk of the data processing consists of reconciling differences in purpose, coverage, and scope between the CE and PCE datasets (see Passero, et al. [2013] for a detailed discussion). The CE collects mainly out-of-pocket spending on goods and services by U.S. households, consisting of purchases from private businesses, as well as some purchases from other households (e.g., for used cars). On the other hand, PCE measures purchases by and on behalf of households from sellers outside the household sector. In addition to purchases from private businesses, it includes purchases financed by third-party payers on behalf of households, as well as spending by non-profit institutions serving households (NPISHs). Third-party payer expenditures include those for employer-paid health insurance, medical care financed through government programs, and financial services (such as banking services) that benefit households but for which they do not pay directly. CE and PCE are also based on slightly different household populations [U.S. Bureau of Economic Analysis 2021; U.S. Bureau of Labor Statistics 2022].

We start with a basic mapping of CE to PCE product categories which is maintained by BLS for the purposes of making CE-to-PCE comparisons [Bureau of Labor Statistics 2019]. Unlike these studies, which focus on comparable categories only, we make several additional adjustments and imputations to bring the CE data in line with PCE definitions as much as

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<sup>3</sup> Equivalizing across households based on regional price parities is a potential avenue for future research. However, real spending based on chain-type quantity indexes over time at the household level are infeasible with repeated one-year cross sections because they require expenditure shares for prior years.

possible. For example, we exclude used car purchases from private households from the CE data. We also impute categories not collected in the CE using a variety of data sources, including government survey and administrative sources (health care), and by using other out-of-pocket spending as indicators (e.g., financial services furnished without payment). As the CE does not have information on benefits received from NPISHs, we only distribute the household consumption expenditure components of PCE explicitly (lines 2-12, 14-21 of NIPA Table 2.3.5). Our results do include PCE aggregates which include spending by NPISHs (lines 1 and 13), but in these cases, the NPISH portion of these (line 22) has been distributed so as to not change the overall distribution. Due to data limitations, we also do not make any adjustments for differing population definitions between CE and PCE.

We base our distributional estimates on the CE Interview samples, weighted to represent the U.S. population. The Interview survey has a three-month recall period and is designed to cover major purchases, such as rent and automobiles. Households are interviewed once every three months, on a rolling basis, for up to four consecutive quarters. The CE also has an independent Diary survey which covers minor and more frequently purchased items (such as food) with a recall period of one week. The Interview and Diary overlap for some categories, though the level of aggregation, frequency, and reliability may differ. We choose to represent about 95% of total CE-defined spending using the Interview, relying especially on its global food questions. To represent the remainder, we use a statistical matching procedure.

There are some challenges to using the CE Interview to represent annual expenditures at the household level. Observations enter and exit the sample on a rolling basis and may provide fewer than twelve months of expenditures due to nonresponse. For these reasons, the

number of observations corresponding to a precise calendar year is relatively small—only about 300 in 2019. To create larger samples for a calendar year, we include all units whose reference periods started as early as November of the year prior or ended as late as February of the next year, provided they completed at least two quarterly interviews. This yields 6,000-8,000 observations for a given year. If a household completed fewer than four quarters, we scale up their expenditures to represent one year, and we recalibrate the sampling weights to match average household and person demographic characteristics from the Current Population Survey.

Even after imputations to capture spending which is out-of-scope to the CE, weighted sums by category still tend to be less than the PCE aggregates. Without further adjustment, this gap is unlikely to have the same distribution over households as the spending already captured in the microdata. In fact, it is likely the microdata understate inequality in consumption expenditures due to sampling and potential underreporting by higher income and expenditure households, as argued by Fisher, et al. [2022] and elsewhere. To mitigate the understatement of inequality, we apply an additional adjustment to the top 5% of households ranked by total spending after other adjustments and imputations. The adjustment is based on random draws from a type-I Pareto distribution, applying insights from Zwijnenburg, et al. [2022]. Following this, we apply category specific scaling factors so that the weighted totals by major product group match BEA’s published estimates. This scaling, referred to as “proportional adjustment,” follows OECD guidelines and implicitly allocates the remaining gap between CE and PCE totals in proportion to the underlying micro data.

