Inequality in Living Standards since 1980

Income Tells Only a Small Part of the Story

Orazio P. Attanasio
Erich Battistin
Mario Padula

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Foreword

Nicholas Eberstadt

Economics is the study of welfare maximization under resource constraints. For the better part of the past two centuries, economic analysts have investigated patterns of household and individual well-being—and the strategies households and individuals devise to maximize their well-being under resource constraints—through the conjoint study of a household's income and its consumption (with the latter typically proxied by expenditures).

The milestones in this intellectual effort are well known. In the nineteenth century, for example, German economist and statistician Ernst Engel famously demonstrated that Belgian households with higher income levels allocated a progressively lower proportion of their overall income to expenditures on food and nutrition: thus his "Engel coefficient" (the share of food expenditures within a household's overall budget) provides an indication of household living standards that is still used today.

In the twentieth century, pioneering work by Nobel Laureates Milton Friedman (with his "permanent income" hypothesis), Franco Modigliani (the "life cycle income" theory), and others persuasively established that consumer expenditures at any given point in time were dependent upon a household's expectations about their income prospects in years ahead, and not just their immediate income inflows. A household's annual level of consumption, in other words, could exceed its annual income level for entirely rational, welfare-maximizing reasons, if that household were planning for the long run. Reliance on income data or consumption data alone, these theories emphasized, could provide a highly misleading

impression of a household's self-assessed well-being, as well as its actual living standards: joint analysis of income and consumption patterns would be necessary for a more reliable picture of these dynamics.

Despite these crucial insights, the study of household well-being in the United States—and by extension, the study of livings standards, poverty, and economic inequality in America—has become increasingly "one-sided" over the past several generations. Instead of jointly examining household income and consumption patterns, scholars and researchers have typically focused on income trends alone. (There are exceptions to this generalization, to be sure, but they are just that: exceptions.)

The explanation for this tendency to study America's income patterns in detail while neglecting or even ignoring the country's attendant patterns of household consumption in large part has to do with what might be called "data opportunism." Simply put, work in this field has been strongly influenced by the brute fact that modern America has an abundance of relatively high-quality data sources that provide great detail about U.S household income patterns, while offering little or no corresponding information on consumption patterns. First and foremost among such sources is the U.S. Census Bureau's Current Population Survey (CPS). This database—the one most commonly used today for the analysis of trends on living standards, poverty, and inequality in contemporary America—makes no effort to represent the expenditure patterns for the families and individuals it surveys.

Conversely, contemporary U.S. data sources that attempt to track household patterns of consumption and expenditures are commonly regarded by specialists as problematic in a number of technical respects. The most important database on U.S. household consumption patterns is the U.S. Bureau of Labor Statistics' Consumer Expenditure Survey (CEX)—but for most of the twentieth century this survey was conducted episodically, roughly only once each decade, and was used primarily for adjusting the weights of the basket of goods used to calculate the Consumer Price Index. For the past quarter of a century, the CEX has been conducted annually, and it gathers detailed household data on both income (more specifically, wages and earnings) and consumption (meaning here the breakdown of expenditures on both durable and nondurable goods). But the CEX data on income are widely regarded as spotty and incomplete, an impression reinforced by the Bureau of Labor Statistics itself, which still cautions against the use of CEX data for analysis of U.S. household income trends.

In economics, public policy, and the allied social sciences, research strategies are naturally conditioned by data availability. The perceived abundance of U.S. data on household income, along with the widely held perception that contemporary U.S. data on household expenditures are more sparse and difficult to use, seems to have contributed to a curious intellectual fashion among contemporary labor economists, poverty analysts, and others: namely, that it should be entirely acceptable to describe current U.S. trends in living standards, poverty, and inequality by reference to income data alone, without recourse to data on actual patterns of household consumption or expenditures. This assumption is seldom stated explicitly, yet it is pervasive, perhaps predominant, within the literature. This is so even though we know that reliance on income data in the absence of corresponding household consumption and expenditure data can only result in a much less nuanced assessment of actual household conditions—and quite possibly, in skewed or even positively misleading assessments.

This is the present conundrum of research on poverty and inequality in modern America. Fortunately, in the following monograph, intellectual allies from the other side of the Atlantic take a major step toward resolving it. In the following pages, European scholars Orazio P. Attanasio, Erich Battistin, and Mario Padula provide an original and important analysis of CEX survey data, using ingenious and sophisticated quantitative methods. They demonstrate, to begin, that CPS and CEX data on household income (wages and earnings) in fact conform closely, with CEX trends and levels on household income corresponding remarkably well to results derived from the CPS survey for the period 1982–2003. In so doing, they establish that the CEX can indeed be regarded as a reliable source for levels and trends in American household income (to the extent, that is, that the CPS itself is a reliable source for discerning such trends today—an important but somewhat different issue). Having established the inherent reliability of the CEX data for analysis of U.S. household income trends, they then investigate what the CEX survey can tell us about trends in U.S. living standards and inequality from the consumption perspective.

By jointly analyzing U.S. household trends in income and consumption, Attanasio, Battistin, and Padula uncover at least four findings that require attention from interested scholars and concerned policymakers.

First, while consumption inequality in America does appear to increase during the period under consideration, its increase is much more limited than the increase in income inequality. That is to say, only a fairly small fraction of the increase in income inequality appears to translate directly into an increase in consumption inequality.

Second, the relationship between wage changes and consumption changes for U.S. households appears to become progressively weaker during the years under consideration. Indeed, for the years 1992–2003, changes in wages seem to have almost no influence on changes in household expenditure patterns.

Third, the relationship between current income levels and current consumption levels is weakest for American households at the lowest end of the income distribution (where, in fact, reported spending typically exceeds reported income in any given year).

Fourth and by no means least important, income data and consumption data provide very different perspectives on just who is poor in modern America. Whether one uses earnings or wages as the income criterion, fewer than one third of U.S. households in the bottom income quintile are also in the bottom consumption quintile—while well over half of those bottom-income-quintile households rank in the top 65 percent of the consumption distribution. The results are in some respects even more striking for the bottom income decile—far fewer than one sixth of whose members also fall within the bottom tenth of the distribution for consumption, and over half of whose members are found in the top two-thirds of the consumption distribution.

Such findings would seem to qualify significantly the received wisdom about living standards, poverty, and inequality in modern America. For one thing, they suggest that the current one-sided focus on income numbers may have led to a somewhat exaggerated sense of the widening of economic disparities within the country in recent decades—certainly to an overestimate of widening differences in living standards, as represented by levels of household consumption. For another, they persuasively underscore the point, too often overlooked today by scholars and policymakers alike, that "counting the poor" (to borrow a phrase from the late Mollie Orshansky, the progenitor of the official income-based poverty measure that is still used for this purpose today) is by no means as straightforward a task as many seem

to assume. As the authors remind us more than once, many Americans who are "income poor" are not "consumption poor."

In addition, the study implicitly underscores both the availability and the importance of mechanisms and institutions (what the authors call "instruments") in America today to help households adjust to income fluctuations and thus to buffer or stabilize their consumption levels (and so their actual material living standards) in the face of income shocks or turbulence. Though the authors do not enumerate or analyze these "instruments," these likely include (among other facilities) personal savings and wealth, government welfare programs, and access to lending through financial markets. Taking stock of, and increasing our understanding of, the instruments that facilitate this crucial interplay between income and consumption in modern America would seem essential for enhancing our understanding of the dynamics of poverty and inequality, among other things.

While the monograph by Attanasio, Battistin and Padula skillfully draws information from the CEX survey, there remain some curiosities and seeming quirks in the CEX dataset that are worth noting here. For one thing, these CEX data seem to suggest that real consumption levels for American households actually stagnated between 1982 and 2003, even after appropriate adjustments for household size and composition. Indeed, the author's own disaggregated estimates for household consumption by educational status indicate that total real consumption levels fell between 1982 and 2003 for households headed by high school dropouts, but that long-term consumption did not appreciably increase for high school graduates or even college graduates. (Were the 1980s and the 1990s really an era of zero growth in consumption for America? Is an overestimate of the CPI sufficient to explain this apparent anomaly?) For another, the CEX data seem to point to greater growth of income than consumption over those same years: tendencies that would imply a rising household savings rate, whereas the prevailing understanding is that U.S. personal savings rates declined over those years. Moreover, the analysis in this monograph seems to suggest that only a very small proportion of U.S. households spent more than they earned in any given year, while a number of other CEX-based studies have concluded that a much higher proportion of the U.S. public—perhaps one third or more—spends more than

its annual earnings. All of these are matters that merit further detailed study with rigorous analytical techniques.

Attanasio, Battistin, and Padula are attentive to the shortcomings of existing data on American household expenditures (for example, the CEX's limited sample size, and the discrepancies between the CEX's interview and diary components). Indeed, their study is a model of how these limitations can be surmounted by masterful analysis—and thus stands as an invitation to further such research for enhancing our understanding of economic conditions in America today. But the authors also call for the United States to develop more detailed, accurate and timely national statistics in this area. In their words,

> While it is true that over the last twenty years the reliability and quality of many individual-based surveys seems to have worsened, the case of U.S. consumption is particularly serious because the largest economy in the world lacks a reliable and comprehensive survey that measures the main purpose of economic activity, namely consumption.

Better data on consumption patterns would serve a host of public purposes. A more effective and efficient targeting of public funds for anti-poverty programs is one of these purposes—an objective especially compelling at a time of deep economic recession—but it is just one of many potential benefits to the commonwealth.

One can only hope in the years ahead that the American public and its elected representatives will heed the call this monograph by foreign friends has so persuasively sounded.

Introduction

It is a commonplace assertion that economic inequalities in the United States have greatly increased in recent decades. The presumption is that the distribution of economic well-being has widened because those who are better off have improved their circumstances. Investigating and quantifying the claim that the United States has become much more unequal are important to our understanding of the operation of the American economy and therefore the design of economic policy. It is especially important to the design of welfare policies that aim to help those who are worst off in the distribution of well-being.

Indeed, the evolution of inequality in the United States has been widely investigated. A large literature has documented a substantial increase during the last thirty years in the distribution of wages and income in the United States as well as in other OECD countries. This increase was particularly rapid during the 1980s, and it continued, although at a slower pace, in the 1990s and 2000s. For instance, Autor, Katz, and Kearney (2007) report that the ratio of the 90th to the 10th percentile for full-time weekly earnings increased by about 23 percent between 1980 and 1992 and a further 12 percent between 1992 and 2003. The increase in wage and income inequality during the 1980s was accompanied by a decline in the wages and incomes of those at the bottom of the distribution.[1]

However, we argue that the picture of inequality in the United States offered by study of the evolution of income and wage inequality is at best a partial one. Although changes in inequality in wages and income are certainly germane to an understanding of inequality in the United States, we gain a better picture of the changes in inequality from an analysis of changes to the distribution of consumption and expenditure. Income, after all, is valued mostly because it allows consumption. Therefore, studying

consumption directly provides a better measure of distribution of well-being than study of income.

We further argue that studying the evolution of inequalities in consumption gives, when analyzed *together* with the evolution of inequalities in income, new insights about the factors that affect changes in income inequality and about the instruments individuals have to smooth out income shocks. Consider that when an individual receives a temporary (or perceived as such) income shock, she generally does not change her patterns of consumption. A temporary positive shock might be saved and a negative shock can be buffered by running down savings, borrowing, or using different forms of public and private transfers. On the other hand, a permanent change in resources, or a shock that is too big to be buffered with available instruments, will probably lead her to change her consumption. Hence, comparing the evolution of income and consumption inequalities can be informative about the instruments available to an individual or household for smoothing different types of income shocks. While establishing which instruments (such as individual savings, borrowing, and private and public transfers) are used for such a purpose is important, a necessary first step is to establish to what extent income shocks result in changes in consumption.

Moreover, recent empirical evidence for the United States and the United Kingdom has shown that consumption-poor households do not coincide with income-poor households. In particular, income-poor households report consumption levels far greater than their level of income.[2] Underreporting of welfare income and other informal sources of income may preclude a correct interpretation of the income dynamics at the bottom of the distribution. Moreover, the picture that emerges from the expenditure definition of poverty is quite different depending on the survey instrument considered. Because of this, it is desirable to use the distribution of both income and consumption to establish a better measure of the distribution of well-being.

In addition to the joint analysis of inequalities of income and consumption, the joint analysis of income and consumption *levels* can also be of considerable interest. We will consider the evolution of the *levels* of income and consumption for different groups of the U.S. population, and focus particularly on households headed by those with different levels of

academic achievement (high school dropouts, high school graduates, those with some college, and college graduates) as well as households headed by those born in different decades (the 1930s, 1940s, 1950s, and 1960s). The comparison between the average levels of different groups and their evolution over time constitutes an important dimension of inequality. In a sense, overall inequality can be decomposed into differences across groups and inequality within groups.[3]

While we argue that the analysis of consumption and expenditure is the best way to study inequality in the United States, there are good reasons that most studies of inequality have relied on information about the distribution of wages and income. Probably the most important one is the limited availability of reliable and comprehensive data about consumption and expenditure that cover the relevant periods and are of sufficient breadth to allow the construction of reliable measures of well-being and of inequality. Comprehensive surveys that collect information on expenditure and expenditure pattern have been available for a long time. The first version of the Consumer Expenditure Survey (CEX) was collected in 1916–17. Unfortunately, as the main use of these data was the computation of the weights for the Consumer Price Index (CPI), until the 1980s they were only collected at about ten-year intervals. Moreover, the methodology for collection was not homogenous. Starting in 1980, the CEX collected data continuously.

Despite this characteristic, the CEX still has important limitations. First, as we discuss below, the CEX data do not align with data from the National Income and Product Account (NIPA) data on Personal Consumption Expenditure (PCE). Indeed the relationship between aggregated CEX data and PCE data has worsened over time, and the gaps between the CEX and PCE data suggest that the CEX data may be unreliable. Moreover, the size of the CEX is quite limited, with only 5,000 households per year contacted between 1980 and 1998 (the size increased in 1999). This limited size makes the analysis of inequality and, in particular, the study of inequalities within and among different subgroups of the population problematic and imprecise.

Other surveys do collect information on individual expenditures. However, they have other, even more important, limitations than the CEX. The Panel Study of Income Dynamics (PSID), which was started in 1968 and is one of the most widely used surveys, collects only some information

on food expenditure and a few other items. Recently, the Health and Retirement Survey (HRS) supplemented its main core of data with a postal survey on consumption. However, the HRS is representative only of older individuals. In the end, therefore, with all its limitations, the CEX is probably the best source of information on consumption. We will strongly urge a revamp of the CEX that would improve its quality and increase its size.

Our main findings can be summarized in the following three points.

1. The dynamics of wages, income, and consumption inequality has been quite different over the past twenty-five years. While wage inequality (as measured by the standard deviation of logs) has increased by about 15 percent, income inequality has increased by about 10 percent and consumption inequality by about 7 percent. These figures, for a variety of conceptual and data problems discussed below, are not uncontroversial.

2. Individuals and households that are identified as income-poor are not necessarily the same as those identified as consumption-poor. For example, in table 5-1 in chapter 5 we find that 43 percent of households in the bottom 10 percent of the earnings distribution have consumption levels in the top 60 percent of the consumption distribution.

3. The dynamics of consumption and wage inequality, as measured by differences in means across groups defined by decade of birth and educational achievement, was very related until the early 1990s and much less so after that. In table 6-1, the correlation between wages and consumption means across groups, after removing fixed group and time effects, goes down from 0.88 before 1992 to 0.06 after that.

This monograph is organized in six chapters. In all chapters we keep technical details at a minimum and cite only the most important contributions in the literature. More details and citations are given at the end of some of the chapters in a short subsection titled "Further Readings."

In chapter 1, we present the methodological and conceptual issues. We examine the relation between consumption and income inequality and develop the arguments above. We first argue that measures of inequality based on consumption better reflect long-term differences in household and individual well-being. We also argue that the comparative analysis of consumption and income inequality is informative about the nature of insurance markets.

In chapter 2, we discuss measurement issues. We tackle three types of problems. First, we discuss the quality of our main data source, the CEX, and how it has varied over time. Second, we discuss the methods we use to combine the information from the two independent components that constitute the CEX. Finally, we describe how we adjusted the data for inflation, changes in household size, and how we estimated the service flows from durables.

In chapter 3, we report recent trends in wages and income inequality. We employ all the available data sources, trying to make sense of the sometimes conflicting evidence that comes out of them. Moreover, we identify socio-economic groups' specific trends and decompose overall inequality into its within- and between-group components. We particularly focus on the differences by decade of birth and education groups. Furthermore, we examine the degree of covariation of earnings within the household.

In chapter 4, we present evidence on expenditure and consumption inequality. We provide information both on nondurable and total consumption, starting with the narrowest definitions that include only nondurable and services, to the widest, which include the services provided by durables. Again, the analysis illustrates the overall pattern of inequality as well as patterns specific to decade of birth and education groups. This evidence (and that presented in chapter 3) is behind finding 1 mentioned above.

In chapter 5, we consider the differences in distribution of income and consumption, focusing in particular on the distribution of consumption at the bottom of the income distribution. We use this data to develop our finding 2 mentioned above.

In chapter 6, we relate the trends of consumption and income inequality. In particular, we consider both the relationship between the means (and their changes) of relative wages and consumption of different

groups and the relationship between the inequality *within* the same groups. This chapter contains our finding.[3]

In a short conclusion, we summarize our main results and offer some considerations for future research and about the need for high-quality data on consumption.

Further Readings

The evolution of wages and (to an extent) income inequality in the United States is now well documented. There is an enormous literature on the topic that we cannot hope to summarize here. Some of the best-known early papers on the topic are Katz and Murphy (1992), Murphy and Welch (1992), and Juhn, Murphy, and Pierce (1993). Some analysts have tried to decompose the increase in that part due to transitory and to permanent shocks. For example, Gottschalk and Moffitt (1994) have attributed one-third to temporary and two-thirds to permanent shocks. The rise in inequality has continued in the nineties, but at a slower rate. Gottschalk and Moffitt (1994), Gottschalk and Smeeding (1997), and Katz and Autor (1999) have related the increase in income inequality to an increase in the distribution of lifetime resources and in the volatility of high-frequency shocks. A recent paper that summarizes much of the literature and provides some new insights is Autor, Katz, and Kearney (2007).

Following Cutler and Katz (1991), several authors have used the CEX to study the evolution of consumption inequality. Attanasio and Davis (1996) showed that the evolution of consumption inequality across groups defined in terms of educational achievement of the household head mirrored closely the evolution of wage inequality. Since then, however, the picture has become murkier. Some authors, such as Krueger and Perri (2006), have claimed that consumption inequality has not increased much, while other authors, such as Attanasio, Battistin, and Ichimura (2007) as well as Blundell, Pistaferri, and Preston (2008) claim that consumption inequality has increased markedly.

The conflicting evidence brings us to the main problem with the analysis of consumption inequality: that of data quality. In developed economies, consumption is notoriously difficult to measure.[4] Thus, there are few

household-level databases containing detailed and high-quality information on consumption. Often, these databases are collected to obtain information used in constructing the weights for consumer price indexes. The United States is no exception in this respect. The CEX, which constitutes the only household-level source containing detailed and complete consumption information over the period we are interested in studying, has a number of problems. The sample size is not very large, and there are indications that the quality of the data has deteriorated over time (though very recent research from the Bureau of Labor Statistics provides a different view; see for instance, Garner et al., 2006). We discuss these issues at length in chapter 2.

1

Consumption Inequality versus Wage and Income Inequality

A starting point of our argument is that to obtain a better and comprehensive picture of the evolution of inequality in economic well-being it is important to go beyond a description of inequality in wages and income. We therefore start by discussing the theoretical reasons for this position. In particular, in this chapter we argue that:

- **A proper understanding of the evolution of the distribution of well-being requires the analysis of both the distribution of income and the distribution of consumption.** Shocks to income do not necessarily cause changes in consumption and well-being. Individuals can borrow, rely on past savings, or rely on public welfare to prevent income shocks from affecting consumption. Therefore, a temporarily low income does not necessarily induce low consumption and a decrease in material well-being. This makes consumption a useful measure of well-being, which does not require observing the actions individuals use to smooth out adverse income shocks.

- **To measure consumption, we will need to draw upon expenditure data.** However, expenditure data alone are not enough to measure well-being, because consumption and expenditure are two different concepts. Individuals' well-being depends on consumption, but data normally measure expenditure. For non-durable goods, such as food, expenditure can be taken as a good proxy for consumption. However, for durable goods such as

cars, fridges, and dishwashers, expenditure is a very poor proxy of consumption. The expenditure on durable goods is lumpy and infrequent, but individuals enjoy the services from such goods over a certain period of time even if the expenditure is zero.

- **The joint examination of consumption and income data provides valuable information on the evolution of the distribution of material well-being.** If consumption is lower than income, then part of the latter will be available for future consumption. If a change in income is not reflected in a change in consumption, then it is an indication that the household might be able to smooth out that particular income shock. Therefore, the dynamic aspect of individual choices can be only understood by the joint distribution of income and consumption.

Income versus Consumption

From an intuitive point of view, looking at the distribution of consumption should be the most profitable strategy to study the distribution of well-being. It is consumption that gives individuals utility, and, usually, income is appreciated because it makes consumption possible. More important, the consequences for the material well-being of an income shock depend on the ability an individual has to smooth it. If the shock is perceived to be temporary and if the individual can smooth it, its consequences will be small and consumption will not change (much). To achieve this, the individual will engage in some transactions (drawing upon savings, borrowing, receiving transfers from public or private sources) that might be difficult to observe or even to categorize. Observing consumption choices has the advantage to sidestep such transactions. And yet, a large majority of studies that have analyzed distribution issues have looked at income, rather than consumption, inequality.

Probably the main reason for the prevalence of studies that look at income is the availability of high-quality data. In addition to the scarcity of high-quality individual-level consumption data, however, there has probably been some resistance to new concepts and unfamiliar data.

In this monograph, we present extensive evidence based on expenditure data. These data are not exempt from problems, some of which we discuss extensively in chapter 2. However, it can provide very valuable information on the questions at hand and, in some respects, can be of superior quality to income data. Meyer and Sullivan (2004), for instance, argue that information on the bottom of the consumption distribution can be of better quality than the information on the bottom of the income distribution, as the former has a relatively simple structure, while the latter can be quite complex, as it includes, in addition to earnings, welfare transfers, interpersonal transfers, and informal income.

Consumption versus Expenditure

If our main motivation for looking at consumption rather than income is that it is the former rather than the latter that provides utility, the fact that often high-quality data are available only on expenditure and not on consumption is a problem. The two concepts differ for a variety of reasons. In the extreme case of large durable goods, what the individual consumes are the services provided by that good, while the expenditure represents the lumpy purchase of a unit of the good that occurs relatively infrequently. At the other extreme are cases of perishable food items that are consumed at the same frequency with which they are bought. In the middle there are many intermediate cases, ranging from storable food items, which may be bought in bulk, to clothing and footwear, which in many cases last more than a quarter or a year.

In principle we would like to observe for any commodity with some level of durability the service flow provided by the stock available to the consumer in addition to the flow of expenditure. Unfortunately, detailed information on stocks is rarely available in household surveys. In chapter 2 and appendix 2, we present some information on the stock of vehicles available to the consumers in our main data sources. This type of information, however, is more an exception than a norm.

We must then rely upon information on expenditure. The standard approach is to distinguish the expenditures for the acquisition of "nondurable" commodities and "services" from the expenditure for the

acquisition of durable commodities. Most of our analysis will be based on an aggregate defined as "nondurable and services." While we will occasionally refer to inequality in this aggregate as "inequality in consumption," we should keep in mind that this is only a proxy for total consumption. Where we can, we will use information on the stocks (such as in the case of vehicles).

The distinction between durables and nondurable goods and services is not merely academic if we are interested in the extent to which shocks to income are reflected in changes in consumption (and expenditure). As different commodities provide different types of services and utility and are characterized by different degrees of lumpiness in expenditure, it is likely that a consumer will adjust differently the expenditure on different items when facing a shock to income. There is some evidence, for instance, that expenditure on durables is much more sensitive to shocks than the expenditure on food: when facing a short-term income problem an individual is more likely to postpone the purchase of a new car than to reduce the amount of food her family eats.