Finally, for use in distributional statistics, we create a ranking of households based on their total expenditure (after all adjustments, imputations, and scaling) equivalized by dividing by the square root of family size. Equivalization recognizes economies of scale inherent to household consumption and facilitates better comparisons between households of different sizes. Many of our results pertain to household groupings based on these rankings (e.g., the bottom quintile, or the top percentile). The rankings and subsequent statistics use the CE sampling weights, which we have recalibrated for our subsample.

### **3. Results**

We find over the 2017-2021 period, PCE was far from equally distributed, with substantial heterogeneity by product category. As shown in Figure 1 and Table 1, out of total nominal PCE (excluding expenditures by non-profits serving households), we find the bottom 20% (as ranked by adult-equivalized PCE) accounted for between 8.4% and 9.5%, while the top 20% accounted for 39.4%-41.6%. The top 1% accounted for a similar proportion of consumption expenditures as the bottom 20% and in fact exceeded it in three out of the five years of our study period. The shares of spending by each quintile were mostly stable, with the exception of 2020 and 2021. Figure 2 shows how the changes in the spending accounted for by each grouping compare to the overall percent change in nominal PCE.<sup>4</sup> In 2020, spending was slightly more equal as the spending attributed to the top two quintiles fell sharply, while the share attributed to the bottom three quintiles rose slightly. This was partially a result of

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<sup>4</sup> Note, our household samples are repeated cross sections, so while we can compare the shares of PCE accounted for by the 0-20% group in 2020 versus the 0-20% group in 2019, we cannot make statements about the change over time in expenditures for a particular year's group.



government transfers aimed at the lower end of the distribution, and partially because of other factors such as decreased opportunities for travel, leisure, and hospitality, which disproportionately affected spending at the upper end of the distribution. In 2021, however, while PCE levels were higher across the whole distribution, the share accounted for by the top quintiles increased to pre-pandemic levels.

Figure 3 and Table 2 summarize different measures of inequality. Figure 2 plots three well-known inequality indexes—the Gini, Theil’s T, and Theil’s L (mean log-deviation). These inequality indexes are a way to concisely measure the degree of inequality with higher values corresponding to greater inequality. All three, while dipping noticeably in 2020, had flat trends over the study period. The Gini coefficient ranged from 0.31 to 0.33, Theil’s T from 0.21 to 0.27, and Theil’s L from 0.16 to 0.19. From Table 2, the mean of equalized PCE exceeded the median by over 20% each year. Also reflecting this skewed distribution, the 90/10 ratio ranged from 3.3 to 3.7, while the 50/10 ratio was less than 2. While far from equal, we find that inequality in PCE is less than that of personal income. For instance, BEA estimates the Gini index for personal income to be between 0.42 and 0.45 over the 2017-2021 period, with 90/10 ratios ranging from 4.8 to 5.6 [U.S. Bureau of Economic Analysis 2023a].

The detailed expenditure categories show varying degrees of inequality. Figure 4 describes the composition of PCE for the five quintiles of equalized expenditure in 2021. For instance, the bottom quintile spent 31% of its total PCE on Nondurable Goods, whereas the top quintile only spent 16.6%. Lower quintiles also directed a higher share of their spending toward health care services (21.9% for the bottom quintile and 11.7% for the top quintile) and housing services (20.5% for the bottom quintile versus 17.0% for the top quintile). Because higher

quintile households account for a greater share of total PCE, however, they still accounted for a disproportionate amount of overall Health Care and Nondurable Goods PCE. On the other hand, the lower quintiles spent relatively less on Durable Goods (4.6% for the bottom quintile versus 19.9% for the top quintile) and Other Services (22.0% for the bottom quintile versus 34.7% for the top quintile). Figure 5 shows concentration curves for select PCE product categories. The convexities of the curves indicate the degrees of inequality reflected in the distributions, with the 45-degree line corresponding to perfect equality. Health Care Services was the most equally distributed in 2021, followed closely by Nondurable Goods, while Durable Goods was the least equally distributed. As discussed earlier, the PCE for Health Care Services includes third-party payments on behalf of households, including employer and government-sponsored health plans.