There is some arbitrariness about whether a certain commodity is a durable or a nondurable: clothing is a good example of a commodity that could go in either group. And even for services, some items, such as health or education, should have (at least one hopes!) durable effects. In these cases, we exclude these expenditures from our basic "nondurable and services."

Analyzing Income *and* Consumption

Having stated that expenditure (or, more precisely, consumption) can provide more valuable information on the evolution and distribution of material well-being than income, it should be stressed that both variables are important. And indeed, we argue in chapter 6 that the joint consideration of income *and* consumption can be particularly informative.

When one considers the discussion in terms of joint movements in consumption and income, one immediately puts the issues in a dynamic context: if consumption is less than income, then part of the latter will be available for future consumption (and/or for consumption by other individuals). If consumption is larger than income, the individual must deplete her savings, borrow, or receive transfers from private or public

sources. In the first two instances, this implies a reduction of future consumption. In addition to the issue of allocating her resources intertemporally, she is also confronted with uncertainty about the future. In order to decide how much to consume and to save at each stage of their life cycle, consumers must be able to forecast their future income.

However, expected future income might or might not be equal to realized future income. Since individuals are reluctant to reduce their consumption, consumption is updated in the face of an income change only if such a change is expected to be permanent. Shocks, such as a sudden layoff or an illness, can cause income to be different from what was expected. If possible, individuals are likely to absorb these shocks either by drawing upon savings, saving less, or borrowing. Consumption therefore should react to income shocks, and the size of the change should depend on the nature of shocks. Only shocks to lifetime resources, such as a promotion or a permanent change in the remuneration of skills (perhaps induced by technological innovations) should entail substantial revision of consumption. The welfare consequences of transitory and permanent income shocks are therefore very different, and their balance depends on the availability of various smoothing mechanisms.

The relative importance of these instruments is different for different socio-economic groups. For example, participation in financial markets is related to education. Therefore, the more educated are more likely to use financial assets to buffer income shocks. On the other hand, taxes and other government programs, such as unemployment insurance programs, Medicaid, and food stamps, are more likely to be effective for the less well-off. We therefore describe in chapters 3 and 4 the dynamic of wage, income, and consumption inequality for various levels of education, which allows us to discuss the empirical relevance of the various instruments for smoothing income shocks.

Suppose, for instance, that the inequality of income increases because its temporary components have become more volatile. It might be more common to be laid off, although this might not necessarily mean a decrease in average earnings over a long period of time. Suppose, also, that an individual is aware of this situation and has access to a number of mechanisms that can help him or her to smooth out such shocks. In the cross-section, this means that inequality of income increases while inequality of

consumption will *not*. On the other hand, if the increase in the cross-sectional distribution of income reflects permanent shifts and/or the individual does not have the tools to buffer the shocks that hit her income, one should witness that the cross-sectional variance of consumption mirrors the increase in that of income. We therefore complement inequality measures based on income with measures based on consumption.

When we study the distribution of material well-being across individuals or households, the distributions of wages and income as measured by a cross-section at a point in time tell only part of the story. Suppose, for instance, that the distribution of wages among a population is caused in part by permanent differences (such as in abilities or skills) and in part by shocks caused by transitory events such as a layoff or illness.

Consider first a scenario in which the transitory events do not have persistent consequences: an individual hit by a negative shock is not more or less likely in the future to be hit by a similar shock. This implies that, within a group of individuals with a certain permanent level of income, one should observe a considerable amount of mobility: individuals with low levels of income today will not necessarily have low levels of income tomorrow. An alternative scenario is one in which shocks have persistent consequences. In this scenario, we would observe less mobility. An increase in the level of inequality (as measured, for instance, by the size of the shocks that individuals receive) would have very different consequences for individuals under these different scenarios: an increase in shocks in the high-mobility scenario would have much less severe consequences for inequality in well-being than the same increase in shocks in the low-mobility scenario.

In the previous paragraph, the difference between the low- and high-mobility scenarios followed from the different nature of income shocks. Another interesting set of scenarios is the following. In one scenario, an increase in income inequality is caused by an increase in the remuneration of skills. Given a certain distribution of skills, individuals with a larger stock of more highly valued skills will now be remunerated more than before. Alternatively, an increase in income inequality is caused by an increase in the dispersion of temporary shocks. Once again, the consequences for material well-being would probably be very different.

Similar considerations could be made when considering differences in institutions that allow the smoothing of income shocks. When there are institutions or tools that allow individuals to smooth out income shocks, an increase in the dispersion of income shocks may be completely undone by appropriate insurance. The important point to make is that the static study of the distribution of income might provide very partial information and that much more is to be gained by looking at consumption and expenditure.

Indeed, even comparisons across different countries in a dynamic context give a different view from comparisons drawn from a snapshot in time. As stressed in recent studies by Flinn (2002) and Bowlus and Robin (2004), the United States looks much more unequal than continental Europe when considering a single snapshot. However, the picture is very different when considering lifetime resources; in this view, the United States appears more egalitarian than in the snapshot view. The differences between the two views are explained by the higher level of income mobility that characterizes the United States.

Further Readings

Cutler and Katz (1991, 1992) and Slesnick (1993) also use consumption inequality as a measure of inequality in well-being. Attanasio and Davis (1996) analyze jointly changes in average consumption and wages for different groups in the population to assess the extent to which changes in remunerations are reflected in changes in consumption (and presumably well-being) at different horizons. They interpret their results as being informative about the availability of mechanisms that allow risk sharing. Krueger and Perri (2006) use data from the Interview component of the CEX to argue that consumption inequality, unlike income inequality, did not seem to increase in the United States in the 1990s. This implies that some insurance mechanisms are available to households from market (or non-market) sources.

Blundell and Preston (1998) derive the technical conditions that allow using consumption inequality as a measure of welfare inequality. Blundell and Preston (1998) also show how to use information on the evolution of consumption and income inequality jointly to identify changes in permanent and transitory income inequality. Blundell, Pistaferri, and Preston (2008) combine information from the cross-sectional distribution of income and consumption in a longitudinal dataset to extend the methodology in Blundell and Preston (1998) and identify the amount of insurance available to each household.

Several articles treat the smoothing devices that households employ to isolate consumption from income idiosyncrasies. These include studies of family networks (Attanasio and Ríos-Rull, 2000), the timing of durable purchases (Browning and Crossley, 2000), progressive income taxation and other so-called automatic stabilizers (Mankiw and Kimball, 1989; Grant, Koulovatianos, Michaelides, and Padula, 2006), personal bankruptcy law (Fay, Hurst, and White, 2002), and financial assets (Davis and Willen, 2000).

2

Measurement Issues

In the previous chapter we argued for the desirability of the joint analysis of income and consumption. For such an analysis to be possible, it is necessary to have household-level information on the relevant variables. This chapter analyzes the availability of this type of data. In particular, we discuss:

- **Why most studies on inequality use income data.** Compared to income data, consumption data gathered over a long time period are scanty. Surveys designed to measure income have been around for a long time. However, although surveys to measure consumption are less common, the Consumer Expenditure Survey provides data on a consistent basis from 1980 and is the only survey on the U.S. household population to have information on consumption for an extended period of time.

- **Why the CEX is useful to the purpose of studying the evolution of well-being in the United States.** Other than the availability for a long time span, there are at least two more reasons to focus on the CEX. First, the CEX is made of two survey instruments (interview questions and diaries), and their joint use can improve the quality of our measures of consumption. Second, the CEX provides data on stock of some durables, and such information can be used to impute the flow of services from those durables. We describe how the CEX is gathered and discuss some important limitations of the CEX survey, ranging from the quality of the data to the size of the sample. We also discuss briefly other problems that affect our ability to analyze the evolution of

well-being, which are common to the analysis of income and consumption (such as problems with the measurement of inflation).

- **The main features of our samples, the adjustments needed to use the data from the CEX as a basis to measure U.S. households' well-being, and other methodological issues.** The CEX is representative of the U.S. household population. In our sample we focus on urban households, on private and public employees, and on those aged between twenty-five and sixty-five. These selection criteria are standard, are driven by the survey design, and make our results comparable with what is found in other studies on income data. We describe how we adjusted consumption measures to take into account inflation, changes and differences in household size, as well as how we combined the interview and diary data and estimated the flow from durables.

Data Sources: The CEX

In several instances in the previous chapter, we referred to important measurement issues. We mentioned that consumption data have been rarely used for the analysis of well-being and inequality.[1] We also mentioned the relative quality of income and consumption data and the difficulties in obtaining *consumption* information from *expenditure* data. One of the reasons for the prevalence of income surveys in the study of inequality is that surveys such as the Current Population Survey (CPS), the Panel Study of Income Dynamics, and the National Longitudinal Survey of Youth (NLSY) have been around for a long time and have become the bread and butter of labor economists. On the other hand, the CEX exists in its current format with a consistent methodology only since 1980. Earlier versions were collected infrequently and with different methodologies (most notably the 1960–61 and the 1972–73 versions). These difficulties led many economists to be reluctant to use the CEX, although it is the only survey that contains comprehensive information about consumption expenditure.

Like all surveys, the CEX is not exempt from problems, some of which we discuss at length in what follows. However, its quality is not worse than many of the standard surveys routinely used by economists and

policymakers. It is also a fairly comprehensive survey, containing information not only about consumption expenditure but also about a variety of other variables. Partly to assert the credentials of the CEX as a legitimate and high-quality survey, in chapter 3 we start our analysis of wage inequality by reporting figures both from the CEX and the more commonly used CPS to show that the patterns that emerge from the CEX sample are remarkably similar to those from the CPS. Before delving into that comparison, we now discuss the main features of the CEX survey and some important statistical issues.

The CEX and Its Two Components. The CEX first appeared in its present form in 1980, but it has a long history that goes back to the beginning of the twentieth century. It is managed by the Bureau of Labor Statistics (BLS) and is collected by the Census Office.

Since 1980 the CEX has comprised two independent components. The first and larger component is the interview survey. This survey is a rotating panel of about 5,000 households per quarter (which increased by around 30 percent in 1999), who are interviewed five times at a quarterly frequency. Each quarter, 25 percent of the sample is refreshed. The first interview is a contact one, in which not much information is collected. No information from this contact interview is available in the public domain. In each of the following interviews, a respondent for each household is asked detailed questions on the amount spent in each of the three months preceding the interview on many expenditure items. For some expenditure items the questions are quite detailed, while for other expenditure items (most notably food), respondents are asked for aggregate estimates of expenditure. Given the sample structure, if a household completes its cycle of interviews, the CEX will contain twelve monthly observations on the expenditures of each household. In addition to expenditure, the survey collects complete information on the demographic composition of the household and on many socio-economic characteristics of its members. Information is collected on the education levels and economic activities of each household member. The second and fifth interviews collect information on earnings and labor supply. Finally, the fifth interview collects some information about financial and other types of assets. Since 1988, the BLS has started producing special modules that contain rich information on a variety of issues. For example, there is a module on credit cards, a module

on mortgages and real estate, and a module on health expenditure. In what follows we have used the module on vehicles, which was started in 1984.

The sampling frame is renewed every ten years, in the years ending in "6," to reflect the weights of the last census. For example, in 1986, the weights of the 1980 census were adopted in constructing the 1986 sample. This implies that the rotating panel feature of the survey is lost in those years. The structure of the questionnaire has been remarkably constant and consistent over time. Very few questions have changed.[2] Occasionally, some questions are made more detailed (for instance in 1991, the expenditure on personal computers was divided between software and hardware).

The second component of the CEX is the diary survey. This survey is made up of a sample of 5,000 households and is refreshed every year. Respondents are asked to keep a diary for two consecutive weeks. There is no longitudinal dimension to this sample. The diary and interview samples are completely independent. Until 1986, the respondents in the diary survey were asked to include in their diaries only entries regarding food items and other frequently purchased commodities (such as toothpaste or other personal care items). After 1986, the diary survey became comprehensive. Thus, we have two different measures for most commodities.[3]

The BLS, however, thinks that some items are measured appropriately by one survey and others by another. This belief is reflected in its methodology to compute the tables that are routinely published and, ultimately, the weights for the CPI: information from the diary survey is used for some items and from the interview survey for others. In constructing our evidence, we will follow this practice.

The Quality of CEX Data. Collecting information on expenditure in a developed country can be a daunting task. A typical household is characterized by very complex expenditure patterns, the spending is done by several household members, and many purchases are not particularly memorable and might be difficult to remember during a retrospective interview. This very difficulty motivates the existence of two different samples and data collection methodologies. For all these reasons, we may expect a substantial amount of measurement error.

One problem with verifying the quality of the CEX is the lack of a benchmark. Traditionally, the term of comparison has been aggregate PCE

data published quarterly by the Bureau of Economic Analysis within the NIPA. This comparison, however, is not without problems. First, the definition of expenditures used in the NIPA and in the CEX is not the same. Some items stand out: housing includes imputed rents for homeowners in the NIPA, while it does not in the CEX; the purchase of second-hand cars from other households is excluded in the NIPA, but it is included in the CEX. Even when the differences are not as large as in these examples, for many items there are important conceptual differences. Second, the population of reference is different. The CEX only includes non-institutionalized households, while the NIPA data include the consumption of institutionalized individuals (e.g., individuals living in jails and orphanages) and the consumption done on behalf of households by various institutions. Finally, the NIPA PCE figures are obtained as a residual, starting from sales figures and removing amounts that are *not* bought by households. The fact that PCE data are routinely subject to revisions (sometimes very substantial revisions) testifies that these data are subject to large measurement errors.

For better or worse, however, the NIPA data have traditionally constituted the benchmark against which the CEX, appropriately aggregated, has been evaluated. The BLS itself routinely compares the CEX aggregates with NIPA data. However, the comparison between the CEX household surveys and NIPA data is not straightforward. There are many issues, ranging from what is defined as expenditure and consumption to the population of reference (see, for instance, Slesnick, 1998 and Garner et al., 2006). The two main facts that emerge from these comparisons are that the CEX aggregates are substantially below the PCE, and that this ratio has been deteriorating in the last five or six years. The most recent BLS publication (Garner et al., 2006) puts at 0.65 the ratio of total consumption expenditure as estimated in the CEX to the corresponding PCE aggregate in 1997. There is large variation in sub-categories, with the ratio varying from 0.19 for sewing goods to 5.11 for railway transportation. The same paper, considering variation over time, shows that the ratio for the total goes from 0.67 in 1992, to 0.65 in 1997, to 0.60 in 2002. The same ratios for nondurable consumption are 0.65, 0.63, and 0.58. Going back to the 1980s, these ratios do not vary much, but are roughly at the level of 1992 (Gieseman, 1987).

This evidence seems to indicate a substantial deterioration of the quality of the CEX data, at least as measured by its correspondence to the PCE data.

Garner et al. (2006), however, argue forcefully that this is not necessarily the case. They analyze relatively fine classifications of consumption and determine that when the categories are conceptually comparable between the CEX and PCE data, the ratio is much closer to unity and there is much more modest deterioration over time. For expenditure categories that are *indeed* comparable, they find that the ratio of the aggregated CEX data to the PCE data ranges from 0.88 in 1992 and 1997 to 0.84 in 2002, and is relatively stable. These categories account for a small fraction of total expenditure. This characterization is not without exception but, by and large, holds. While this evidence is obviously important and encourages confidence in the quality of the CEX data, the changes in the ratios over time for some categories remain a mystery. Two possible hypotheses, not necessarily alternatives, are: (1) the importance of the sectors excluded by the CEX but included in PCE data has increased over time, and (2) certain segments of the population, in particular at the top of the income distribution, have become less willing to collaborate with surveyors. The increased difficulty in contacting well-off households for economic surveys is a fact that has been observed in a variety of surveys. Nevertheless, the discrepancy between the CEX aggregate data and the PCE data is disconcerting and worrying.

Our Samples, Adjustments of CEX Data, and Other Methodological Issues

We conclude this chapter with information on the way we select the samples from the CEX and with the way we deal with several issues, such as inflation and equivalence scales for households of different sizes. As we will use the CPS to make comparisons with the CEX, we will select the CPS sample in a way that mirrors exactly the criteria for the CEX. We also discuss methodological issues that arise from combining the CEX diary and interview surveys and from estimating the service flow from durables.

Sample Selection. We select our CEX sample to include only urban households. This was done partly to be able to use the 1982–83 data, which did not cover rural households, and partly because of difficulties with the rural data. We did not use the 1980 and 1981 data because many variables were

changed in the 1982 vintage of the survey. Our last year of analysis is 2003. We excluded households headed by self-employed individuals. For these households it can be hard to isolate expenditures for the household from expenditures for the business. Moreover, income is notoriously difficult to measure for self-employed individuals. We are aware of the fact that this is an important limitation, as self-employment status can be a reaction to specific income shocks and could therefore change over the business cycle.

Less controversially, we exclude households with incomplete income responses from the analysis of income as well as the analysis of consumption. The incomplete income response variable is generated by the BLS to flag households whose income data are of poor quality. We thus take a conservative approach and assume that households with poor quality income responses also give poor quality consumption expenditure responses. The share of households with incomplete income responses is roughly constant over time, ranging between 14.7 to 15.1 percent in the interview survey and from 22.6 to 27.4 in the diary survey.[4] Finally, when analyzing wages, we use individual rather than household-level data, and focus on males in full-time employment.

Some of the analysis will look at year-of-birth cohorts. In defining cohorts, we faced a trade-off between cell sizes and homogeneity. We decided to form four cohorts defined by decades: households whose head was born in the 1930s, the 1940s, the 1950s, and the 1960s.

Inflation. We measure inflation through the general CPI for all urban consumers produced monthly by the BLS. The base years are 1982–84. The CPI is available on a continuous basis for our sample period and is widely used for a variety of purposes, including the indexing of Social Security benefits and several other social programs in the United States. The construction of an appropriate price index is fraught with many conceptual and methodological problems. Due to the importance of the CPI for policy purposes, the ability of the CPI to reflect increases in the cost of living (rather than other factors, such as increases in quality) has been recently examined closely in a variety of studies. The Boskin Commission undertook this task in 1995.[5] The Boskin Commission argued that the CPI fails to account properly for product substitution and quality change and concluded that the CPI was upwardly biased by about 1.1 percent per year

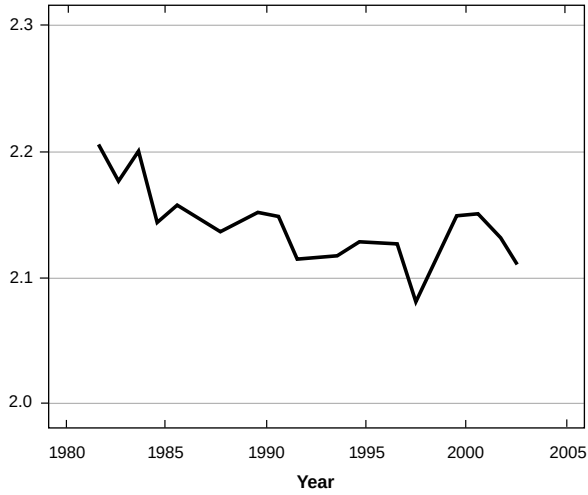
in 1995–96. In a later evaluation of the Boskin Commission results, Gordon (2006) suggests that the bias for the years 1995–96 is 1.2–1.3 percent per year and that it is currently about 0.8 per year.

Assessing the bias in the CPI requires being able to construct a "true" cost-of-living index. Broda and Weinstein (2007) pursue this approach and use barcode data to provide estimates of the bias in the CPI. Their work shows that quality bias causes the CPI to overstate inflation by 0.8 percent a year between 1994 and 2003. The Boskin Commission's report and the subsequent studies that have looked at this issue show the importance of improving on the current CPI, but do not provide an index on a continuous basis for our sample period. Therefore, we use the CPI. However, when interpreting the results referring to trends in the *level* of consumption or income, it should be kept in mind that overestimating inflation will underestimate the rate of growth of these variables.[6] However, biases in the CPI do not affect the results for inequality, because the CPI bias does not vary with individuals' or households' characteristics.

Household Size. In a famous statement, the Irish economist W. M. Gorman summarized the importance of equivalence scale by saying, "If you have a wife and baby, a one-penny bun costs three pennies." When evaluating changes in material well-being and its distribution, we must take into account the evolution of household sizes and therefore household needs. Expenditure is recorded at the household level, but the size and composition of American households have changed considerably over the period analyzed, and they have changed differently for various groups in the population. It is therefore important to control for household needs. We do so by using a very simple equivalence scale: we count as 1 the first adult, as 0.7 any additional adult, and as 0.5 any child in the family.[7] Figure 2-1 shows the time pattern of such equivalence scale and documents the changing structure of the U.S. families in the last two decades. More sophisticated scales are possible, but do not much affect the thrust of our results.

Combining the Diary and Interview Surveys. The fact that the CEX is composed of two different surveys poses several methodological problems for our study. The fact of two different surveys is not a problem for all questions in labor economics. Were we, for example, interested in the evolution

FIGURE 2-1
MEAN EQUIVALENCE SCALE



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.
NOTE: The figure shows the mean of equivalence scale computed from the interview survey.

of average consumption, the existence of two separate components of the CEX would not constitute a problem. As the two surveys are both representative of the same population, we could rely on the interview survey for some components of consumption and on the diary survey for others and use the simple fact that the average of a sum is equal to the sum of the averages to compute the average of total consumption.

The one issue that can generate problems is differential attrition and non-response, for which there is some evidence. The two samples are indeed slightly different, with the diary survey being made of households that are typically better off and better educated. These factors may, to a certain extent, be taken into account as long as differences are confined to household characteristics that are observable in the two surveys.

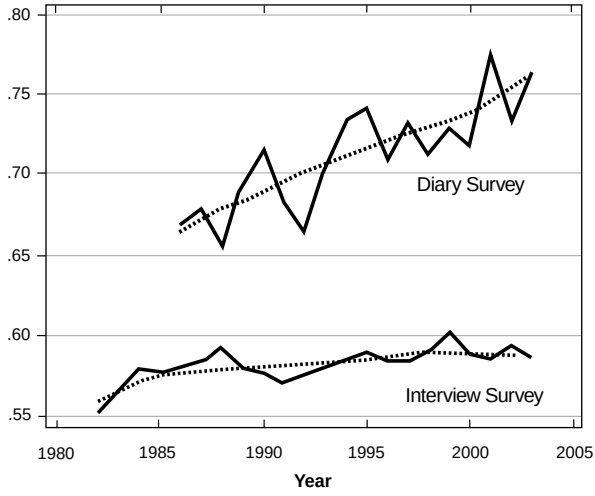
However, since we are interested in the distribution of overall consumption, the fact that we have some items well measured in one survey and other items well measured in the other may constitute a problem. Suppose, for instance, that we are interested in the difference between the

10th and 90th percentile in total consumption and suppose we divide total consumption in the items measured in the diary survey (D henceforth) and those measured in the interview survey (I henceforth). We can compute the 10th and 90th percentile for I and D separately, but the 10th and 90th percentiles will not be given by the sum of the respective percentiles because the family on the 10th (90th) percentile for I is not the same as the family on the 10th (90th) percentile for D. Similar considerations apply if we want to compute the standard deviation of all commodities.

We have mentioned that in 1986 the diary surveys became more comprehensive. In fact, since 1986, publicly available data from both surveys contain an (almost) comprehensive list of consumption commodities. The temptation, therefore, would be to ignore the BLS practice to rely on the diary survey for the frequently purchased items and on the interview survey for the others and use just one survey. This solution has been followed in most of the literature, which has ignored the diary survey and used the larger interview survey. This practice would be fine if the picture that emerges from the diary survey were roughly consistent with the picture from the interview survey. Unfortunately, Battistin (2003) and Attanasio, Battistin, and Ichimura (2007, henceforth referred to as ABI, 2007) showed that the pattern of expenditure inequality, as measured by the coefficient of variation of consumption, is very different in the two surveys. If the inequality of total consumption is measured from the interview survey it seems that inequality has not changed much since the late 1980s or early 1990s. On the other hand, if one uses the diary survey, one sees that inequality has increased dramatically. Figure 2-2 (which replicates figure 17.1 from ABI, 2007) shows this dramatic difference. It should be stressed that the fact that inequality as measured in the diary survey is much larger than as measured in the interview survey is not surprising, given that the former covers only two weeks of expenditure and the latter covers one month.[8] What is puzzling is the different dynamics of the two series.

ABI (2007) show that this disparity does not have simple explanations, such as differences in the composition of the two samples or a decreasing frequency of purchases of various goods in the diary survey. The latter explanation rests on the supposition that if people shop ever less frequently, the number of households reporting zeros in the diary for a large number of commodities will increase over time. This would artificially increase the variance of

FIGURE 2-2
NONDURABLE CONSUMPTION INEQUALITY FROM THE INTERVIEW AND DIARY SURVEYS



SOURCES: Attanasio, Orazio P., Erich Battistin, and Hidehiko Ichimura. 2007. *What Really Happened to Consumption Inequality in the U.S.?* In *Measurement Issues in Economics—Paths Ahead: Essays in Honour of Zvi Griliches*, ed. E. Berndt and C. Hulten, 515-44. Chicago: University of Chicago Press; and U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

NOTE: The figure plots the time evolution of the coefficient of variation of nondurable consumption as measured in the CEX diary survey and in the CEX interview survey. The dashed lines are obtained by a locally weighted regression on a linear time trend.

consumption. ABI (2007) dismiss this hypothesis by observing that the proportion of zeros in the diary survey does not increase significantly over time.

ABI (2007) propose a methodology to combine the two data sources that we adopt here (see also Battistin, 2003). The main idea is to follow the recommendation of the BLS and use information on frequently purchased items from the diary survey and information on other commodities from the interview survey. To compute the variance of total consumption we will then need the covariance between I and D. ABI (2007) show how to use the error-ridden information on D in the interview survey and/or the error-ridden information on I in the diary survey to approximate this covariance. In what follows, we will use the same methodology, and we refer our reader to the ABI paper for technical details and some evidence in favor of the

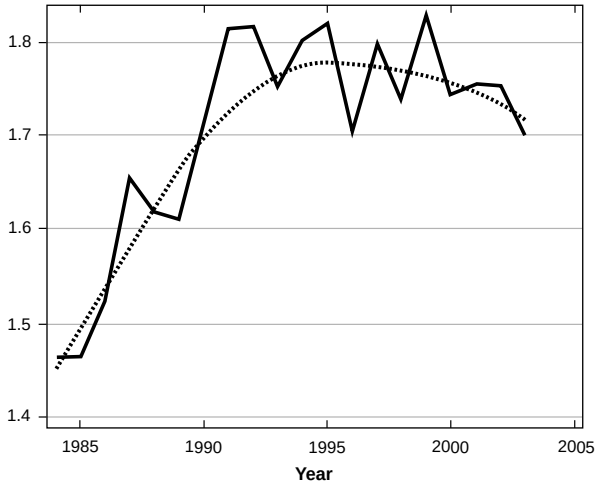
assumptions made to apply these methods. The validity of such assumptions is further investigated by Battistin and Padula (2009).

One consequence of using the two surveys and the methodology from ABI (2007) is that we need to make some additional hypotheses to estimate the evolution of consumption inequality. If we were to limit ourselves to the study of the standard deviation of consumption, we would need only a limited number of assumptions. Effectively all we would need is to be able to estimate the covariance between I and D using the imperfect information we have in the two surveys. Instead, because we are interested in the entire distribution (so as to develop an inequality index for the ratio of two percentiles, such as the 90th and the 10th), we need additional assumptions on the nature of the distribution. For instance, if we assume log-normality of the distribution of consumption at a point in time, we could recover all the percentiles of the consumption distribution. These percentiles, however, will be necessarily a function of the mean and standard deviation that we recover with the basic sets of assumption. For this reason, in what follows, we use as our measure of inequality the standard deviation of log consumption. Such a measure is a proportional measure and as such does not depend on the scale of consumption and has been used widely in the literature. Battistin and Padula (2009) discuss a set of assumptions that generalize the approach taken by ABI (2007) and can be used to study a variety of inequality measures.

Estimating the Service Flow from Durables. Consumption is commonly measured through expenditures both in aggregate and in microdata. Assuming that consumption coincides with expenditure suits reasonably well the case of nondurable commodities. However, it is obviously a very poor approximation for durables. The distinction between expenditure and consumption is not trivial in this case, since durables are typically bought infrequently and provide utility for a long time.

In order to measure durable consumption, we must be able to quantify the flow of services that households enjoy. This requires estimating the value of the stock of durables, since the flow of services is likely to be proportional to it. In what follows, we estimate the services of a major durable good: cars (see figure 2-3). The decision to focus on cars is grounded on three arguments. First, cars are arguably the most important

FIGURE 2-3
DURABLE CONSUMPTION INEQUALITY



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.
NOTE: The figure shows the coefficient of variation of durable consumption measured as the sum of the flow of services from cars.

component of durable expenditure after housing. Second, the available information makes it possible to estimate the value of the stock of cars, but not the stock of smaller durables. Third, houses were not used because they are also an investment that provides a return. It is difficult to distinguish between housing services and the return to houses seen as an asset.

Although we estimate only the services of cars, in what follows we will refer to the sum of expenditure on nondurables and services and our estimates of the flow of services from cars as "total consumption." This is obviously an abuse of language that we justify only for the sake of brevity.

To quantify services from cars we estimate the value of the stock of vehicles owned by each household in the sample. The remainder of this section discusses how we estimate the stock in cars from the CEX data by combining expenditure information with the additional information on stocks.

The data on cars come from two files. The BLS has made these files publicly available since 1984. The first file, Owned Vehicles file B (OVB), which refers to the vehicles owned by the household, records the characteristics of the vehicles in the Consumption Unit (CU) at the interview

date. An incomplete list of these characteristics includes the type of the vehicle (car, truck, van, pickup truck, motorbike, boat, and, eventually, airplane), the make and the model of the vehicle, the year and the month of purchase, the vintage, the number of cylinders, whether the vehicle entered the CU as new or used, as well as whether the vehicle is equipped with air-conditioning, automatic transmission, power brakes, power steering, radio, and a sunroof. The list also includes the purchase price, including net purchasing price (the cash outflow at the date of the purchase) and the trade-in allowance received, if any.

Moreover, households are asked if they disposed of a vehicle and, if they did, they are asked when and how they did so, as well as about the vehicle's characteristics. This information is recorded in the second file, Owned Vehicles file C (OVC). Households can dispose of their vehicles in six ways: vehicles can be sold, traded in, given away outside the CU, damaged beyond repair, stolen, and other.

We then identify a single numerical index measuring the car value, which is known to depend on a number of features, including the car's year of production, its age, and the general level of prices. This is done by regressing the log of the purchase (or selling) price of a car on year and age dummies and on a set of controls representing the car's vintage, and then predicting the index measuring car value out of this equation. Each car in the database is identified by its make and model, the year of production, and the year of purchase (or sale). More details on the estimation of car values are provided in appendix 2.

Further Readings

Slesnick (2000, 2001) contains detailed discussions of a number of issues we touched in this section. In particular, he discusses the problem of inflation and its measurement, the problem of equivalence scales, and the quality of the CEX data and their comparability with the NIPA data. The entry in the *Palgrave Dictionary of Economics* on equivalence scales, authored by Arthur Lewbel, is also a useful reference on this issue (Lewbel and Pendakur, 2008). The problem of the comparability of CEX and PCE data is discussed periodically in various BLS publications. Garner et al. (2006) is the latest.

3

Recent Trends on Wages and Household Income Inequality

In this chapter, we report data on the evolution of inequality in individual wages and household earnings. These are the variables that have been routinely analyzed in most studies of inequality and will provide the background against which we set the data on consumption inequality we present in the next chapter. We show that:

- **The wage and the earnings data from the CEX and CPS provide comparable information on the evolution of income inequality.** The CPS has been widely used in the study of the evolution of income inequality. It lacks, however, information on consumption and therefore prevents the joint examination of consumption and income. The CEX, in addition to the information on expenditure, contains information on wages and earnings. It is therefore important to validate the CEX wages and earnings data against the CPS. The mean and the standard deviation of the wages and earnings distribution for different groups in the population and their evolution over time are remarkably similar across the two datasets. Therefore, the two datasets provide consistent evidence on the evolution of income inequality.

- **Averages of wages and earnings have increased in the United States between 1982 and 2003.** Real average wages increased in the United States by about 10 percent between 1982 and 2003. This increase was not steady over this period: real average wages decreased between 1982 and 1992 by 10

percent and then increased between 1992 and 2003 by 20 percent. When we consider household earnings rather than wages, we also find a considerable increase over this period: average earnings increased between 1982 and 2003 by about 21 percent. Earnings rose especially quickly after the mid-1990s, increasing by 17 percent from 1993 to 2003. These increases are underestimated (and decreases overestimated) if the available price indexes overestimate inflation.

- **Inequality, as measured by wage or earnings discrepancies, increased in the United States between 1982 and 2003.** We use the difference between the 90th and the 10th percentile of the log wages distribution as a measure of wage inequality and that between the 90th and the 10th percentile of the log earnings distribution as a measure of earnings inequality. As a further measure of inequality, we also look at the coefficient of variation, that is, the ratio between the standard deviation and the mean. Whatever measure and income definition is used, the data show that inequality increases between 1982 and 2003. Such increase is steady and is more pronounced for wages (15 percent) than for earnings (10 percent).

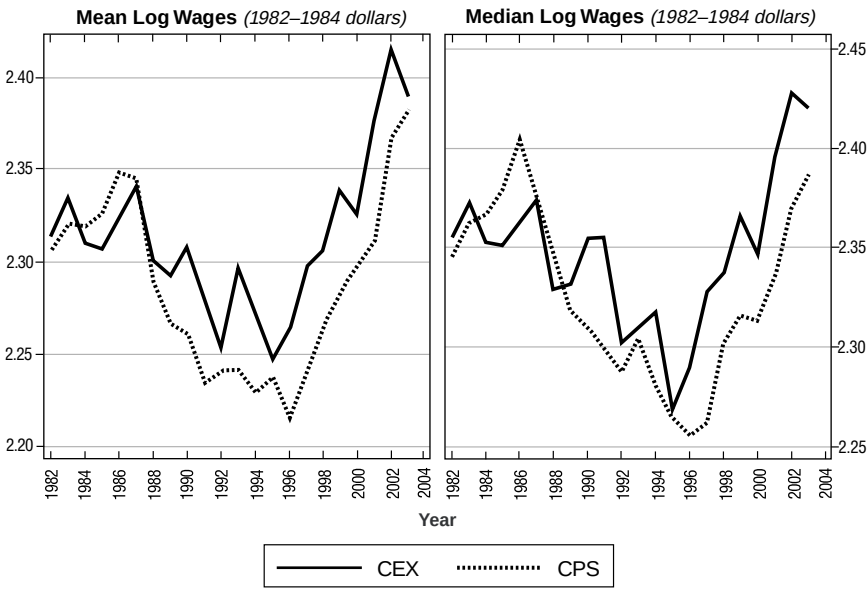
We start this chapter with some findings that illustrate the main facts of the evolution of inequality for wages in the United States during the 1980s, the 1990s, and the early 2000s. As mentioned in the introduction, these facts are very well known: the Autor, Katz, and Kearney (2007) study we cited is only one of the last contributions to an extensive literature that analyzes them. The novelty of our analysis is that we use data both from the CEX and the CPS. A comparison between the two data sources shows that, as far as the income components are concerned, the picture that emerges from the CEX is similar to that that comes out of the widely used CPS database. This comparison constitutes an important validation of the sample used by the CEX, especially because, to the best of our knowledge, this is the first study that compares the wage information in the CPS and the CEX. We then discuss the evolution of household income. Since the diary survey is characterized by a much smaller sample size than the interview survey, in

what follows we will make use of information on income and wages only from the latter. It is worth noting that time series obtained from the diary survey proved noisier but provides equivalent information to that reported here.

Wages: CEX and CPS Evidence

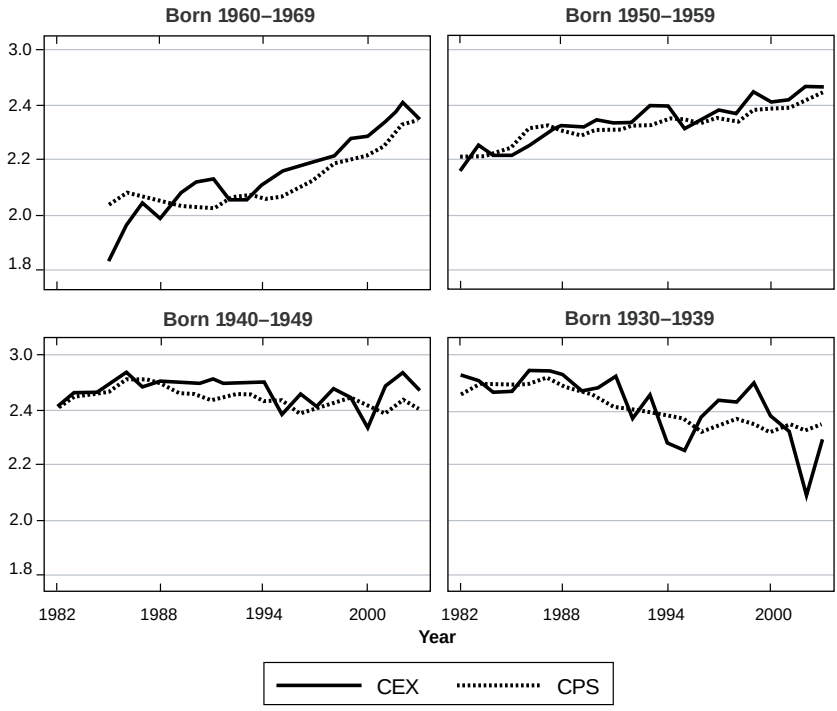
In figure 3-1, we plot the time series from 1982 to 2003 for the mean and median log nominal wages derived from the CEX and the CPS. These statistics are computed on the sub-samples selected according to the criteria mentioned in chapter 2. In figure 3-2, we look at the median log wages for the four decades of birth cohorts we are considering: individuals born in the 1930s, 1940s, 1950s, and 1960s. Again the series for CEX and CPS

FIGURE 3-1
CEX AND CPS WAGES



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

FIGURE 3-2
MEDIAN LOG WAGES (CEX AND CPS) BY DECADE-OF-BIRTH COHORT



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

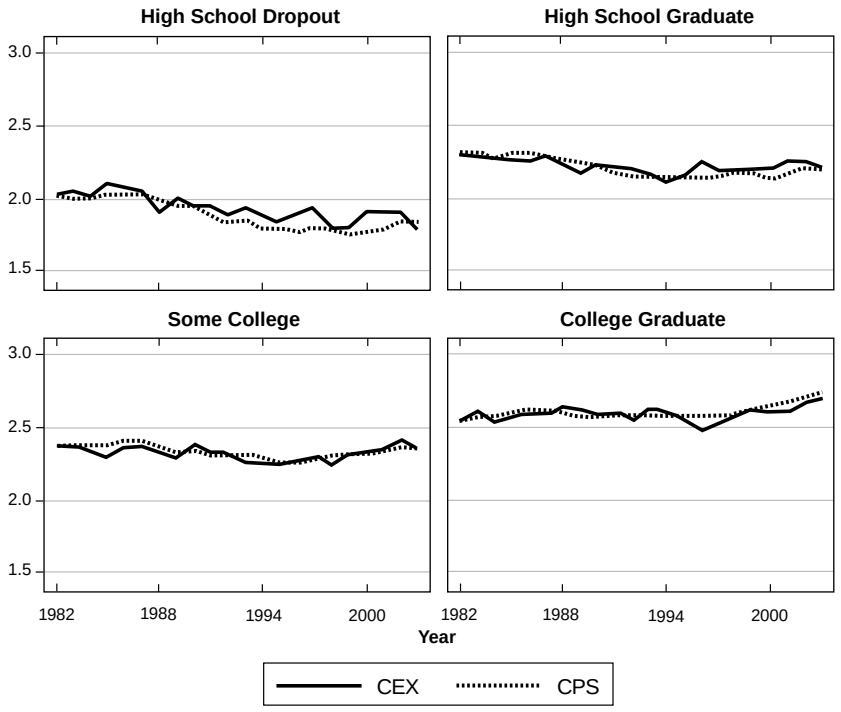
align very well in each graph. The only exception is the end of the sample period for the 1930s cohort: as the CEX is a smaller sample and many individuals belonging to that cohort retired by the early 2000s, the graph for the CEX is a bit noisier. Notice how the life cycle profile for wages is steeper at the beginning of the life cycle, flattens out, and then declines toward the end of the life cycle. If we neglect the issue of retirement and more generally of unemployment, these profiles represent the evolution of average wages over time.[1]

Figures 3-1 and 3-2 also reveal that real wages increased by about 10 percent between 1982 and 2003. If one assumes that the inflation rate is overestimated by 0.8 percent a year during the whole period, as discussed

in Broda and Weinstein (2007), the actual change in real wages amounts to just below 28 percent. The increase is even larger if one uses the estimates provided in Gordon (2006), who suggests that the bias in the CPI is between 1.2 and 1.35 percent in the years between 1978 and 1996 and 0.8 in later years. Therefore, while the bias in inflation does not affect the comparison between CEX and CPS, it affects the quantitative conclusions on the long-run trends in the market price of labor.

In figure 3-3, we plot the evolution of wages for four academic achievement categories: high school dropouts, high school graduates, those with some college, and college graduates. Even in this dimension,

FIGURE 3-3
MEDIAN LOG WAGES (CEX AND CPS) BY EDUCATIONAL ACHIEVEMENT



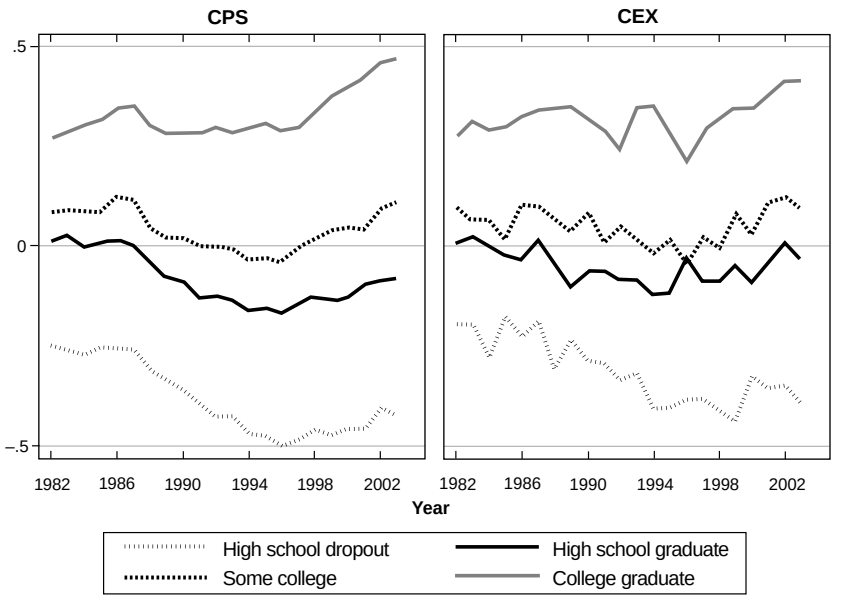
SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

the two databases align very well. They both point to the fact that the real wages of individuals with lower education levels declined, especially in the first years of the sample period, but the real wages for college graduates were first stationary and then increased.

The different dynamics across education groups is made very evident in figure 3-4, where we plot the difference between each mean log wage and that of the high school graduate in 1984. The left panel corresponds to the CPS, while the right panel corresponds to the CEX. Apart from the right graph being noisier because of the smaller sample size of the CEX, the two panels tell effectively the same story.

Having briefly discussed the evolution of the levels of wages, we now discuss the evidence on wage inequality. A first preview on an important component of wage inequality was given in figure 3-4, which makes it clear

FIGURE 3-4
DIFFERENCES ACROSS EDUCATION GROUPS: CEX AND CPS

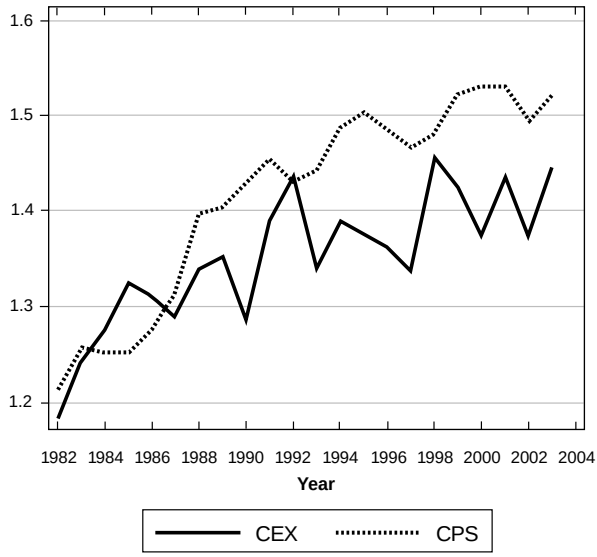


SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

that the differences in the remuneration of different skills has played an important role in the evolution of inequality in the United States. We will come back to this in what follows.

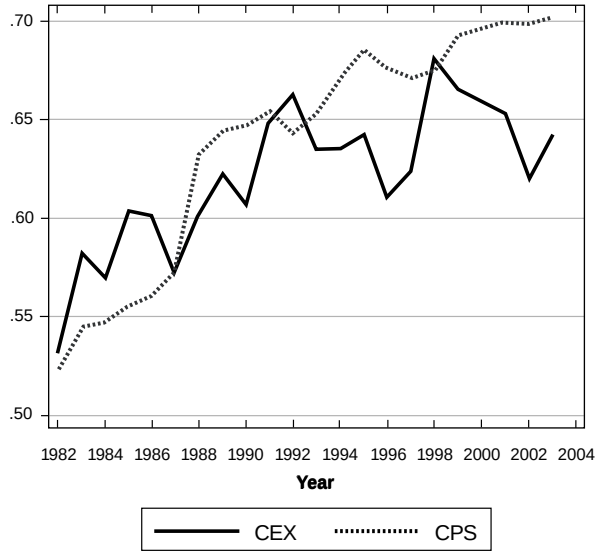
We start by reporting data on the difference between the 90th and the 10th percentile of the log wages distribution. In figure 3-5, we plot this difference computed for the sample of male employees in the CEX and in the CPS. Two things are worth noting. First and not surprisingly, the picture that emerges confirms the evidence described extensively in the literature of a marked increase in the first years of the period and a slower increase in later years. Second, the CEX and the CPS seem to be telling, once again, similar stories. In measuring inequality the larger noise induced by the smaller sample size of the CEX is more evident than in the corresponding picture for the means and the medians.

FIGURE 3-5
DIFFERENCE BETWEEN THE 90TH AND 10TH PERCENTILE FOR LOG WAGES: CEX AND CPS



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

FIGURE 3-6
COEFFICIENT OF VARIATION OF WAGES: CEX AND CPS



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

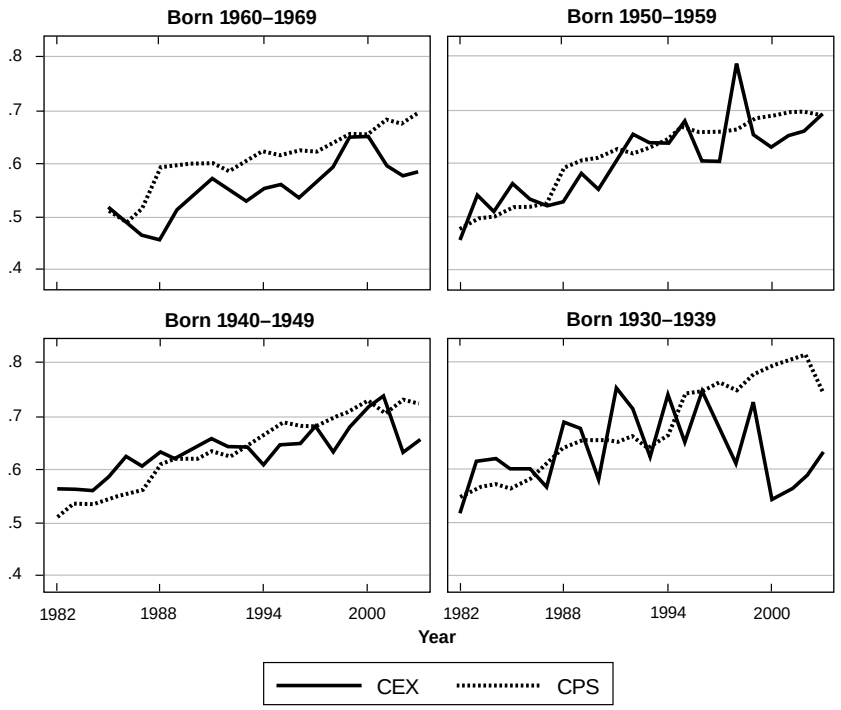
In the case of consumption we will be looking at a different index of inequality. Rather than the difference between the 90th and the 10th percentile, we will be looking at the coefficient of variation.[2] In figure 3-6, we plot this statistic for wages, again for both the CEX and the CPS, both to check how the two measures (90th/10th ratio and coefficient of variation) compare and to check how the two databases compare in this dimension. In figure 3-7, the coefficient of variation for the two databases is computed within groups defined by the decade of birth of the household head, while in figure 3-8 the coefficient of variation is computed for groups defined by the education attainment of the household head. The purpose of these graphs is to compare both measures of overall inequality and of inequality within differently defined groups obtained in the two surveys. On both counts the comparison confirms that the CEX and CPS databases yield similar information. The pattern over time of the 90th/10th ratio is very

similar to that of the standard deviation of logs, while the alignment between the CPS and the CEX for the latter is even closer than for the former.