## **4. Conclusions and Future Work**

We leverage Consumer Expenditure Surveys data to tell a more complete story of PCE in the U.S. national accounts. The distribution of PCE is far from equal—in 2021, for instance, the top 20% accounted for over 40% of spending. Categories like motor vehicles and recreation services are quite skewed toward the upper end, while others like health care services, while not equally distributed, have a shallower gradient. Summary measures of inequality like the Gini index dipped in 2020 with the COVID19 pandemic, but they reversed their declines in 2021 as recovery in overall spending levels was disproportionately accounted for by the upper end of the distribution.

Our methods of linking microeconomic data to macroeconomic concepts are still in development. One particular concern for estimating inequality is the coverage at the upper end of the distribution. As a preliminary measure, we choose a simple adjustment based on the type I Pareto distribution, choosing a shape parameter based on income distribution work from Zwiijnenburg, et al. [2022], as well as our judgement. Other options are available, however. For instance, Zwiijnenburg, et al. [2022] also explore the more flexible generalized Pareto distributions, which are also used in Blanchet, et al. [2022]. The literature thus far has focused on Pareto adjustments for income distributions. One challenge we face with consumption expenditure adjustments is a lack of comprehensive administrative data with which to estimate the Pareto distribution parameters. One option may be to use the SCF, as in Fisher, et al. [2022], as this does a better job of sampling higher income households and therefore may better capture the top of the expenditure distribution. Finally, we plan to produce updated estimates for future years and will release the results on the BLS website [U.S. Bureau of Labor Statistics 2023].

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## Figures and Tables:

Figure 1: PCE by Equivalent PCE Groupings

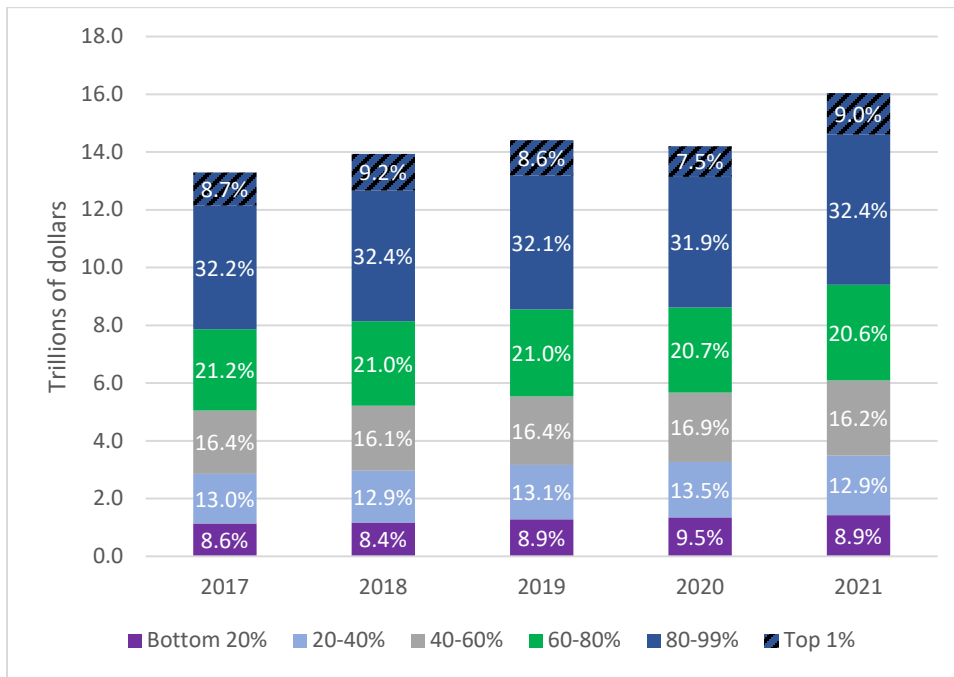


Figure 2: Contribution to Annual Growth in PCE less NPISH by Equivalent PCE Groupings

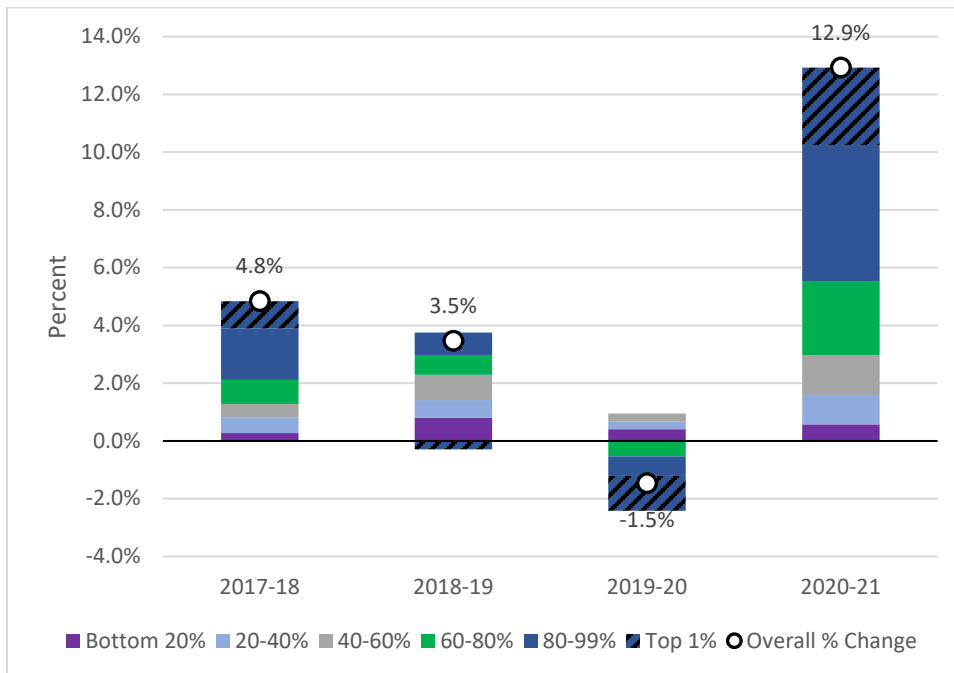


Figure 3: Measures of Inequality in Equivalized PCE

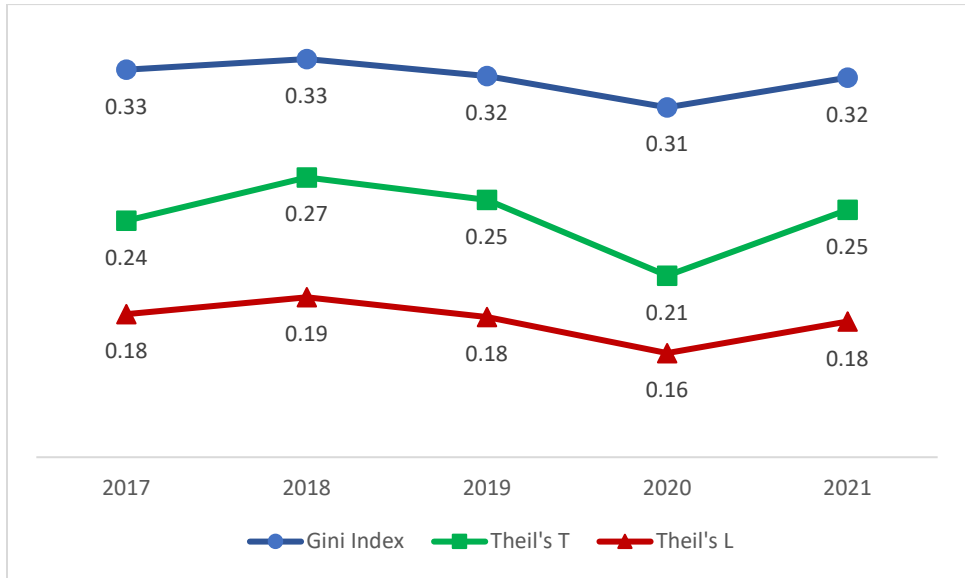


Figure 4: Composition of Personal Consumption Expenditures (2021, excludes NPISH)