To conclude this section, we may say that the CEX and CPS tell, by and large, a very similar story, especially if we look at the levels of average wages and the levels of inequality. This is heartening, as the CEX is the only database that contains information on consumption, and the CPS has the advantage of being a larger and better studied database.

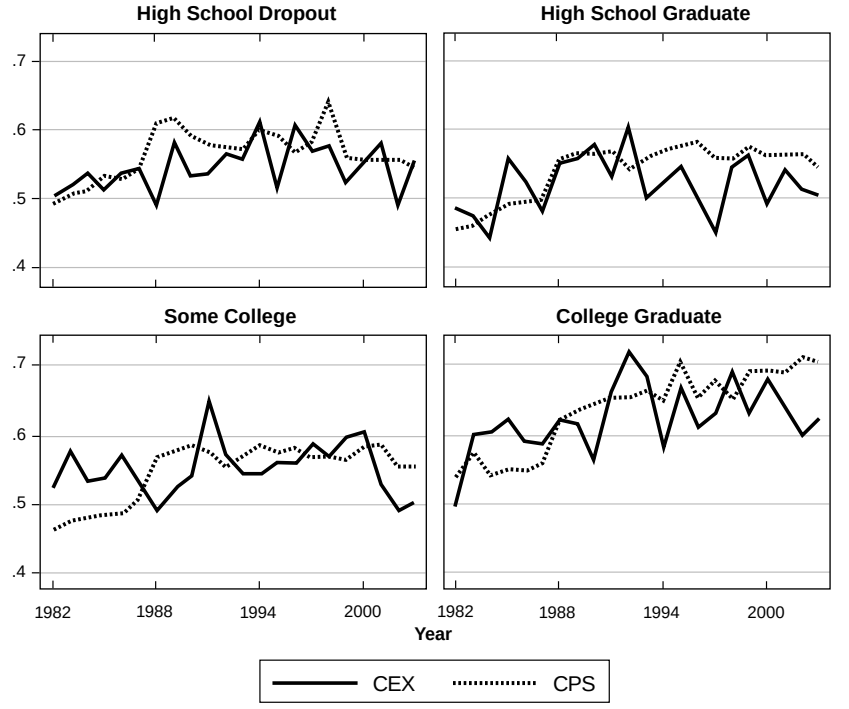
However, a word of caution is needed about the evaluation of the long-run trend in real wages. Both the CEX and CPS imply that real wages have increased between 1982 and 2003 (see figure 3-7). The extent of such

FIGURE 3-7
COEFFICIENT OF VARIATION OF WAGES: CEX AND CPS BY DECADE-OF-BIRTH COHORT



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

FIGURE 3-8
COEFFICIENT OF VARIATION OF WAGES: CEX AND CPS BY EDUCATION



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

increases is very similar across the two databases. Moreover, we observe that the overall level of real wages declined slightly until the early 1990s and that it has increased after that. Quantifying the increase in real wages, however, depends crucially on the measure of inflation one uses: deflating nominal wages by the CPI index, the figures show an increase of 10 percent over the sample period, while the increase is much larger, about 28 percentage points, if the CPI overstates inflation by about 0.8 percent a year, as argued by Broda and Weinstein (2007).[3]

Whatever measure of inflation is used, the average pattern hides differences across groups. In general, we observe that real wages of the

bottom of the distribution (and in particular those of individuals with low levels of education) decreased the most in the first years of the sample period, while the level of wages for better-educated (especially college-educated individuals) have stayed roughly constant or increased (see figure 3-8). Inequality, consequently, has increased. Such an increase has been particularly pronounced in the first part of the sample period, but it has, to an extent, continued into the 1990s and early 2000s. The increase is to a large extent driven by an increase in differences among education groups. However, even within education groups, we do see an increase in various measures of inequality, such as the 90th/10th ratio and the coefficient of variation.

These facts are not particularly surprising and are consistent with previous findings in the literature (see the section on Further Readings at the end of this chapter). We now consider household earnings instead of wages.

Household Earnings: CEX and CPS Evidence

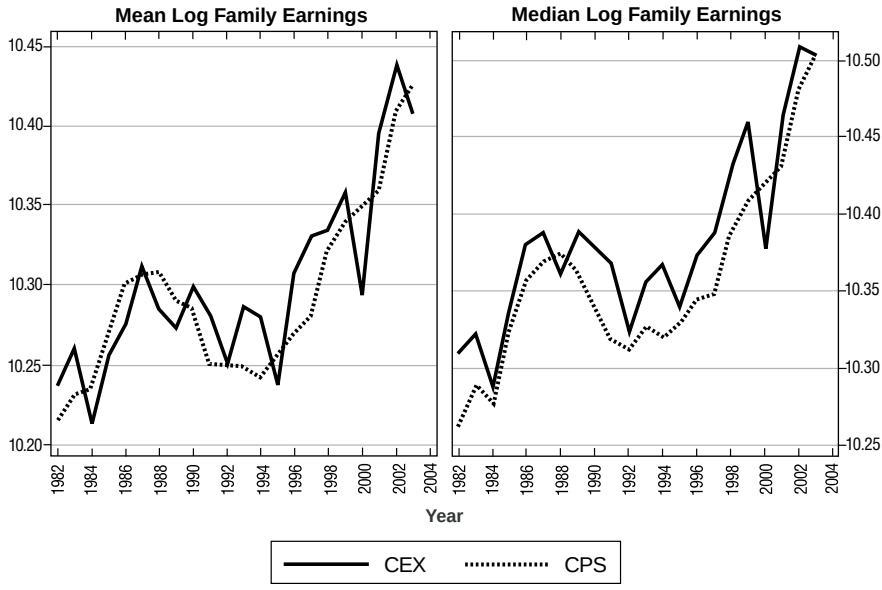
Our measure of household income includes earnings and excludes capital income. This choice is rooted in the difficulty of measuring capital income and wealth. Moreover, we focus on pre-tax and pre-transfer income. This is consistent with the way we treated wages and is motivated by our primary interest in the dynamic of inequality *before* any insurance mechanism, beyond labor supply and mating choices, operates.

Given the wages an individual (or a household) can command, the amount of time spent working by household members will determine earnings. The evolution of the distribution of household earnings will depend, in addition to wages, on how households group people with different earning capacities and on the labor supply behavior of the various members. Both factors can change substantially the patterns observed in the distribution of wages over time. If there is positive correlation in the types of wage shocks received by husbands and wives, considering households (rather than individuals) can increase the patterns observed in the data. On the other hand, if people react to wage shocks by adjusting their labor supply behavior, this could reduce or increase the changes in inequality.

Once again, we report data for both the CEX and the CPS using the same sample selection considered in the previous chapter. In figure 3-9, we

plot mean and median log household earnings from the two data sources. Once again, we notice the remarkable covariation between the two surveys, in particular for the medians: for the mean the correlation coefficient is 0.87, while for the median it is above 0.92. We regress the difference between the mean log earnings in two samples on a linear time trend, and

FIGURE 3-9
CEX AND CPS FAMILY EARNINGS, 1982–1984 DOLLARS



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

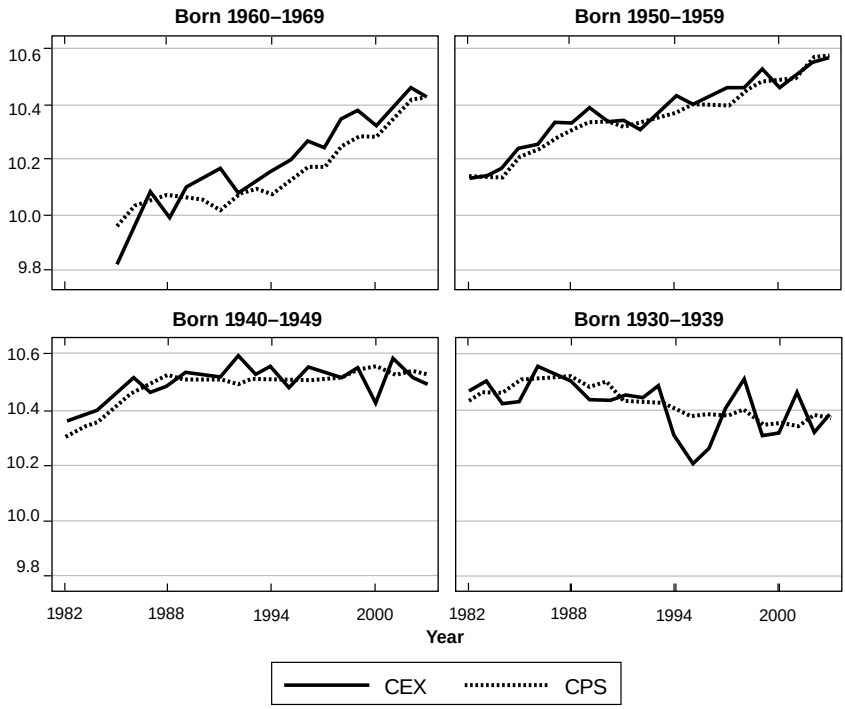
we cannot rule out that such difference is zero and orthogonal to the time trend. Doing the same exercise for the median delivers very similar results.

In terms of the substantial pattern of mean and median income, these pictures stand in remarkable contrast to figure 3-1 on wages. In the first part of the sample, household income did not decline as wages did, although after 1988 and through the early 1990s there is a reduction in real pre-tax income. Since the mid-1990s, household income increased at the same pace

as, if not more than, wages. Between 1993 and 2003, median real household income increased by about 17 percent. This figure underestimates the actual increase by 9 percentage points, if the CPI overestimates actual inflation by 0.8 percent a year.

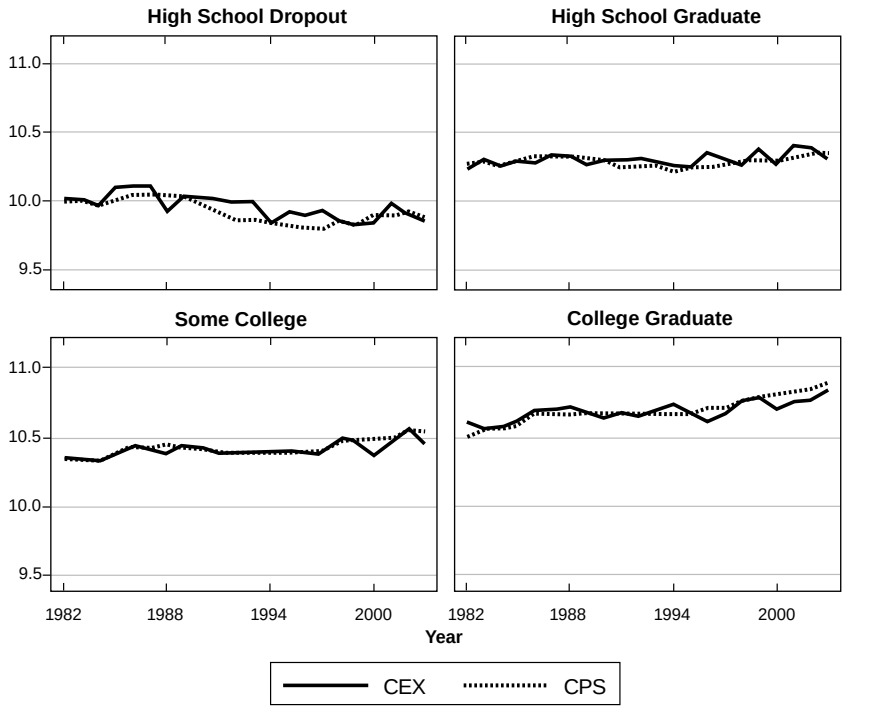
In figure 3-10, we report median log pre-tax income for the four decade-of-birth cohorts we considered earlier. The correspondence between CEX and CPS is, once again, quite good. There are again some exceptions for the 1930s cohort in the last part of the period. The evidence that emerges from this figure is that of strongly increasing real household income for the two youngest cohorts, of flatter income for the third, and declining income for

FIGURE 3-10
MEDIAN OF LOG FAMILY EARNINGS: CEX AND CPS BY DECADE-OF-BIRTH COHORT



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

FIGURE 3-11
MEDIAN OF LOG FAMILY EARNINGS: CEX AND CPS BY EDUCATION



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

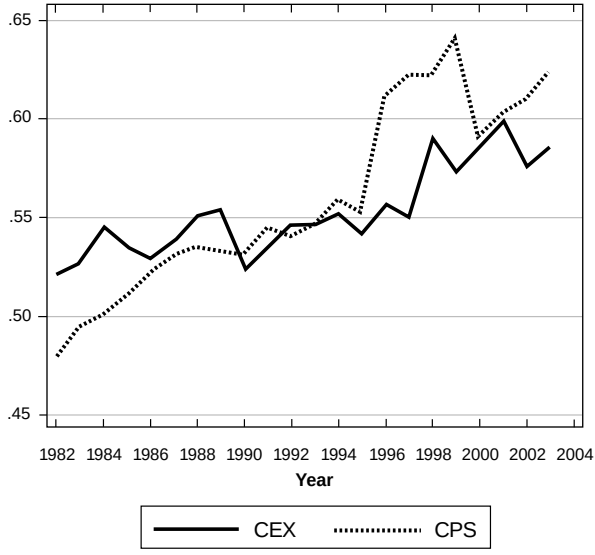
the fourth one. Of course, these cohorts are at different points in their life cycles, so differences should be at least in part interpreted as effects of age.

In figure 3-11, we plot the median log pre-tax earnings for the four education groups. The evidence shows a decrease in earnings for households headed by a high school dropout, a roughly constant income for households headed by a high school graduate, and an increase for households headed by an individual with some years of college education or with a college degree. The increase for the college graduates is particularly strong: over the period considered, median pre-tax household earnings increase by almost 35 percent. Notice also that for the high school dropouts, the decline in earnings stops before the corresponding decline

in wages. It is clear that, while there are similarities between the story told by wages and that told by household earnings, there are also important differences. These differences might indicate a reaction of labor supply to the changes in wages over this period, as some individuals might choose to work additional hours to compensate for declining wages. The overall picture that emerges, however, is that of an increased difference between the income received by low-skilled individuals and that received by highly skilled individuals.

As with the analysis of wages, after looking at the evolution over time of earnings, both in the aggregate and for subgroups of the population, we now analyze the overall inequality and the inequality within the same groups. We start, in figure 3-12, by looking at the coefficient of variation of earnings in the population. In the CPS, inequality increases steadily over the sample period, while the increase in the CEX is less pronounced.

FIGURE 3-12
COEFFICIENT OF VARIATION OF LOG FAMILY EARNINGS: CEX AND CPS

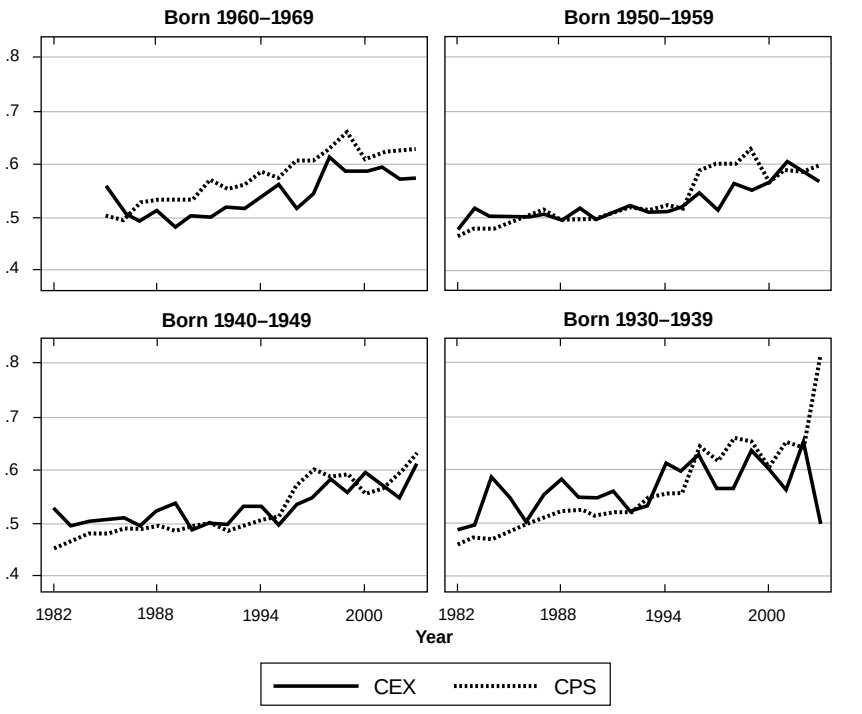


SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

However, the correlation coefficient between the times series obtained from the CEX and the CPS is 0.81. It is worth noting that inequality in the early 1980s is higher as measured by the CEX data than by the CPS data, and this results in a more modest increase in this decade using CEX data compared to the greater increase using the CPS. Moreover, note that increases in inequality as measured by both the CPS and CEX appear to slow for the period 1988-90, and this is more pronounced in the CEX data.

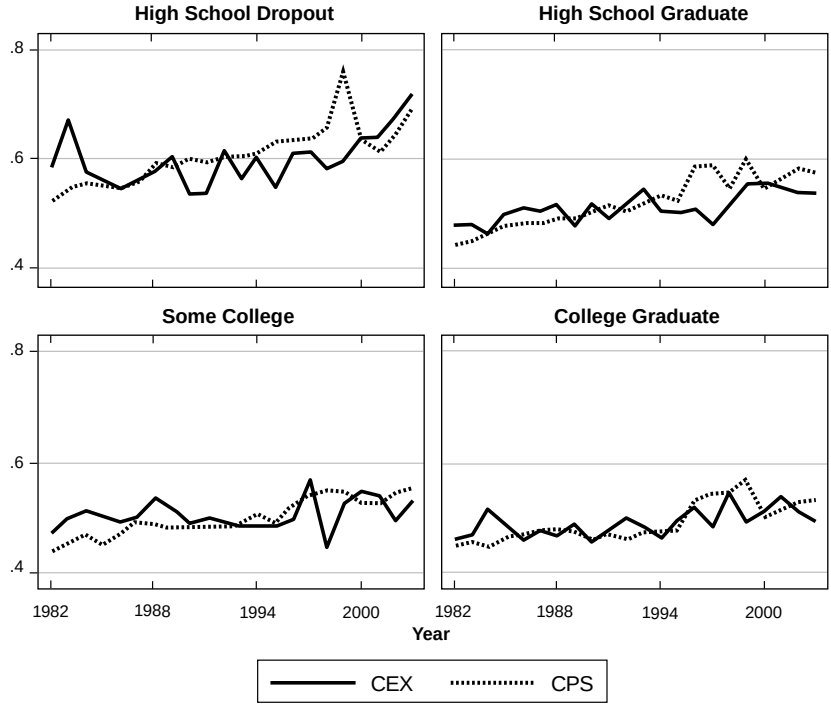
In figure 3-13 we plot the dynamics of the coefficient of variation of earnings for the four birth cohorts we have been analyzing. Perhaps not surprisingly, the CEX data are noisier, and this is most likely due to

FIGURE 3-13
COEFFICIENT OF VARIATION OF LOG FAMILY EARNINGS: CEX AND CPS BY DECADE-OF-BIRTH COHORT



SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

FIGURE 3-14
COEFFICIENT OF VARIATION OF LOG FAMILY EARNINGS: CEX AND CPS BY EDUCATION



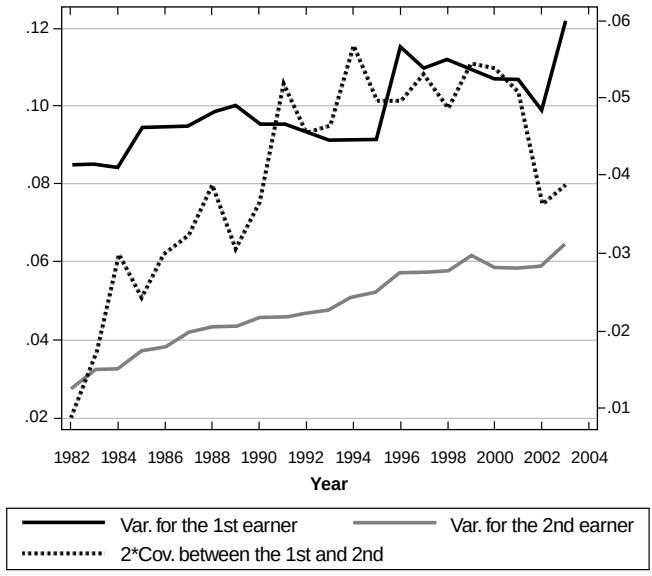
SOURCES: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey and U.S. Census Bureau, Current Population Survey.

differences in the sample size of the two surveys. However, both CEX and CPS figures show increasing inequality for all four cohorts; the correlation between the two series ranges from 0.69 for the youngest cohort to 0.81 for the second youngest. Finally, in figure 3-14, we plot the coefficient of variation for the four education groups. Again, the CEX data are noisier, but, consistent with the CPS data, show increasing inequality for all education groups. The increase in inequality, as measured by both the CEX and the CPS data, is most pronounced for high school dropouts. This contrasts with what happens with wages, where we see a sharper increase in inequality among college graduates that is possibly due to

differences in labor supply behavior between the two education groups, as well as to differences in the synchronization of wage shocks within the household. While the focus on full-time employees should minimize the impact of different supply behavior at least along the extensive margin, one cannot rule out that the education-related differences in female labor participation are behind these results.

In order to understand to what extent individuals with different earning abilities and labor supply behaviors are grouped within the same household, we investigate the degree of association between earnings within the household in the rest of this chapter. This is done by computing the covariance between the salaries within the two-earner households. In both the CEX and the CPS, households with more than two breadwinners make up 1.5 percent of the sample. Including those households does not affect the inequality dynamics, but increases the level of overall inequality.

FIGURE 3-15
INEQUALITY TRENDS WITHIN THE HOUSEHOLD

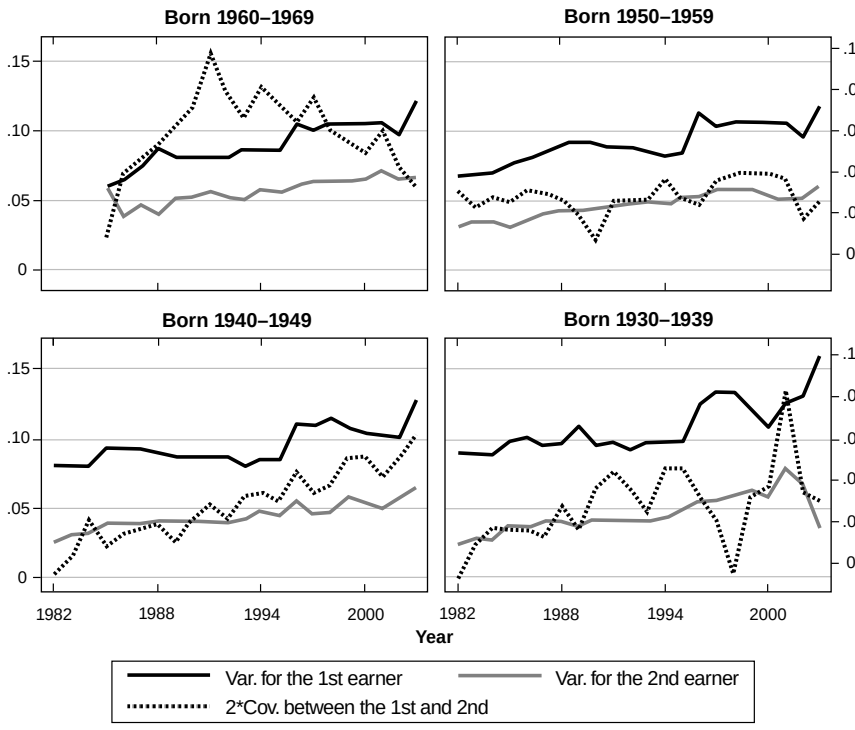


SOURCE: U.S. Census Bureau, Current Population Survey.

To ascertain the contribution to overall inequality of the covariance between spouses' earnings, notice that, for the population of two-earner households, the squared coefficient of variation can be decomposed in three components: the variance of earnings for first household earner, the variance for the second, and twice the covariance between the two, all divided by the squared mean household earnings.[4]

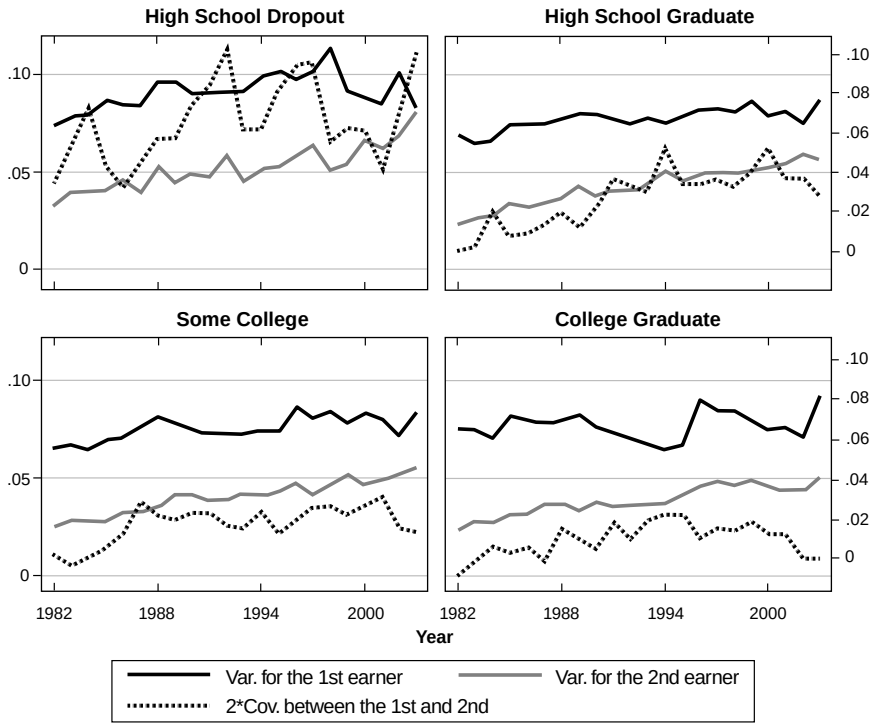
In figure 3-15, we show the evolution of each of these three components in the CPS over time. The left scale of the figure refers to the first two components, the right to the third. It is apparent from the figure that the component that contributed the most to the increase of inequality is the

FIGURE 3-16
INEQUALITY TRENDS WITHIN THE HOUSEHOLD BY DECADE-OF-BIRTH COHORT



SOURCE: U.S. Census Bureau, Current Population Survey.

FIGURE 3-17
INEQUALITY TRENDS WITHIN THE HOUSEHOLD BY EDUCATION



SOURCE: U.S. Census Bureau, Current Population Survey.

covariance between earnings, which, as a fraction of squared mean households, has increased from just below 1 percent in 1982 to almost 4 percent at the end of our sample.

We also decompose overall earnings inequality for the four birth cohorts and education groups. Figure 3-16 displays the dynamics of the three components of the overall inequality and makes it apparent that the covariance component increases for all cohorts except for those born in the period 1950–59. Interestingly, for this cohort, the increase in overall inequality is less pronounced.

Since education is an important determinant of labor supply behavior and might therefore affect the degree of covariation between earnings

within the households, we also plot in figure 3-17 the decomposition of overall inequality for the four education groups. It should be noted that the groups are formed on the basis of the education of the household head. The figure reveals that the steepness of the covariance line decreases with education. This implies that the covariance of the more educated has increased less from 1982 to 2003.

Further Readings

The literature on the evolution of wages and earnings inequality in the United States (as well as other countries) is too large to be summarized here. The recent paper by Autor, Katz, and Kearney (2007) contains many relevant references as well as some of the most recent estimates. Gottschalk and Moffitt (1994) pay particular attention to the changes in the variance of transitory and permanent components of income.

4

Expenditure and Consumption

Having analyzed the pattern of wages and income inequality and validated the use of the CEX by comparison with results from CPS data, we now turn to the core of our monograph: the analysis of consumption levels and inequality in consumption. We believe that inequality in consumption reveals more about inequality in well-being than does inequality in wages and income. As with wages and income, we start our discussion by presenting information on the levels of expenditure in the aggregate and for some subgroups of the population. We then move to information about the distribution of expenditure, both in the aggregate and within the same groups. In particular, in this chapter we discuss:

- **The evolution of consumption inequality across U.S. households.** To be able to combine the information from the components that make up the CEX, we use the standard deviation of logs as our measure of inequality. According to our evidence, consumption inequality increases by about 7 percentage points between 1982 and 2003. The increase is more pronounced for nondurable than for total consumption, which is observed only from 1984 and increases by just above 5 percent.

- **Increasing consumption inequality between individuals with different levels of education.** We measure skills by the educational achievement of the household head. The consumption of college graduates increases in comparison to that of the high school graduates in 1984 by 12 percentage points between 1982 and 2003. High school dropouts perform very badly: their consumption goes down not only in absolute terms but

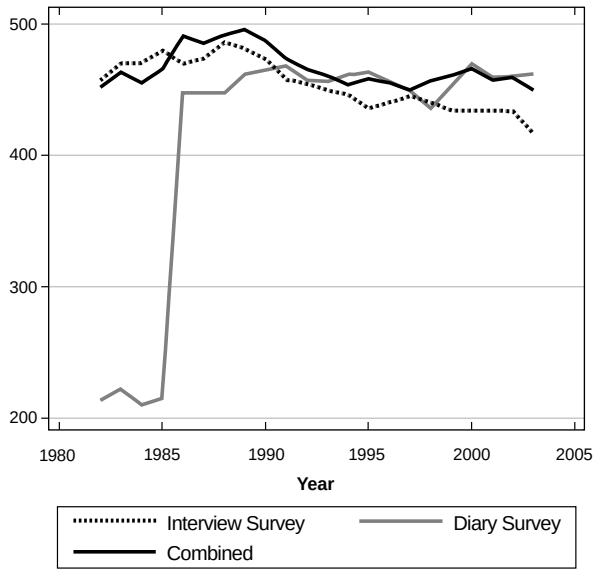
also relative to the other groups. In comparison with high school graduates in 1984, the consumption of high school dropouts decreases by as much as 20 percent.

- **Consumption inequality among households sharing similar levels of education.** Within-group consumption inequality increases for all education groups, but the increase is more pronounced for high school dropouts. For high school dropouts we see an increase of 15–20 percentage points, for high school graduates an increase of about 10 percentage points, and for college graduates an increase of only 5 percent.

In this chapter we use only CEX data, as the CPS does not contain information on consumption. As we explained in chapter 2, the CEX is made of two different surveys: the interview survey and the diary survey. We combine the two surveys on the assumption (shared by the BLS) that some commodities are better measured in the interview survey and others in the diary survey. Most other papers in this literature focus exclusively on the interview survey. To show the extent to which our combination of the two surveys makes a difference, we report the average monthly consumption (per adult-equivalent) for each year from 1982 to 2003 in figure 4-1. In the graph there are three lines: the dotted line is computed using data from the interview survey, the gray one using data from the diary survey, and the black line using our methodology to combine the two data sources. Note that the diary survey did not include infrequently purchased commodities and services prior to 1986. This has the consequence that, for the first few years, the diary survey aggregate is much lower than the other two aggregates. After 1986, instead, the diary survey becomes as comprehensive as the interview survey (if not more so). Note also that our estimates that combine the two surveys are, for most years, above either of the two components. The pattern that emerges is of an increase over time in per adult-equivalent consumption until the late 1980s. After 1990, however, the aggregate average drops slightly and consistently over time, especially in the period 1990–96. After 1996, the combined estimates increase slightly. The overall pattern described is consistent with that from figures published by the BLS for the period covered by our analysis. Given the discrepancy

between the CEX and the PCE data we discussed in chapter 2, one cannot take the decline in real per capita consumption expenditure shown by the CEX aggregate data at face value.[1] This supposed decline reveals more about the necessity of improving the quality of the survey and its ability to reflect aggregate averages than about the evolution of economic well-being. We will return to this issue in the conclusion, when we discuss data needs.

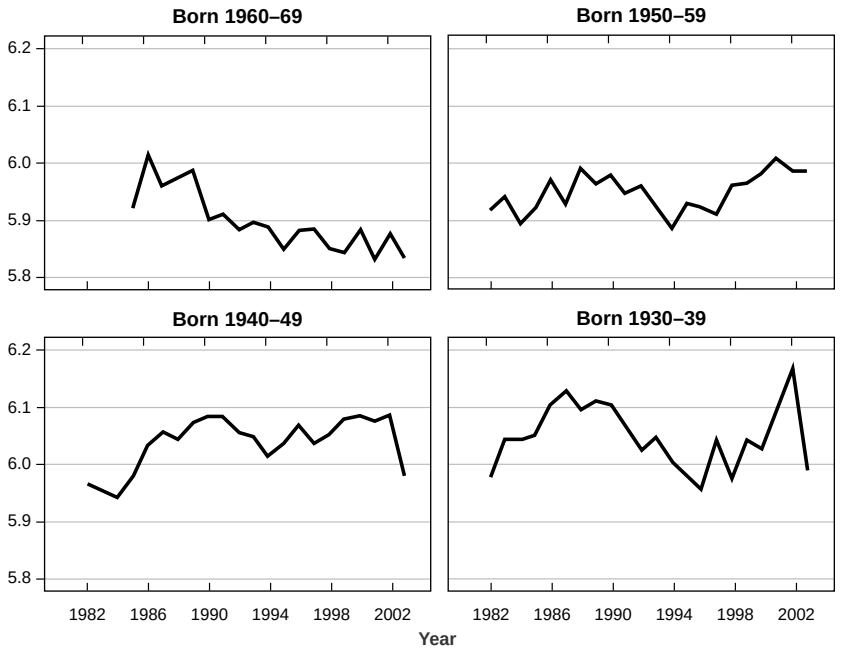
FIGURE 4-1
NONDURABLE CONSUMPTION AND SERVICES: LEVELS



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

In figure 4-2, we consider the evolution of consumption levels for different birth cohorts in the population. In this and in the subsequent figures we only report the data that combine the diary survey and the interview survey. Moreover, rather than reporting means of levels, we report means of logs.[2] In the case of the youngest cohort, the consumption of nondurables and services appears to decline throughout the period, in accordance with what we have shown for the aggregate figure. This might be

FIGURE 4-2
NONDURABLE CONSUMPTION AND SERVICES LEVELS BY DECADE-OF-BIRTH COHORT



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

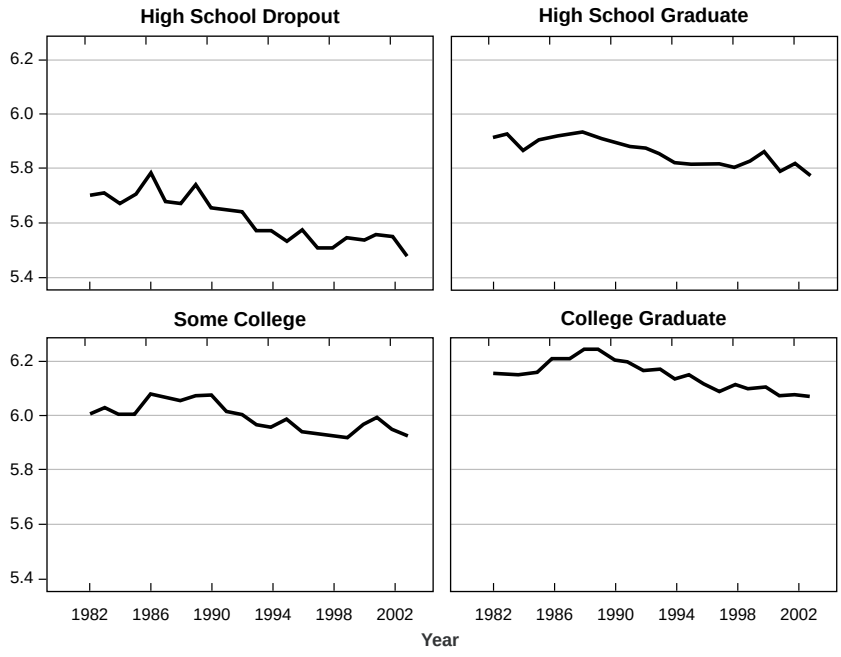
surprising, as these individuals experience, on average, an increase in their incomes. However, increasing the inflation rate by 0.8 percent a year to account for the upward bias in the inflation rate eliminates the decrease in real consumption. The consumption of the middle two cohorts does show an increase through most or part of the sample period, while that of the oldest cohort is more noisy, especially in the last few years of the sample. Accounting for the upward bias of the CPI would reinforce such an increase.

In figure 4-3, we look at the average log consumption of nondurables and services for the four education groups we considered previously. The consumption of all four groups, by and large, decreases over time after the early 1990s. Such a decline, however, is much more pronounced for the less-educated households. Indeed, college graduates are the only group that experiences an increase in the first years of the sample. The quality bias in the

CPI might account for the general decrease of real consumption, but not explain the differences between groups.[3] To stress the relative performance of these groups, and therefore have a first direct look at inequality, in figure 4-4 we plot the consumption of nondurables and services of each education group relative to the consumption of the high school graduates in the relevant year. This picture is comparable to similar pictures we constructed for wages and income. It shows an increase in the first years of the sample of the consumption of college graduates (and, to an extent, of households headed by an individual with some college) relative to high school graduates. Those who perform worst are the high school dropouts, whose consumption goes down not only in absolute terms but relative to the other groups as well.

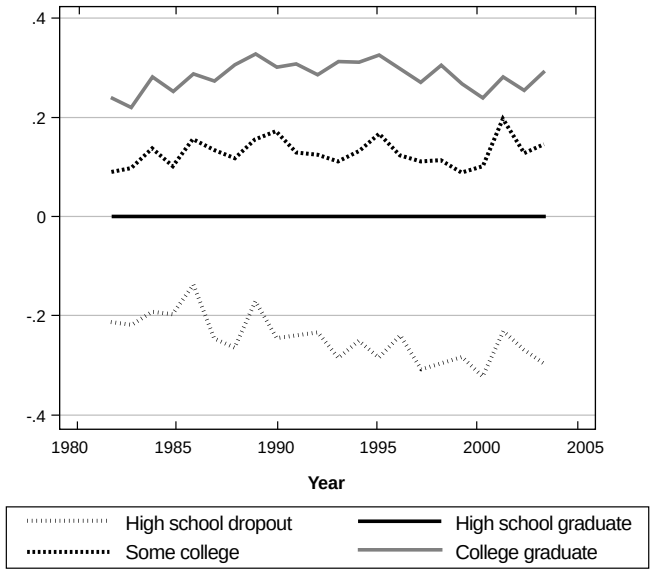
In chapter 2, we argued that the consumption of nondurables and services gives only a partial picture of the well-being of individual

FIGURE 4-3
NONDURABLE CONSUMPTION AND SERVICES LEVELS BY EDUCATION



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

FIGURE 4-4
RELATIVE CONSUMPTION LEVELS:
LOG NONDURABLE CONSUMPTION RELATIVE TO HIGH SCHOOL GRADUATES

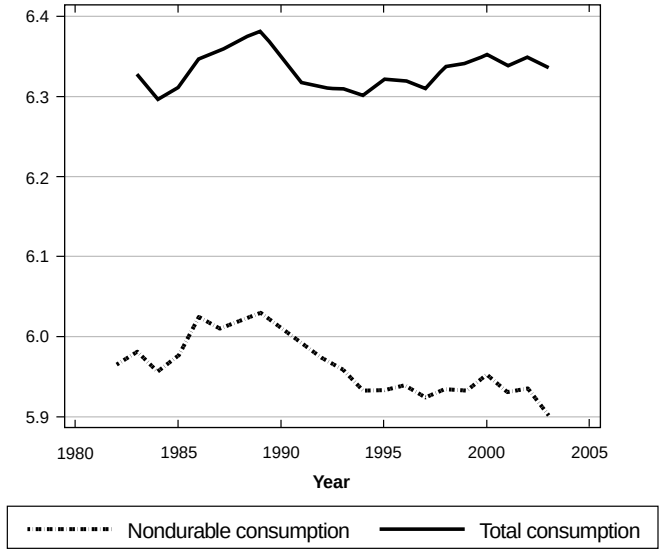


SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

households, as it excludes the utility derived from durable commodities. The interview survey contains very detailed information on vehicles, which allows us to estimate the value of the stock of cars for each household in our sample. However, such information is available on a continuous basis only after 1983. In figure 4-5, we use the methods discussed in chapter 2 and appendix 2 to add the flow of consumption services from vehicles to the expenditure on nondurables and services. To give a term of comparison, in figure 4-5 we also plot the average log of consumption of nondurables and services, which starts one year earlier. The time path of total consumption is similar to that of nondurable consumption in the early years of the sample: the two variables increase until 1989, decline starting in 1990, and flatten out in 1994. However, after 1994, accounting for cars makes the series of total consumption increase slightly over time, with a total increase of about 5 percent by 2003.[4]

Figures 4-6 and 4-7, which plot total consumption, mirror figures 4-2 and 4-3, which plot nondurable consumption levels. For comparison, we also plot the figures for the consumption of nondurables and services. The only cohort for which the consideration of durables makes any difference

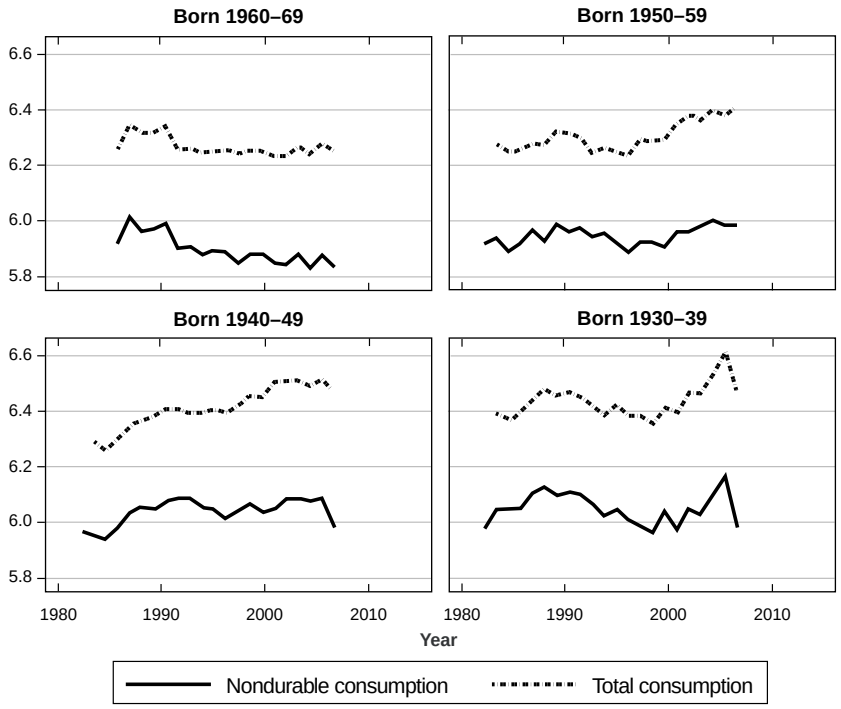
FIGURE 4-5
TOTAL CONSUMPTION: LEVELS



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

in terms of the time path is households headed by an individual born in the 1940s. For these households the increase in the later years of the sample is more pronounced when we consider total consumption than when we consider only nondurables. As for the education groups, the one picture where the time path of total consumption is slightly different from that of nondurable consumption is that for college graduates. The relative performance in terms of total consumption for our education groups is plotted in figure 4-8, which mirrors figure 4-4. Again, the differences between these two pictures are minor and confined to the most educated households.

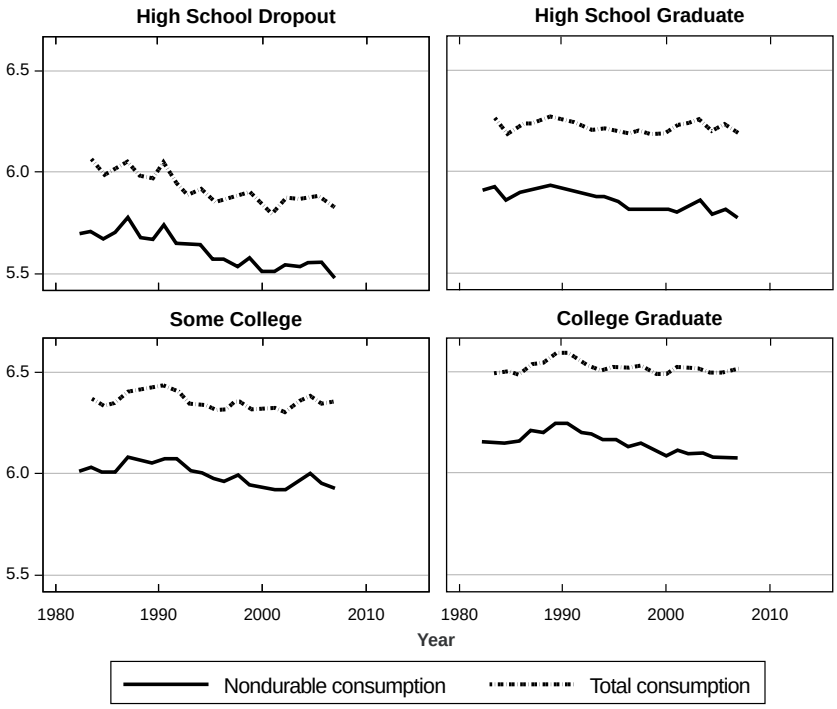
FIGURE 4-6
TOTAL CONSUMPTION LEVELS BY DECADE-OF-BIRTH COHORT



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

Having analyzed the main trends for the average *level* of consumption as emerging from the CEX, we now move to the analysis of inequality in consumption. In chapter 2 we discussed the puzzlingly divergent accounts of consumption inequality emerging from the two components of the CEX. There we noted that an analysis based on the diary survey suggests a large increase in inequality during the years we are considering, while one based on the interview survey suggests that inequality has not changed much during this period. In figure 4-9, we use the methodology mentioned in chapter 2 and described in appendix 1 to compute the standard deviation of log nondurable and total consumption. As we mentioned in chapter 2, to compute this measure of inequality we need an estimate of the covariance between the commodities measured in the diary survey and those

FIGURE 4-7
TOTAL CONSUMPTION LEVELS BY EDUCATION

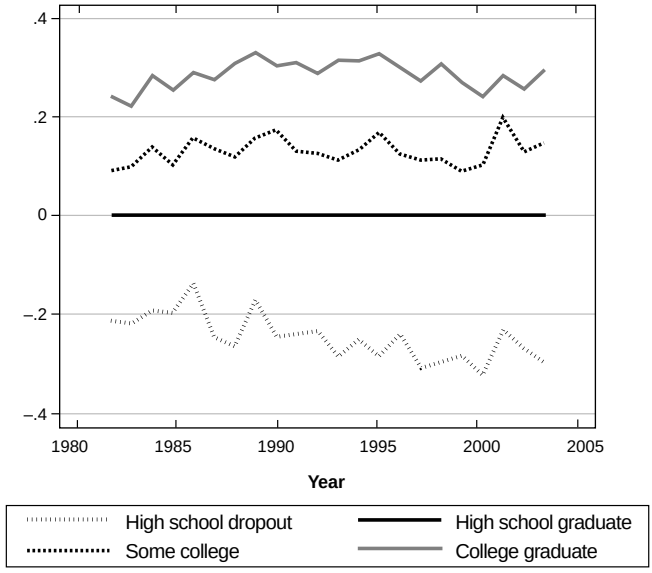


SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

measured in the interview survey, which can be obtained either from the interview survey or the diary survey. ABI (2007) show that it does not make much difference which one is used. As the estimate for the covariance in the diary survey is only available since 1986 (when the diary survey becomes an exhaustive measure of consumption), we use the measure of covariance in the interview survey, available since 1982.[5]

If we compare the path of the series in figure 4-9 to those in figure 2-2, we not surprisingly observe that inequality in nondurable consumption as measured by combining both surveys does not increase as rapidly as inequality measured in the diary survey, but it is not as flat as the series computed from the interview survey. The increase in inequality in nondurable consumption is particularly strong in the early years of the sample and

FIGURE 4-8
RELATIVE TOTAL CONSUMPTION BY EDUCATION

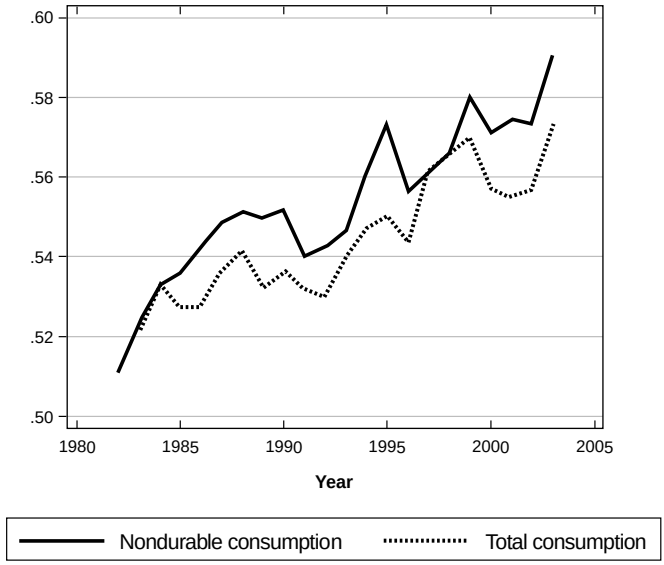


SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

seems to slow down in the later years, although there seems to be acceleration in the last few years. As for total consumption, we can only measure its inequality starting in 1983. In the first few years, the dynamics of inequality are almost identical, whether measured either by changes in inequality of total consumption or by changes in inequality of nondurables and services consumption. However, after 1985 and for most of the sample period, inequality in nondurable consumption increases faster than inequality in total consumption. This might suggest that adjustments are made in terms of composition of consumption in the face of income shocks.