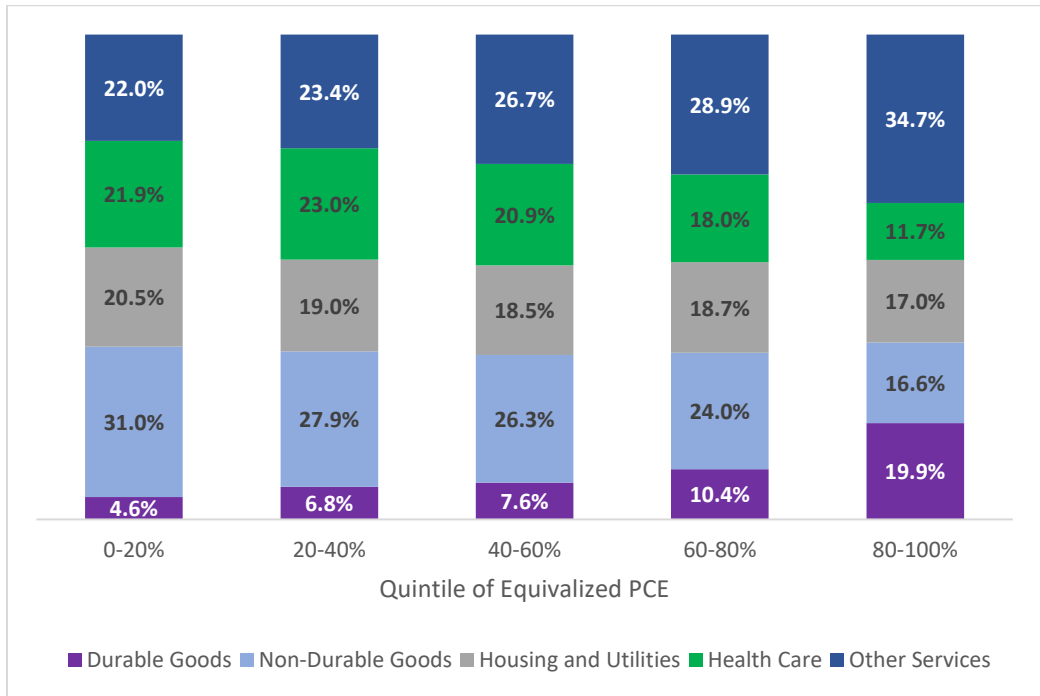
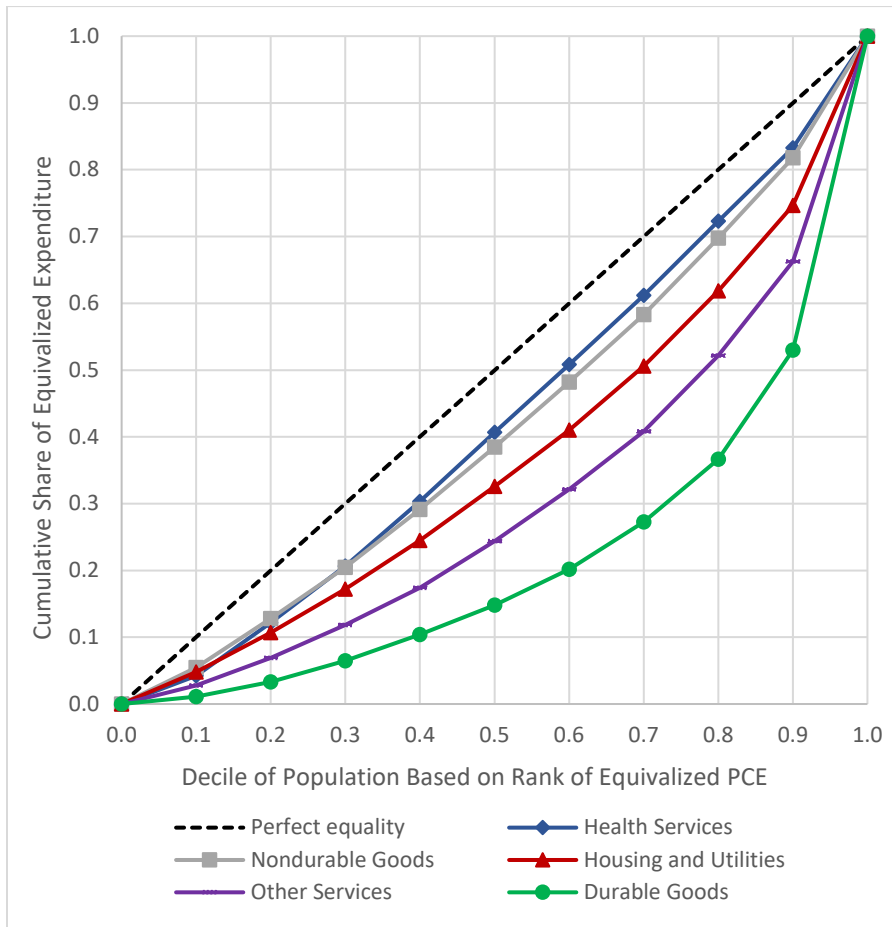