In figure 4-10, we plot inequality for total and nondurable consumption for our four birth cohorts separately. This has the advantage of following individuals who have the same age at the same time as they go through different phases of the life cycle, during which they are differently affected by shocks to their income. These shocks are different for individuals of different ages and are reflected in consumption inequality

FIGURE 4-9
CONSUMPTION INEQUALITY:
STANDARD DEVIATION OF LOG TOTAL AND NONDURABLE CONSUMPTION

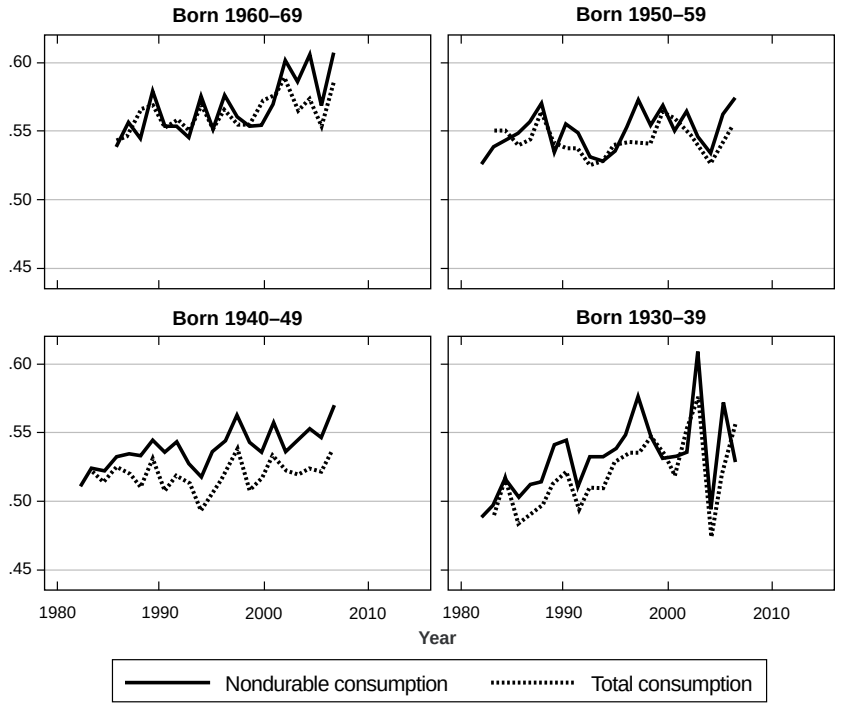


SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

differently, as different cohorts (at different ages) have access to different instruments to absorb and smooth individual earnings shocks.

Households headed by individuals born in the 1950s are the only ones for which consumption inequality (whether measured by total consumption or nondurable consumption) does not increase considerably. For the other three cohorts, nondurable consumption inequality increases considerably throughout the period. For the youngest and oldest cohort, the same is true for inequality in total consumption. In contrast, for the cohort born in the 1940s, total consumption inequality does not increase much over this period. Such differences across decade-of-birth cohorts might be driven by differences in productivity and differences in the availability of insurance mechanisms. Consumption data alone cannot help to disentangle these two sources of differences, and therefore chapter 6 deals with the joint examination of consumption and income.

FIGURE 4-10
STANDARD DEVIATION OF LOGS BY DECADE-OF-BIRTH COHORT



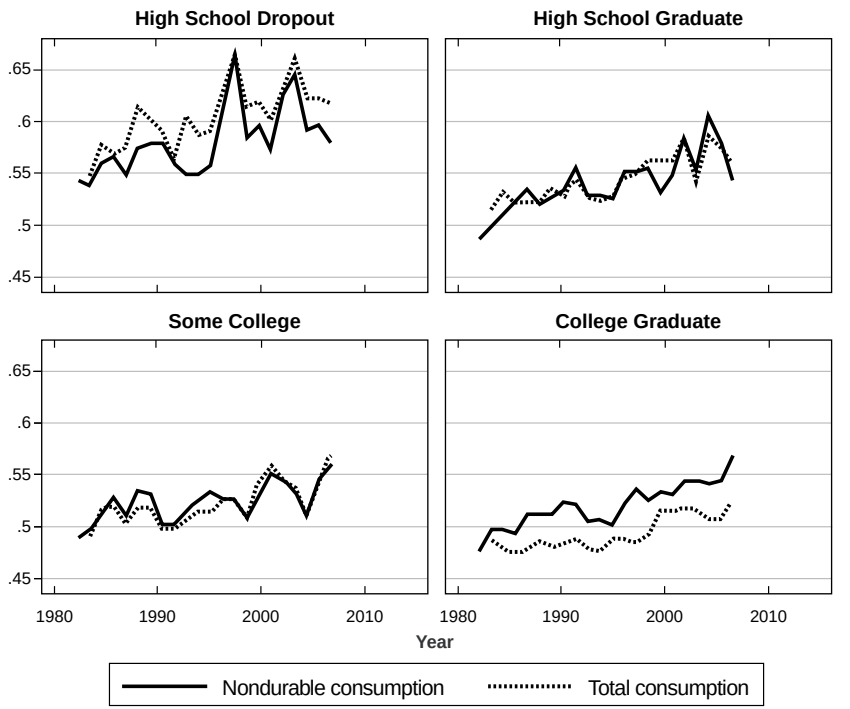
SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

Since individuals' productivity depends on education, as shown in figure 4-11, we analyze the path of inequality in total and nondurable consumption within education groups. Here the only group for which there is a difference between the two inequality measures is that of college graduates, for whom total consumption inequality is consistently lower and flatter than nondurable consumption inequality. For the other groups, the two series increase in similar fashion. And the less-educated groups have a considerably larger increase over time. For high school dropouts we see an increase of 15–20 percent, for high school graduates an increase of about 10 percent, and for college graduates an increase of only 5 percent (or 0 if we look at total consumption). Since inequality in wages increases by 20 percent in this group, and by around 10 percent in the other groups (see

figure 3-8), this suggests that more highly educated individuals were better able to smooth shocks to the market price of skills. The shocks are at least in part smoothed within the households, since the increase of earnings inequality is more pronounced for the households headed by more highly educated individuals (see figure 3-14).

In summary, overall consumption inequality increases whether we focus on total or on nondurable consumption. The increase, however, is more pronounced for the measure of nondurable consumption, which goes from 0.51 in 1982 to 0.59 in 2003, and for the high school dropouts. Interestingly, for this group the increase in earnings inequality and in the degree of within-household covariation of earnings is also more pronounced. The next chapter is devoted to further investigation of this issue.

FIGURE 4-11
STANDARD DEVIATION OF LOGS BY EDUCATION



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

5

Income and Expenditure Poverty: How Do They Differ?

After considering the dynamics of consumption, earnings, and wage distributions separately, we now relate the various distributions. Before we present in the next chapter our analysis of the relationships between these distributions, in this chapter we ask some simple questions about the bottom of the distributions: are the people on the lower tail of the earnings and wage distributions the same as those on the lower tail of the consumption distribution? And is the relationship between the bottom households and the rest of the households the same in terms of earnings, wages, and consumption? We show how the answers to these questions have changed over time by repeating the analysis for four years: 1985, 1990, 1995, and 2000. In particular, we show that:

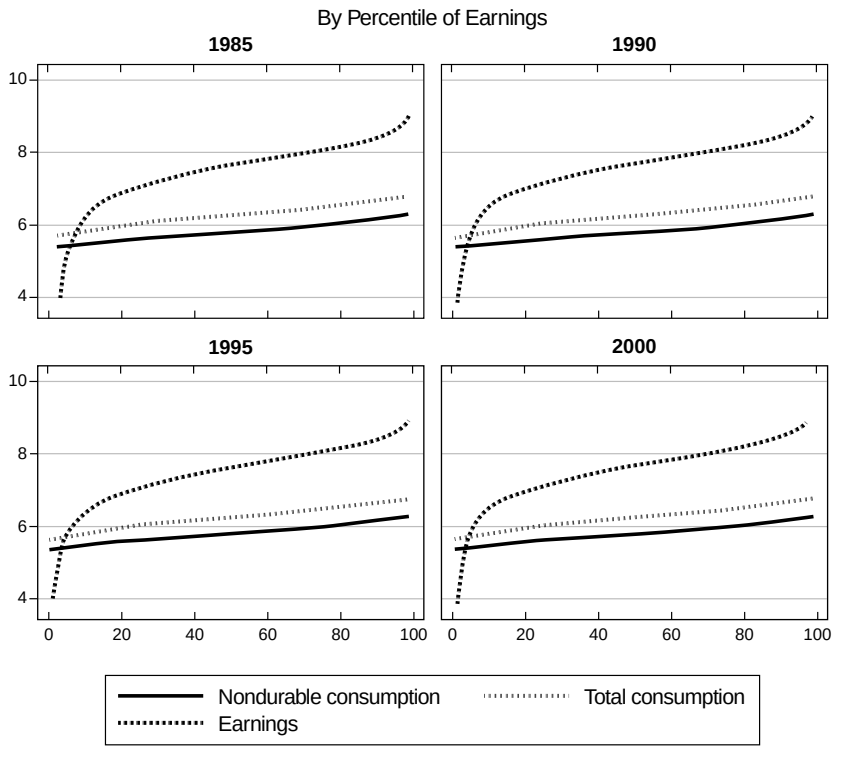
- **There is a positive association between consumption and income, and between saving and income.** Plotting median consumption against earnings and wages percentiles for different subgroups shows that there is a positive association between consumption and both earnings and wages. Moreover, earnings and consumption diverge in the upper part of the earnings (and wages) distribution. Saving defined as earnings minus consumption increases with income.

- **The association between consumption and income weakens in the bottom part of the earnings distribution.** For low percentiles (less than the 20th) of the earnings distribution, nondurable consumption does not vary much across households with these low levels of earnings. Moreover, the level of total and

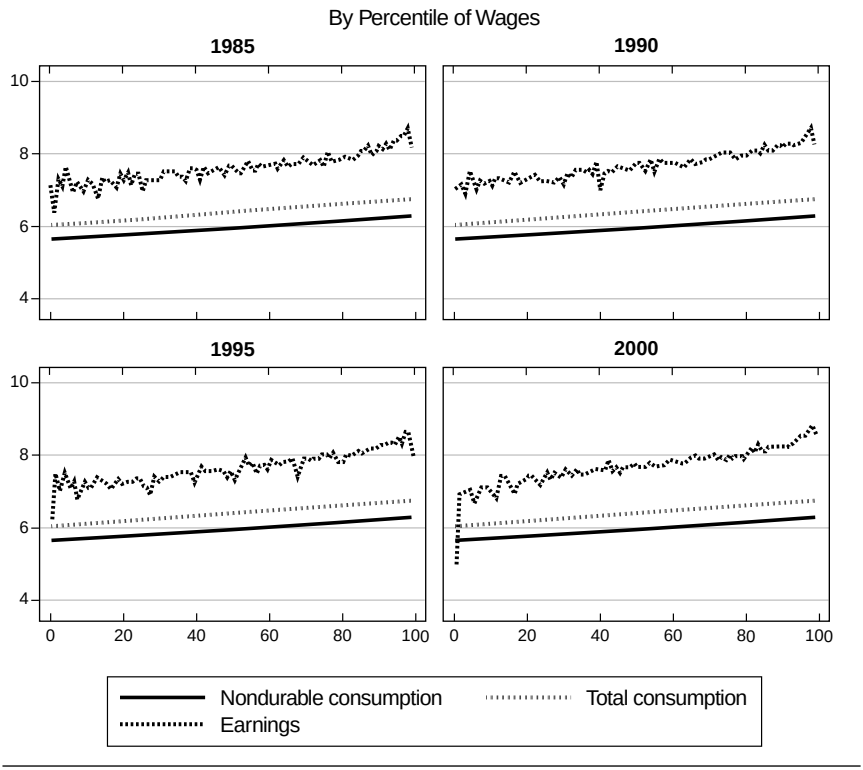
even nondurable consumption is much greater than total household earnings up until the 5th percentile of the earning distribution, implying negative saving for the households in these percentiles.

- **Those who are poor in income do not need to be poor in consumption.** Individuals and households that are identified as income-poor, or at the bottom of the income distribution, are not necessarily the same as those identified as consumption-poor, or at the bottom of the consumption distribution. Forty-three percent of households in the bottom 10 percent of the earnings distribution have consumption levels in the top 60 percent of the consumption distribution.

FIGURE 5-1
MEDIAN CONSUMPTION, 1982–1984 DOLLARS

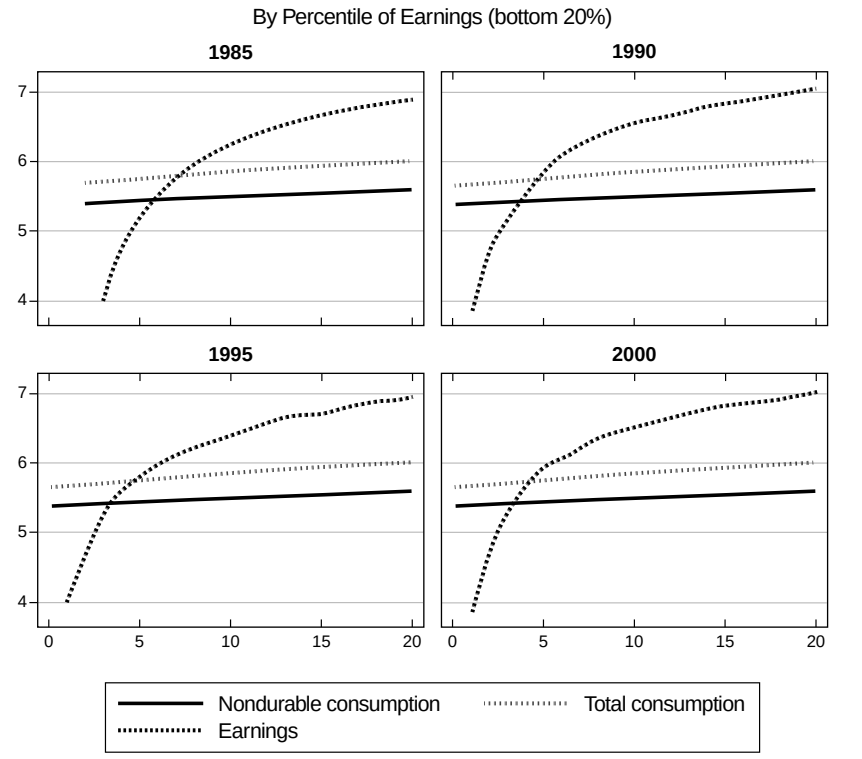


To show how earnings, wages, and consumption are related, figure 5-1 plots median consumption against earnings (left side panel) and wages percentiles (right side panel). To produce this picture (and those that follow), we merge data from several years of the CEX. Similar results would be obtained if these figures were done by year. The figure computes median consumption by earnings and wages percentiles and, not surprisingly, shows that there is a positive association between consumption and both earnings and wages. Moreover, earnings and consumption diverge in the upper part of the earnings (and wages) distribution. This is not peculiar to U.S. data. With U.K. data, Attanasio, Battistin, and Leicester (2006) show that savings increase with income. Moreover, they show that this pattern does not change much over time, as seen when comparing the similar graphs for the four different years we selected in the period we are analyzing.

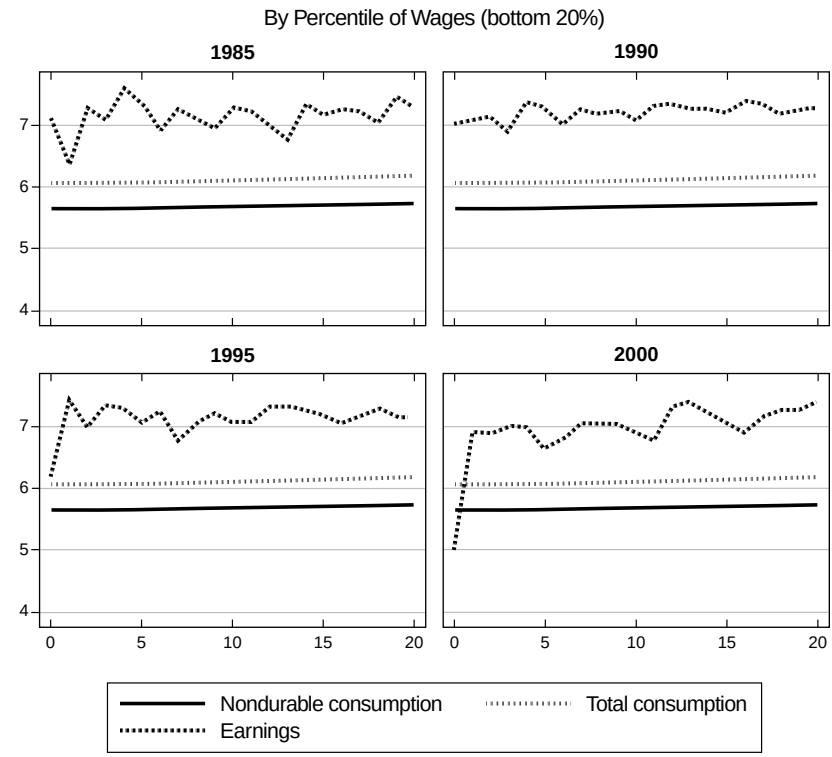


SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

FIGURE 5-2
MEDIAN CONSUMPTION FOR THE POOR, 1982–1984 DOLLARS



To explore further the consumption-income gradient for the poor, we focus on the bottom of the distribution. In figure 5-2, we focus on one part of figure 5-1 and plot the log of median consumption for the bottom 20 percent of both earnings and wages distribution; in doing so, we change the scale of the graph. As in figure 5-1, in addition to the log of nondurable and total consumption, we plot the log of household earnings. The figure uncovers interesting patterns. First, the nondurable and total consumption lines are much flatter than that of earnings. Indeed, focusing on the bottom 20 percent of earnings and wage earners makes it clear that, in the left tail of the earning distribution, there is a much weaker association between income and consumption than in the right tail: for those households in the

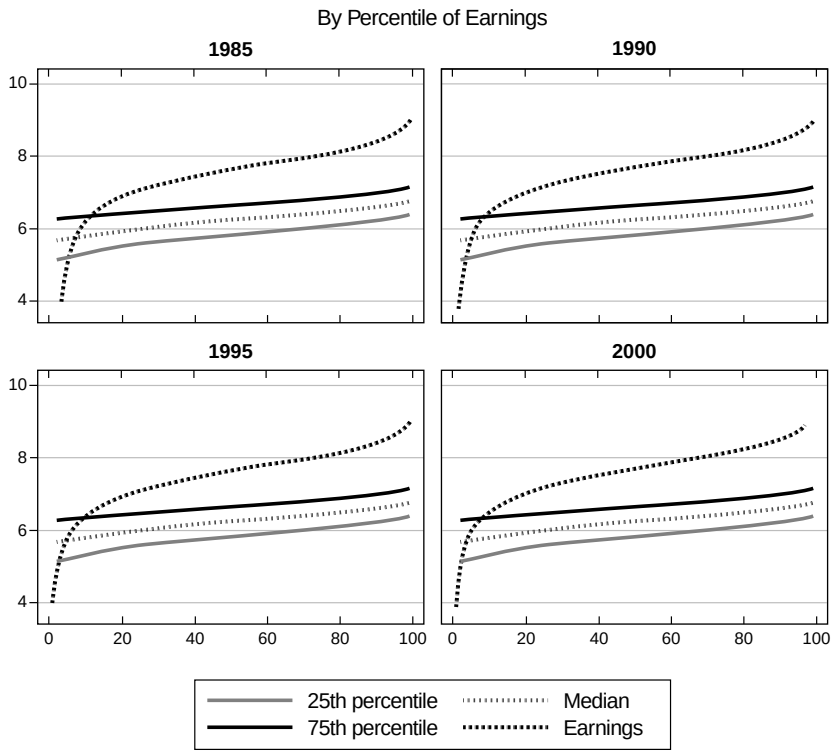


SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

lowest percentiles of earnings, nondurable consumption does not much differ across earnings percentiles. Moreover, the level of total and even of nondurable consumption is much above that of total household earnings up until the 5th percentile of the earnings distribution. A similar picture emerges if, instead of earnings, we consider total household income. This means that saving is negative for the income-poor, suggesting that consumption does not decrease with income for very low level of income.[1]

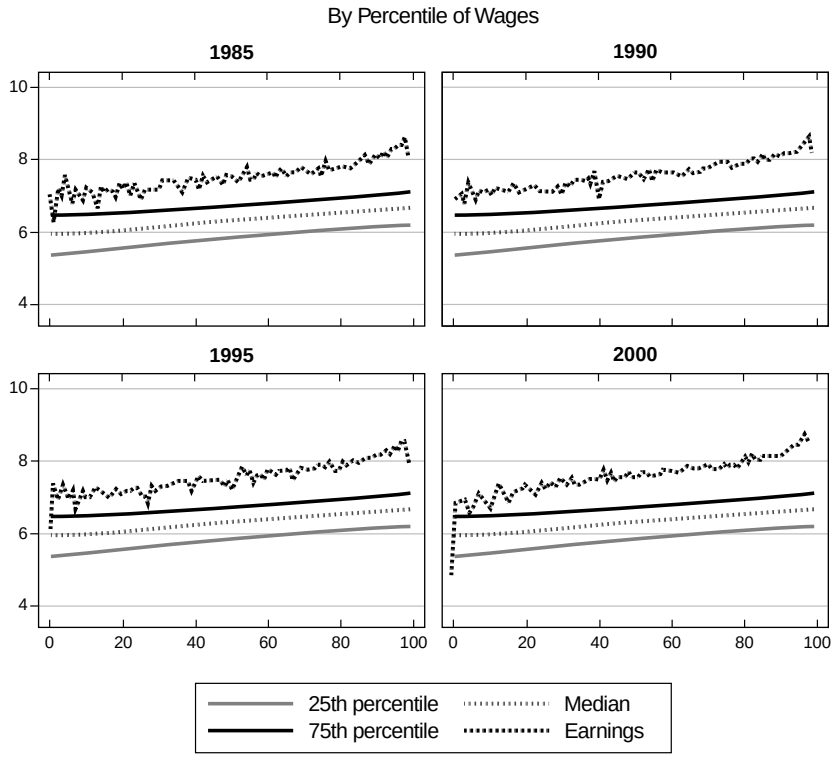
In figures 5-3 and 5-4, we plot the median of consumption (and earnings) for several earnings and wages percentiles. However, within the groups of households defined by earnings and wages percentiles there is a substantial amount of heterogeneity. To show this, we focus on total

FIGURE 5-3
CONSUMPTION QUINTILES, 1982–1984 DOLLARS



consumption. In figure 5-3, we plot not only the median but also the 25th and 75th percentile of the consumption distribution at each earning percentile. In figure 5-4, we again consider groups of households defined by earnings and wages percentiles, and, as in figure 5-3, we focus on the bottom of the earnings distribution. What is striking in these pictures is the amount of heterogeneity in consumption at any given earning percentile, and in particular at the bottom of the earnings distribution: the difference between the 75th and 25th percentile of the consumption distribution at low level of earnings is as large as 100 percent.

This lack of coherence between income and consumption in the bottom distribution of earnings and wages suggests that those who are

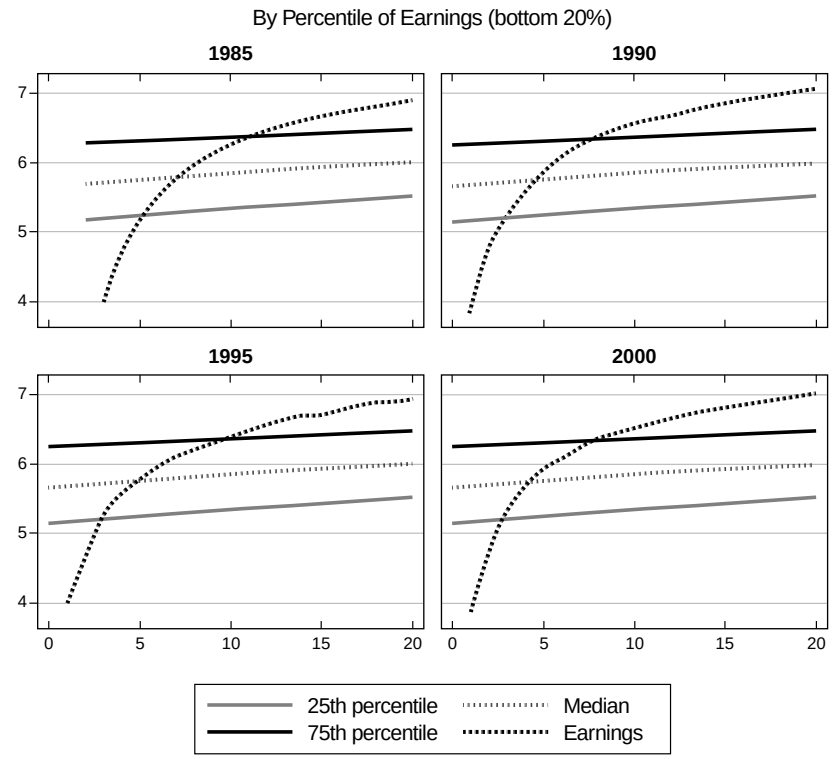


SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

income-poor are not necessarily consumption-poor. To shed further light on this possibility, table 5-1 (on page 74) displays the contingency table between income (earnings and wages) and consumption (nondurable and total) percentiles.[2] In the upper panel of the table, we cross-tab the 10th, 15th, and 20th percentiles of the earnings distribution against the 10th, 15th, 20th, 25th, 30th, 35th, and >40th percentiles of the nondurable consumption distribution.

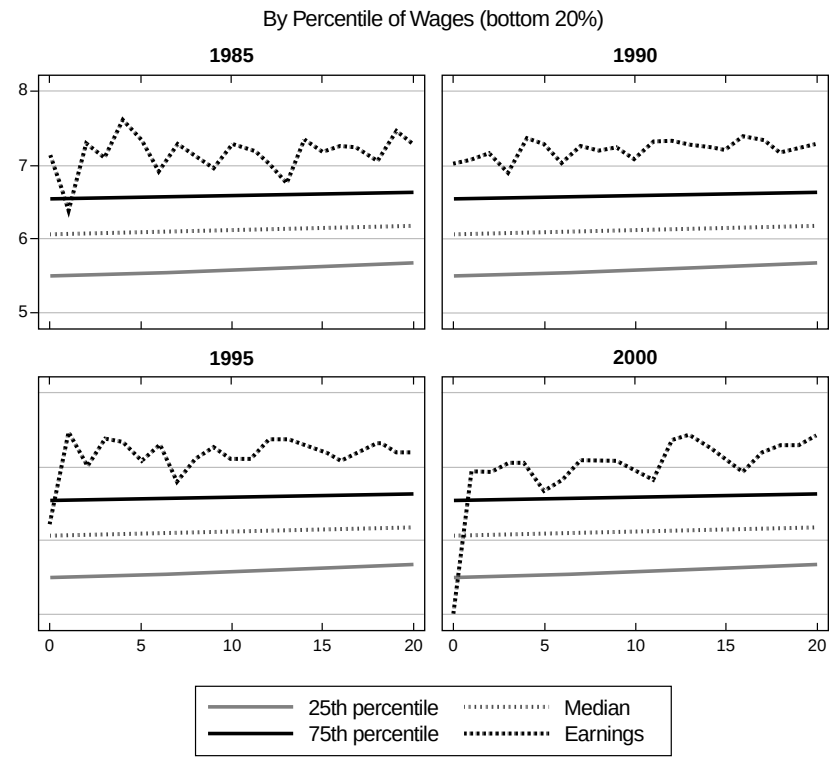
The table confirms that income-poor individuals are not always consumption-poor, whatever measure one uses of income (earnings or wages) and consumption (nondurable or total). For instance, 43 percent of individuals who are in the bottom 10 percent of the earnings distribution

FIGURE 5-4
CONSUMPTION QUINTILES FOR THE POOR, 1982–1984 DOLLARS



have consumption levels in the top 60 percent of the consumption distribution. If income and consumption were proportional, we would see that those who are in the bottom or top of the income distribution are also in the bottom or top, respectively, of the consumption distribution. This is not the case. Therefore, some of the income-poor are relying on debt, past savings, or transfers for their consumption expenditures.

To visualize that the income- and consumption-poor do not necessarily overlap, we compare table 5-1 with the case in which the income- and consumption-poor perfectly overlap (the perfect coherence case). In such case, we would observe that those who are in the 10th, 15th, 20th, 25th, 30th, 35th (and so on) percentiles of the income distribution are in



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

the same percentiles of the consumption distribution: the percentage of households who are in the same percentile of the consumption and income distribution is 100, and accordingly the percentage of households in different income and consumption percentiles is equal to zero. To measure the lack of coherence between the income and the consumption distribution, then, we subtract 100 from the percentage of households that are in the same percentile of the income and consumption distribution: the less coherent the income and consumption distribution, the closer this number to –100. For example, take those who are in the 10th percentile of the earnings distribution. The lack of coherence measure for those households is 3.34 – 100 = –96.66.

TABLE 5-1

CONSUMPTION IN THE BOTTOM OF EARNINGS AND WAGE DISTRIBUTIONS

Nondurable consumption							
Earnings	10	15	20	25	30	35	>40
10	3.34	19.03	11.88	9.47	7.37	6.18	42.73
15	3.68	16.90	10.53	8.88	7.65	6.85	45.52
20	2.53	16.99	9.44	7.36	7.20	6.47	50.02
Total consumption							
Earnings	10	15	20	25	30	35	>40
10	2.78	14.86	7.61	6.73	6.37	5.94	55.71
15	3.01	15.27	8.18	7.18	6.44	5.42	54.51
20	3.15	13.83	6.68	6.50	6.03	6.53	57.28
Nondurable consumption							
Wages	10	15	20	25	30	35	>40
10	22.41	11.19	9.09	7.19	5.81	4.84	39.47
15	18.65	9.47	9.60	7.92	7.36	5.91	41.08
20	16.10	8.35	7.99	7.09	6.24	5.87	48.37
Total consumption							
Wages	10	15	20	25	30	35	>40
10	14.55	7.48	6.80	6.46	6.02	5.29	53.39
15	14.05	7.94	7.29	6.38	5.69	5.84	52.81
20	13.21	6.85	5.51	6.70	6.10	5.97	55.67

SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

NOTE: The table shows the relative frequencies in each nondurable and total consumption percentiles by earnings and wages percentiles.

The other side of this same coin is that the percentage of households who are in the 10th percentile of the earnings distribution is different from zero if we move to percentiles of the consumption distribution higher than the 10th. This is plotted in the top corner panel of the left

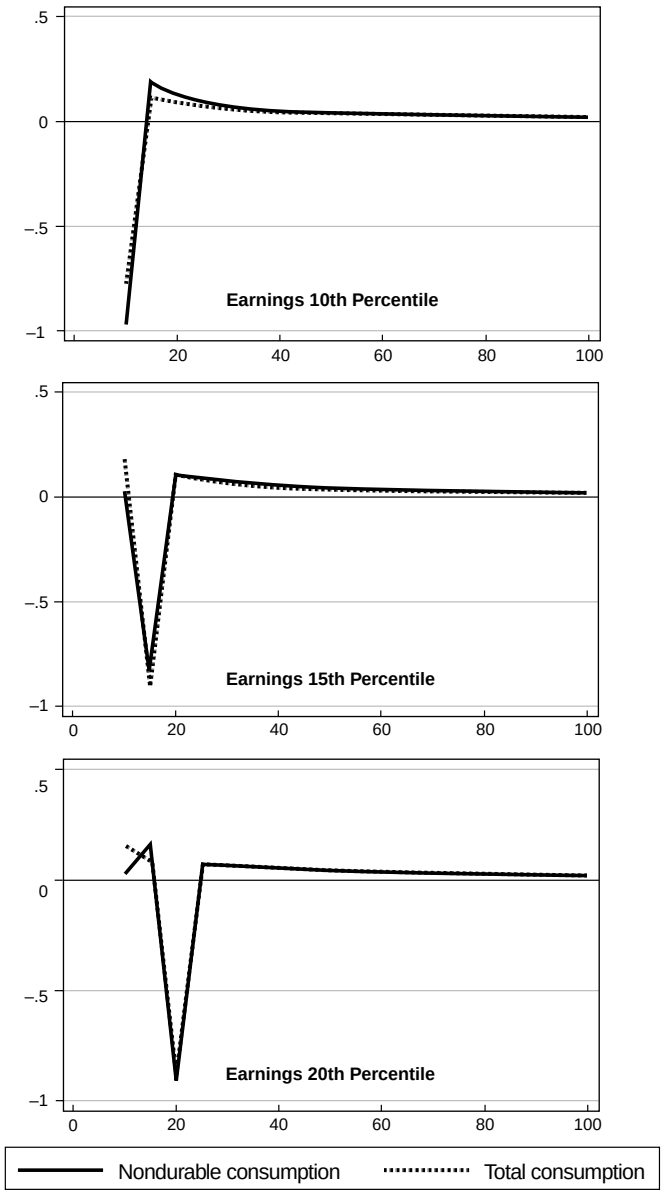
column of figure 5-5, which shows that a large number of households in the 10th percentile of the earnings distribution are in other percentiles of the earnings distribution and that such number is smoothly distributed across consumption percentiles. The other panels of the left column of figure 5-5 focus on the 15th and 20th percentiles of the earnings distribution, the right column on the 10th, 15th, and 20th percentiles of the wages. The figures convey the same basic message: being income-poor does not imply being consumption-poor. Even among those households in the bottom percentiles of the income distribution, the share of those in much higher percentiles of the consumption distribution is not negligible.

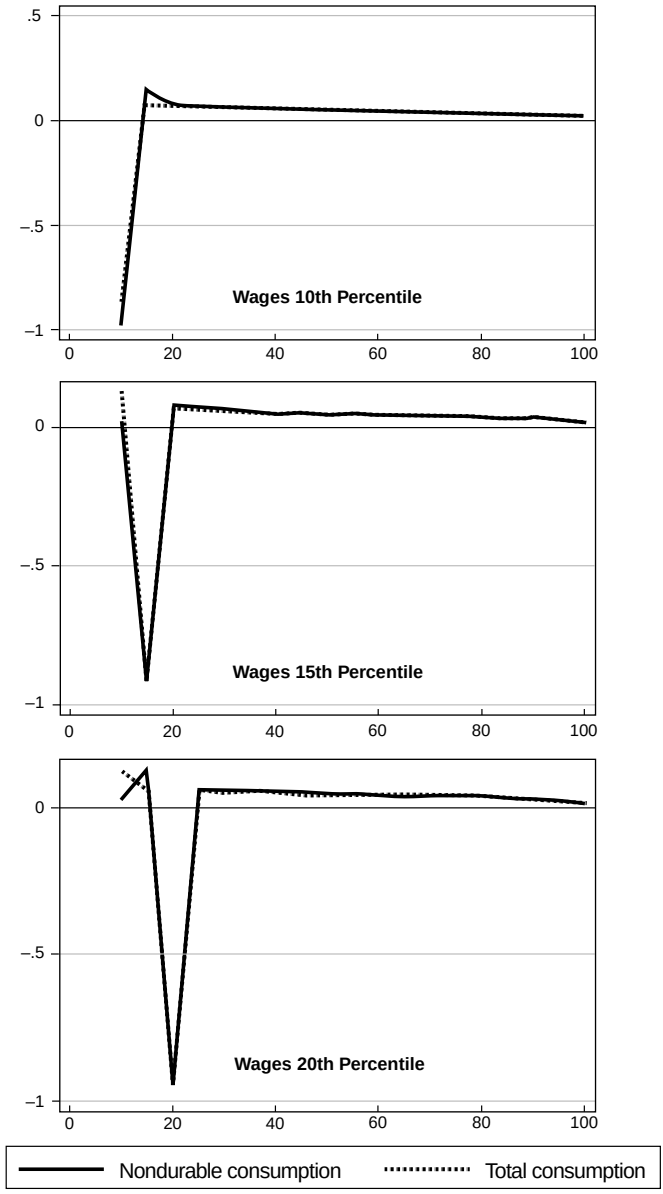
Comparing the wages and consumption distributions delivers similar results. Again, the wages-poor do not coincide with the consumption-poor. However, the association between wages and nondurable consumption is lower than that between earnings and nondurable consumption. The association between consumption and wages is 1.14 percent and between consumption and income percentiles is 7.56 percent.[3] The evidence for total consumption is similar, and the association between the wages and total consumption distributions increases to 2.64 percent.

In all cases, the association between the distributions of consumption and income, though small, is statistically significant. Measurement error tends to flatten both the distributions of consumption and income and, therefore, to reduce the association between them. Thus, the degree of actual association might be higher than what we observe. Since the degree of association between the wages and consumption distributions is lower than that between the earnings and consumption distributions, measurement error may be an issue in our data, and this implies that we should see our estimate as a lower bound for the actual degree of association between the income and consumption distributions.

This chapter has shown that the coherence between the distribution of consumption and income weakens for the poor and that therefore one might expect that those who are income-poor are not necessarily consumption-poor and therefore do not necessarily have a low standard of living. This has important implications for the design of policies that are meant to assist the poor.

FIGURE 5-5
CONSUMPTION, EARNINGS, AND WAGES WELL-BEING





SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

6

Relating Consumption and Income Inequality

We now turn to how consumption and income (and not their distributions) are related. To investigate how the relation between a household's consumption and income changes over time, we would ideally observe the same household for a long time. This is not possible with our data, as each household is only observed for a year at most. However, we circumvent this problem by following groups of households that share some characteristics, such as the decade of birth and the educational achievement of the household head. We analyze how the average level of income and consumption as well as inequality evolves over time for these groups of households. Notice that by focusing on households identified by the decade of birth of the household head, we study cohorts of households whose heads are at different phases of their life cycle. A life cycle analysis is particularly interesting because it lets us consider savings, which are a way for a household to move resources over time, as an instrument to smooth income shocks. In this chapter we show that:

- **The correlation between changes in relative wages and relative consumption is not stable over time.** Until 1992, there seemed to be a strong relationship between relative consumption and wages. Our results show that a 1 percent increase in wages brought about a 0.8–1 percent increase in consumption. For the years after 1992, no statistical relation between consumption and wages is detectable.

- **The correlation between wages and consumption inequality is less than one.** Only a fraction of income inequality translates into consumption inequality. The fraction varies depending on the consumption and income measures used, but it is always well below 1. An increase of wage inequality by 10 percent brings about an increase of consumption inequality of 3.5–3.6 percent. The gap between income and consumption inequality indicates that U.S. households are able to smooth adverse income shocks.

In this chapter, we use the evidence presented in chapters 3 and 4 and complement it with the joint analysis of consumption *and* income inequality. Our analysis considers the ability of individuals (in the population at large or in specific groups) to buffer shocks they receive and the nature of the shocks. If we observe a group of households among whom income inequality has increased greatly and yet their consumption inequality has not, we could speculate that those households did not need to modify their consumption (and ultimately their well-being) as a consequence. This might imply that they had a way to buffer these shocks (savings, borrowing, public and private transfers, and so on) and that they perceived the shocks as temporary.

We divide our analysis in two parts. We first consider the evolution of mean consumption and mean wages in different groups in the population and ask whether those groups that have fared relatively well in terms of wages are also those that have fared well in terms of consumption. This part of the analysis, therefore, focuses on the *relative performance* of different groups.

In the second part, instead, we will be looking at inequality within groups and ask whether the evolution of the level of consumption inequality *within* these groups of individual households is related to the evolution of the level of wage inequality within the same groups. Therefore, this second part of the analysis will complement the first by focusing on the relationship between income and consumption inequality *within* groups.

As before, the groups we will be considering will be formed on the basis of the decade of birth of the household head and on his or her academic achievement. The fact that we will be following the same groups over time will give a dynamic dimension to our analysis.

Relative Consumption and Wages

We report the main results of this section in table 6-1. The table contains our estimates of the relationship between average wages and consumption, controlling for permanent differences across groups as well as common movements over time. In particular, given a group labeled with the superscript g, if we denote with c_t^g and w_t^g its average (log) consumption and wages, we are interested in the following relationship:

$$(1)\quad c_t^g = d^g + \mu_t + \gamma w_t^g + \varepsilon_t^g$$

where d^g captures the average level of consumption over time and therefore controls for permanent differences across groups, μ_t controls for common year effects, and ε_t^g is a random term with zero mean. We are interested in the coefficient, which tells us what part of relative changes in wages is reflected in relative changes in consumption.

There are several ways we may estimate this coefficient. First, we could literally estimate the parameters of equation (1) or, as we will discuss, we may employ different statistical and econometric techniques. Alternatively, we could eliminate the nuisance parameters d^g by considering the terms of equation (1) at two different dates and taking the difference between the two expressions. By doing so, we would estimate:

$$(2)\quad \Delta^k c_t^g = \mu_{t,k} + \gamma \Delta^k w_t^g + v_t^g$$

where

$$\Delta^k c_t^g = c_t^g - c_{t-k}^g, \Delta^k w_t^g = w_t^g - w_{t-k}^g,\ \mu_{t,k} = \mu_t - \mu_{t-k} \text{ and } v_t^g = \varepsilon_t^g - \varepsilon_{t-k}^g.$$

By considering the specification in changes with low values of k, we focus on short-term fluctuations in wages and the extent to which these are reflected in relative changes in consumption. By considering specifications

in changes with higher levels of k, we focus on medium-term relative changes; while considering the specification in level, we focus on more long-term changes and the extent to which they are reflected in long-term changes in relative consumption. In table 6-1, we report the results for annual changes *(k=1)*, for five-year changes *(k=5)*, and (in the last two rows) for the level specification in equation (1).

TABLE 6-1
CORRELATION OVER TIME BETWEEN RELATIVE CHANGES IN CONSUMPTION AND WAGES

	Nondurables			**Total consumption**		
	1982–1992	1993–2003	1982–2003	1982–1992	1993–2003	1982–2003
First Diff.	0.003	0.079	0.053	0.117	0.114	0.117
OLS	(0.494)	(0.059)	(0.044)	(0.062)	(0.060)	(0.043)
First Diff.	–1.538	0.578	0.813	–0.638	–1.168	–1.048
IV	(9.555)	(1.200)	(1.953)	(2.833)	(2.214)	(2.982)
5-year Diff.	0.312	0.060	0.155	0.312	0.063	0.162
OLS	(0.098)	(0.053)	(0.048)	(0.096)	(0.058)	(0.051)
5-year Diff.	0.999	0.111	0.361	0.855	–0.052	0.199
IV	(0.301)	(0.104)	(0.101)	(0.271)	(0.115)	(0.102)
Levels:	0.149	0.123	0.152	0.188	0.125	0.161
OLS	(0.077)	(0.064)	(0.041)	(0.073)	(0.069)	(0.043)
Levels:	0.825	0.061	0.182	0.571	–0.150	0.031
IV	(0.494)	(0.151)	(0.080)	(0.513)	(0.172)	(0.088)

SOURCE: Authors' calculations from the working sample (see chapter 2).

NOTE: Year cohort groups considered if median age is greater than 24 and less than 62. Standard errors reported in parentheses.

In the left side of the table we report the results we obtain when we use expenditure on nondurables and services as our measure of consumption, while in the right side we report the results for the measure that adds to the previous one our measure of car services. For each of the columns, we consider our estimates of the parameter γ considering two sub-samples (years up through 1992 and beginning with 1993) and for the entire period. Finally, each coefficient is estimated twice, first using

Ordinary Least Squares (OLS) and then using a technique, Instrumental Variable (IV), which attempts to take into account the fact that the average wage of a given group is measured with some error because of the limited sample size.[1]

The results indicate some important differences between the first and second part of the sample. For the years up through 1992, there seems to be a strong relationship between average group consumption and average group male wages. The relationship is stronger (although measured with less precision) when we use the IV techniques, as the OLS estimates are probably affected by attenuation bias induced by measurement error. Only when we consider year-on-year changes do we fail to identify a strong relationship between the two variables. In the case of five-year changes, we estimate the coefficient γ to be quite high: 1 in the case of nondurable consumption and 0.85 for the measure of consumption that includes car services. A high coefficient indicates that the shocks to relative wages are reflected into changes in relative consumption. Interestingly, the point estimates seem lower for the more comprehensive measure of consumption.

Things look quite different in the second period (that is, the years beginning with 1993). Both the OLS and the IV estimates are considerably smaller than the corresponding estimates for the first period. Not surprisingly, the estimates for the entire period are in the middle of the estimates for the earlier and later periods.

The results in table 6-1, therefore, indicate that while there was a strict correspondence between consumption and male wage shocks across groups until the early 1990s, this relationship was much attenuated in the subsequent period. The existence of a relationship between changes in relative wages and changes in relative consumption up to the early 1990s confirms the evidence obtained, using slightly different data and techniques, by Attanasio and Davis (1996).

The change in this relationship documented here for the second period is also consistent with some of the results presented by Krueger and Perri (2003), although the size of the changes in consumption inequality they present is different from our measures. Several hypotheses might account for the fact that the coefficient on wage changes is much smaller in the second period than in the first, but one plausible possibility is that the nature of the shocks to relative male wages changed after the early 1990s.