Figure 5: Concentration Curves of PCE Categories, 2021



	Total (Billions)	0-20%	20-40%	40-60%	60-80%	80-100%
2017						
Personal Consumption Expenditures	\$13,291	8.6%	13.0%	16.4%	21.2%	40.9%
Durable goods	\$1,416	3.7%	7.0%	11.4%	19.7%	58.2%
Nondurable goods	\$2,796	11.8%	16.0%	19.1%	22.2%	31.0%
Services	\$9,078	8.3%	13.0%	16.4%	21.1%	41.2%
2018						
Personal Consumption Expenditures	\$13,934	8.4%	12.9%	16.1%	21.0%	41.6%
Durable goods	\$1,489	3.6%	6.9%	11.3%	18.6%	59.6%
Nondurable goods	\$2,925	11.7%	16.2%	18.8%	22.2%	31.0%
Services	\$9,520	8.2%	12.8%	16.0%	21.0%	42.0%
2019						
Personal Consumption Expenditures	\$14,418	8.9%	13.1%	16.4%	21.0%	40.7%
Durable goods	\$1,523	3.8%	7.8%	11.7%	21.2%	55.5%



Nondurable goods	\$3,006	12.3%	16.3%	19.0%	22.0%	30.4%
Services	\$9,888	8.7%	12.9%	16.3%	20.6%	41.5%
2020						
Personal Consumption Expenditures	\$14,206	9.5%	13.5%	16.9%	20.7%	39.4%
Durable goods	\$1,629	3.9%	7.6%	12.3%	18.3%	57.9%
Nondurable goods	\$3,084	12.6%	16.4%	19.3%	22.0%	29.8%
Services	\$9,493	9.4%	13.6%	17.0%	20.7%	39.3%
2021						
Personal Consumption Expenditures	\$16,043	8.9%	12.9%	16.2%	20.6%	41.4%
Durable goods	\$2,006	3.2%	6.8%	9.6%	16.6%	63.9%
Nondurable goods	\$3,500	12.3%	16.0%	19.0%	22.1%	30.7%
Services	\$10,536	8.9%	13.0%	16.6%	20.9%	40.7%

	2017	2018	2019	2020	2021
Equivalized Mean	\$68,052	\$70,635	\$73,118	\$72,199	\$80,170
Equivalized Median	\$55,233	\$57,050	\$59,379	\$59,991	\$65,002
Top 5% Share	0.188	0.195	0.191	0.179	0.192
90th Percentile/10th Percentile	3.65	3.65	3.47	3.32	3.46
50th Percentile/10th Percentile	1.87	1.87	1.82	1.77	1.79