Our evidence on the returns to education in chapter 3 did indicate somewhat smaller movements in relative wages. However, the overall variability of relative wages is, if anything, slightly larger in the second period relative to the first. It is possible, however, that the nature of these changes makes them more easily absorbed and therefore not noticeable in consumption. The evidence in the labor literature that we have cited above seems to indicate that temporary shocks became relatively more important than permanent shocks during the 1990s as compared to the 1980s. Permanent shocks are harder to absorb than merely temporary shocks. It is also possible that institutional changes, such as the development of more sophisticated financial instruments as well as changes in safety nets, endowed households with better and more efficient ways to smooth out certain shocks. Therefore, relative wage changes had less impact on living standards in the period from 1993 to 2002 than in the period from 1982 to 1992.

Within-Group Inequality in Consumption and Wages

We now consider the relationship between the evolution of inequality in consumption and that of inequality in wages (and earnings) within the groups we have considered in the previous chapters. Here we are interested in analyzing the extent to which changes in wage inequality within a group are reflected in changes in consumption inequality within that group, controlling for differences in the *level of inequality* in a given group. To answer this question we consider the following simple equation:

$$(3)\quad Sd_t^g(c) = k^g + \Theta\, Sd_t^g(w) + u_t^g$$

where $Sd_t^g(c)$ and $Sd_t^g(w)$ are the standard deviation of (log) consumption and wages, respectively, within group g at time t. As with equation (1), the coefficient k^g takes into account permanent differences in inequality across groups. Our estimates of the coefficient Θ are reported in table 6-2 where, again, we use both OLS and IV techniques, and use both the measure of nondurable consumption and the measure of consumption that includes car services. In the left side we use male wages, while in the right side we use the standard deviation of log household earnings.

As in table 6-1, the IV estimates are considerably larger than those by OLS, indicating the presence of attenuation bias induced by measurement error. In all cases, the coefficients are statistically different from zero, indicating a relationship between the two measures of within group inequality. In the case of the IV estimates, the coefficients are also economically significant, with the coefficients being as high as 0.35 in the case of male wages. In the case of earnings (right side), the point estimates are slightly lower at 0.27 for nondurable consumption and 0.23 for the measure that includes car services.

TABLE 6-2
CORRELATION BETWEEN CONSUMPTION AND WAGES WITHIN GROUPS INEQUALITY

	Nondurables and male wages	Total consumption and male wages	Nondurables and household earnings	Total consumption and household earnings
OLS	0.053	0.047	0.003	0.003
	(0.026)	(0.024)	(0.013)	(0.012)
IV	0.358	0.347	0.269	0.228
	(0.095)	(0.109)	(0.094)	(0.090)

SOURCE: Authors' calculations from the working sample (see chapter 2).

Table 6-2 conveys an important message: only a fraction of within-group earnings and wage inequality translates into consumption inequality. The fraction varies depending on the consumption and income measures used, but is always well below one. If one focuses on nondurable consumption and (male) wages, an increase of wage inequality by 10 percent brings about an increase of consumption inequality of 3.5–3.6 percent. The gap between income and consumption inequality indicates that U.S. households are able to smooth adverse income shocks, at least in part. Identifying the exact insurance mechanisms is beyond the scope of this work and a challenge for future research

Conclusion

It is now time to take stock of the results of our study. We have argued that the analysis of consumption and expenditure distributions is an important complement to, and perhaps even more informative than, the analysis of income and wage distributions for an understanding of the evolution of inequality and the distribution of material well-being. For most people material well-being is determined by consumption, and income is valuable only insofar as it gives access to consumption. Moreover, consumption is likely to react to permanent shocks affecting households and not necessarily to short-term fluctuations in disposable income. For these reasons, analysis of inequalities in consumption reveals more about inequalities in well-being than do inequalities in income. In addition, we carried out a joint analysis of consumption and income to study the nature of shocks that affect households as well as the instruments (such as assets, debt, and public and private transfers) they may use to absorb income shocks and avoid consumption fluctuations.

Although our analyses have demonstrated the importance of studying inequalities in consumption, it has been much less common in studies of inequality to analyze consumption rather than wages or income. The main reason labor economists have neglected to analyze consumption is the paucity of data on consumption as well as the perception that the extant data on consumption are much inferior to the databases that have been traditionally used in the analysis of wage and income inequality. While it is certainly true that the CEX, which is the main database containing consumption information, is not exempt from problems, these have been exaggerated. In chapter 3, for instance, we show that the CEX samples yield information on wages and income that is consistent, by and large, with that emerging from the CPS. While we do not want to minimize the importance of the data quality problems with the CEX, and in particular the relatively

low fraction of NIPA PCE data that can be accounted for by the CEX data, we think we have shown that these problems do not preclude fruitful analysis of inequalities in consumption.

Given these caveats on the data, some interesting patterns emerge from the data. We may summarize them as follows:

1. Consumption inequality has increased in the 1980s and 1990s, but the increase has been considerably less pronounced than the increase in inequality in wages and income. In the two decades from the early 1980s to the early 2000s, the overall standard deviation of log nondurable consumption increases by more than 7 percentage points. This compares with an increase of 12–15 percentage points for the standard deviation of log wages and of about 10 percentage points for total household earnings.

2. While the increase in overall inequality in wages (and incomes) is concentrated in the first years of our sample, consumption inequality increases throughout the years in our sample.

3. We identify both an increase in inequality across education groups and within education groups. The former, however, happens mainly during the 1980s and the early 1990s. The latter continues until the end of our sample and can be observed for all education groups.

4. Households that can be characterized as income-poor in that they are located in the left tail of the earnings (or wage) distribution do not necessarily coincide with the households that are consumption-poor. Moreover, the difference in consumption between households at the bottom of the earnings distribution is much smaller than the difference in earnings. Consumption of the "income-poorest" household exceeds earnings.

5. If we analyze the dynamics of relative wages and consumption changes in groups defined by decade of birth and educational achievement, we observed that, until the early 1990s, there is a

relationship between relative changes in consumption and wages, consistent with the evidence in Attanasio and Davis (1996). In more recent years, however, this relationship is much weaker. In other words, while the changes in relative wages (across education and age groups) are reflected in changes in consumption, the same is not true of the changes observed after the early 1990s. This could be due to the different nature of the changes observed in incomes and wages in the last decade. It should be stressed, however, that while the increases in inequality of consumption during the last decade of our sample are less than the increases in inequality of wages and income, we did find an increase in inequality in consumption during these years. The changes in wage inequality over the later years are mainly changes *within groups,* rather than across groups. As such, they might reflect temporary rather than permanent shifts and shocks to relative wages.

6. We did identify a relationship between the movements in wage and consumption inequality *within* groups. At least some of the changes in relative wages within groups are reflected in consumption; however, the coefficient is far from being equal to one, indicating that part of the shocks is *not* reflected in consumption. This evidence is consistent with the fact that consumption inequality continued to increase even in the 1990s.

Obviously the results above are based on the assumption that the data quality problems do not introduce too much noise and bias. Our effort to validate the CEX data against the widely used CPS survey shows that the samples from the CEX and CPS are in many respects comparable, especially in terms of the information that can be obtained about wages. There is, however, a real worry about the reliability of the CEX consumption data, especially in the last years of the sample.

Therefore, we cannot conclude this study without an appeal for better measures of consumption in the United States. While it is true that over the last 20 years the reliability and quality of many individual-based surveys seem to have worsened, the case of U.S. consumption is particularly serious because the largest economy in the world lacks a reliable and

comprehensive survey that measures the main purpose of economic activity, namely consumption. Such a measure is crucial for a variety of reasons. The current aim of the CEX, the measurement of the weights for the construction of the CPI, is only one of these reasons. As we have emphasized repeatedly, better data about consumption would allow labor economists and those charged with the development of welfare policies to develop a better understanding of the distribution of well-being, the nature of economic shocks to households, and the instruments households use to smooth these shocks.

The construction of reliable data on consumption at the household level in an advanced society is not easy, as developed economies produce myriads of consumer items. This difficulty is compounded by the apparently increasing reluctance many individuals have to answer time-consuming and invasive surveys. However, in recent years there have been considerable advances in the measurement of other economic variables that, until a couple of decades ago, were deemed almost impossible to measure at the individual level. We are thinking, for instance, of the tremendous progress made in measuring individual financial wealth, promoted in surveys such as the HRS and the PSID. This progress should indicate that innovative questionnaire techniques and intelligent use of new technologies could yield very high payoffs in terms of data quality. There are surveys in the industrialized world that yield measures of household-level consumption that seem to be of better quality than the CEX. The Family Expenditure Survey in the United Kingdom, based on a mixture of individual (rather than household) diaries and retrospective interviews, has been able for many years to match extremely well aggregate PCE data from the NIPA accounts. These experiences could be studied and, suitably adapted, replicated in the United States. Moreover, in addition to an improved survey design, a better survey of consumption would have a larger sample size. While the CEX samples were significantly increased in 1999, the current size is still insufficient for any analysis that requires many dimensions simultaneously, such as educational achievement, decade of birth, or state of residence.

Finally, we would like to mention some of the methodological lessons that the joint analysis of consumption and income inequality has taught us. The inequality of individual and household incomes changes over time,

because changes in individual and household incomes are not coordinated. Some individuals will gain while others will lose or gain less. The consequences of these shocks for the distribution of well-being depend on the nature of these shocks. Permanent changes will obviously be much more relevant than temporary ones. While it is possible to gain some insights on these issues from the analysis of longitudinal data and from appropriate cuts of the data, the analysis of consumption can be much more effective in giving information on the nature of shocks even in the absence of longitudinal data.

Ultimately, the consequences of some shocks to incomes for the distribution of well-being depend on the extent to which these shocks are reflected in consumption and, therefore, depend crucially on the nature of institutions in place to provide some insurance against shocks and to smooth shocks when they do occur. These institutions include the welfare state with its many programs, the tax code, the possibility of borrowing in the face of temporary adverse shocks, and the availability of interpersonal connections. The role these institutions play, however, can be complex and subtle: these institutions affect households' incentives and indirectly affect the distribution of income. The evidence we present here indicates the need for detailed study of these institutions in future research on the design of welfare policy.

Appendix 1

Combining Consumption Information from the Survey Components of the CEX

In this appendix we describe the methodology that we followed to combine the information from the interview survey (IS) and from the diary survey (DS) components of the CEX. The approach that we take in this appendix builds upon previous work by Battistin (2003) and ABI (2007) to which the reader is referred for additional technical details.

The results presented in this appendix can be summarized as follows. The minimum set of assumptions required to combine IS and DS information is about the time series of covariances between consumption components as in Battistin (2003) and ABI (2007). These assumptions allow one to identify the evolution of the mean and the squared coefficient of variation of consumption over time (and by groups), but not percentiles of the distribution of consumption. Further assumptions are necessary in order to identify the entire distribution of consumption, and these assumptions are discussed in Attanasio and Battistin (2005) and Battistin and Padula (2009). The discussion that follows focuses on the former set of assumptions.

Assume that nondurable expenditure comprises expenditures on *two* sets of goods, *I* and *D*, so that it can be defined as follows:

$$C_{ND} = C_I + C_D$$

The set *I* includes expenditures on those types of goods the IS component of the CEX is designed to measure (types of expenditures respondents can recall for a period of three months or longer), whereas the set *D* includes expenditures on frequently purchased smaller items (including food and beverages, both at home and in food establishments,

housekeeping supplies, tobacco, non-prescription drugs, and personal care products and services).

Total expenditure comprises expenditures on nondurable and durable goods and is defined as follows:

$$C_{TOT} = C_{ND} + C_{DUR}$$

the latter set being defined as described at the end of chapter 2 and in appendix 2.

Throughout this appendix we will consider the within-group and between-group variance as indexes of inequality (with groups being indexed by G):

$$V\left[\lg C_{TOT} \mid G = g\right],$$
$$E\left[\lg C_{TOT} \mid G = g\right],$$

for which the following first order approximations are defined:

$$V\left[\lg C_{TOT} \mid G = g\right] = \frac{V\left[C_{TOT} \mid G = g\right]}{E\left[C_{TOT} \mid G = g\right]^2},$$
$$E\left[\lg C_{TOT} \mid G = g\right] = \lg E\left[C_{TOT} \mid G = g\right] - \frac{1}{2} V\left[\lg C_{TOT} \mid G = g\right].$$

Note that the previous expressions hold exactly if total expenditure is normally distributed (see Battistin, Blundell, and Lewbel, 2009). Clearly we have shown that:

$$E\left[C_{TOT} \mid G = g\right] = E\left[C_I \mid G = g\right] + E\left[C_D \mid G = g\right] + E\left[C_{DUR} \mid G = g\right], \qquad (1.1)$$

and

$$\begin{aligned} V[C_{TOT} \mid G = g] = {} & V\left[C_I \mid G = g\right] + V\left[C_D \mid G = g\right] + V\left[C_{DUR} \mid G = g\right] \\ & + 2C\left[C_I, C_D \mid G = g\right] + 2C\left[C_I, C_{DUR} \mid G = g\right] + 2C\left[C_D, C_{DUR} \mid G = g\right], \end{aligned} \qquad (1.2)$$

where each covariance term can also be written as:

$$C\left[C_i, C_k \mid G = g\right] = \rho_{i,k}(g) \sqrt{V\left[C_i \mid G = g\right] V\left[C_k \mid G = g\right]}. \qquad (1.3)$$

The term $\rho_{i,k}(g)$ refers to the correlation coefficient between consumption expenditures (C_i, C_k) and is of course bounded below 1 in absolute terms.

Estimation of the within-group variance proceeds as follows. Means and variances in expressions (1.1) and (1.2) are estimated using the most

reliable survey component of the CEX. As for the covariances in (1.2), we use (1.3) and exploit the two measures of the correlation coefficient between (C_I, C_D) as obtained from the IS and the DS components of the CEX; these measures are combined efficiently in the estimation via a Method of Moment procedure by assuming that the growth rate of the time series of the two covariances is the same in the two surveys. Evidence in favor of this assumption is provided in Battistin (2003) and ABI (2007).

Building upon a summary of the literature on measurement error in survey reports of consumption expenditures as well as very recent publications by researchers at the BLS (see Battistin, 2003, and Garner et al., 2006), table A1-1 reports the expenditure categories used to define the *I* and the *D* sets of goods.

TABLE A1-1
EXPENDITURE CATEGORIES

Nondurable Goods and Services	
Nondurable consumption expenditures from the Diary Survey of the CEX (D goods)	
Food at Home	Food and Non-Alcoholic Beverages at Home
Food away from Home	Food and Non-Alcoholic Beverages away from Home
Alcohol	Alcoholic Beverages (at home and away from home)
Tobacco	Tobacco and Smoking Accessories
Housekeeping Services	Housekeeping Services
Personal Care	Personal Care
Entertainment Services	Nondurable Entertainment Expenses Newspapers and Magazines
Nondurable consumption expenditures from the Interview Survey of the CEX (I goods)	
Housing and Public Services	Home Maintenance Services Public Utilities Miscellaneous Home Services
Heating Fuel, Light & Power	Fuel Gas and Petroleum
Power, Transportation	Fuel for Transportation Transportation Equipment Maintenance and Repair Public Transportation Vehicle Rental and Misc. Transportation Expenses
Clothing, Footwear, and Services	Clothing Footwear Clothing Services
Durable Goods and Services	
Durable consumption from the Interview Survey of the CEX (DUR goods)	
Car Services	Car Services

SOURCES: Erich Battistin, Errors in Survey Reports of Consumption Expenditures, Working Paper W03/07, Institute for Fiscal Studies, London, 2003; and Garner et al., "The CE and the PCE: A Com*parison,"* Monthly Labor Review 129 (September 2006): 20-46.

Appendix 2

Estimating Services from Cars

This section discusses how we estimate the value of the stock of cars using a sample of microdata drawn from the CEX. Estimating the value of a car amounts to identifying a single numerical index measuring its "quality." This last depends on a number of features, including the year of production of the car, its age, and the general level of prices. If the level of prices changes over time because of inflation, no identification strategy that allows distinguishing among the three aforementioned effects is available. To get around this issue, we propose to use a set of cars' characteristics to estimate the year of production effect. Overall, we can estimate the value of the stock of cars for around 415,000 data points (each data point corresponds to a household interviewed in a given quarter).

The Data

As we discussed near the end of chapter 2, the data on cars come from the Owned Vehicles B and C files, made publicly available since 1984. The file B records a full set of characteristic for the vehicles present in the Consumption Unit at the interview date. As noted earlier, an incomplete list of these characteristics includes the type of the vehicle (car, truck, van, pickup truck, motorbike, boat and, eventually, airplane), the make and the model of the vehicle, the year and the month of purchase, the vintage, the number of cylinders, whether the vehicle entered the CU as new or used, and whether the vehicle is equipped with air-conditioning, automatic transmission, power brakes, power steering, radio, and a sunroof. The list also includes the purchase price, including net purchasing price (the cash outflow at the date of the purchase), and the trade-in allowance received, if any.

Moreover, households are asked if they disposed of a vehicle and, if they did, they are asked when and how, and about the vehicle's characteristics. This information is recorded in file C. Households can dispose of their vehicles in six ways: vehicles can be sold, traded in, given away outside the CU, damaged beyond repair, stolen, and other.

To estimate the value of cars, we look at their secondhand market price, which we elicit from the price the CU receives for selling the car and the price the CU paid at time of purchase.

Both the B and the C files include a vehicle number that identifies the vehicle within the CU and allows the information contained in one file to be merged with information in the other.

The sample covers the years from 1984 to 2003. Around 800,000 cars are present in the sample; of these, 60 percent are secondhand, while the number of models averages around 890 and the number of brands around 80. Around the 2.5 percent of cars are top-coded (the upper bound is not known).

The most frequent model is the Oldsmobile Cutlass (around 2 percent). The data include cars produced before 1969. The CEX does not deliver a point value for vintages between 1970 and 1980. Rather, the survey specifies an interval to which the year of production belongs.

We use a set of car characteristics that change across vintages, such as whether the car has automatic transmission or not, the number of cylinders, and whether power brakes or power steering are present, to estimate the vintage effects. Around 76 percent of cars in our sample have automatic transmission, 85 percent of cars have power steering, and the same percentage have power brakes. More important to our purposes, 74 percent of cars produced in 1986 are equipped with automatic transmission, but for cars produced ten years later this number goes to 86 percent. Similarly, 89 percent of cars produced in 1986 are equipped with power brakes, and this increases to 97 percent for cars produced before 1996; the same pattern is observed for the percentage of cars equipped with power steering. The changes in these car characteristics allow them to be used to approximate the vintage effects.

We next turn to the econometric issues involved in the estimation of the index measuring the quality of a car.

The Econometric Issues

There are a number of econometric issues to be dealt with when the quality of a car has to be inferred from the observed price. Next, we clarify these issues and explain how we addressed them.

Suppose that we observe a car for vintages. If we normalize to one the quality of, say, vintage *v,* the ratio:

$$\frac{P_{v+1,t}}{P_{v,t}} \qquad (1)$$

measures the quality of the vintage $v+1$ conditional on the time the two subsequent vintages are observed. If each vintage is observed for a long enough time, averaging (1) over t gives a single numerical index which measures the value of the cars in efficiency unit.

Now, notice that the age of the cars whose price is involved in the computation of (1) is different, since, trivially, $a = t - v$. If the value of cars changes because of aging, which, indeed, seems to be the case, the ratio in (1) depends also on a pure age effect. This age effect is often assumed to be a consequence of the depreciation.

If more aged cars deliver "less" service and then are valued less, we expect the depreciation pattern to be decreasing.[1] The rate at which the car depreciates determines the concavity of the age-value profile. Comparing the price of cars at the same age but at different times might help to account for the age effect. However, this comes at the cost of introducing a time effect, which causes the price of cars to change only because of inflation.

To illustrate this problem further, suppose that the price data are arranged in a matrix. The value of a car is a function of age and time. For simplicity, we assume that the maximum age and the maximum time for which the prices are observed is 5. In the rows of this matrix, the age is constant while the time varies. Obviously, the opposite holds true for the columns. An example of such a matrix is shown in table A2-1.

The difference between the average of prices in the, say, second row and the average of prices in the first row would be a measure of how the price changes because of aging from age 1 to age 2. In the same way, the

TABLE A2-1
THE AGE-TIME MATRIX FOR CARS

(Age, Time)	1	2	3	4	5
1	P(1,1)	P(1,2)	P(1,3)	P(1,4)	P(1,5)
2	P(2,1)	P(2,2)	P(2,3)	P(2,4)	P(2,5)
3	P(3,1)	P(3,2)	P(3,3)	P(3,4)	P(3,5)
4	P(4,1)	P(4,2)	P(4,3)	P(4,4)	P(4,5)
5	P(5,1)	P(5,2)	P(5,3)	P(5,4)	P(5,5)

SOURCE: Authors' calculations.
NOTE: Age is constant along the rows, while time is constant along the columns.

difference between the average of prices in the, say, second column and the average of prices in the first column would be a measure of how the price changes because of inflation from year 1 to year 2.[2]

However, this procedure leads in general to biased estimates of the age and the time effects: the problem is that the prices of cars in a given row (or column) belong to different cars, in that their vintage differs. Only moving along the diagonals do we observe cars belonging to the same vintage.

Whether or not it is problematic to compare cars belonging to different vintages to remove the age and the time effect is an empirical matter. The main difficulty in assessing the relative importance of the three effects (age, time, and vintage) is related to the fact that they are not separately identifiable.

The literature offers two main strategies to deal with the problem. The first one amounts to normalizing one of the three effects, say, the vintage effect, to zero. If the vintage effect approximates the degree of technological progress embodied in the price of cars, this assumption sets to zero the net price change due to technological progress. In other words, this strategy does not allow one to identify the trend in the degree of technological progress.

Hall (1971), in a study that focuses on trucks, suggests an alternative approach using a set of characteristics, such as the wheelbase, weight,

ratio of bore to stroke, horsepower, torque, and tire width, to estimate the vintage effect in a hedonic prices regression framework. The rationale is that this set of characteristics can be arranged in a vector that is a sufficient statistic for the vintage effect. If this is indeed the case, the identification problem is circumvented because these characteristic are chosen to be orthogonal to the age and time effects.

Given that the ultimate goal of this work is to evaluate the stock of cars, either strategy might be used. In what follows, we decide to pursue the second strategy. The main advantage of this strategy is that it makes possible the identification of all three effects, while its main disadvantage is its reliance on the availability of a set of characteristics rich enough to be used as a proxy for the quality. The choice of the second strategy is mainly based on empirical grounds.

The price of the cars at age a and time t can be written as:

$$P(a,t) = d_a t_t f_v \qquad (2)$$

where v is the vintage; d_a is the age effect, t_t is the time effect, and f_v is the vintage effect. From (2) it is clear that we cannot simultaneously identify the three effects. In order to achieve identification I, replace f_v by a set of characteristics.

We assume that prices are measured with error and that the error is multiplicative. Since the model is linear in the logs, the age, time, and the vintage effects could be estimated through a linear regression. The issue here is what functional form to choose. To understand it, consider again table A2-1.

If in a matrix like table A2-1 there are no "holes" (that is, we observe at least one price for each age-time cell), an analysis of variance (ANOVA) model could be used. The prices of cars are regressed on a (restricted) set of age, time, and vintage dummies.

If, instead, we do not observe a price for each age-time cell, we need to save on the number of parameters to be estimated. This might be accomplished by fitting to the price of cars a polynomial in age, time, and vintage (abstracting for a while from the identification issues). Due to data constraints, we opt for this second model and estimate the following parsimonious specification:

$$\ln P_{i,}(a,t) = a_o + a_1 t + a_2 a_i^2 + v_i' a_4 + \varepsilon_{i,a,t} \qquad (3)$$

where the left side variable is the log of the price, and on the right are a linear time trend, a quadratic polynomial in age, and a vector of car characteristics, v_i.[3] Padula (2001) has more details on the estimation of (3) and validates the results by comparing the estimated with the actual price of some selected models of cars.

The parameters estimated from equation (3) are then used to impute the value of the stock of cars. Imputing the value of the stock of cars only on the basis of equation (3) would amount to reducing the amount of heterogeneity in the value of cars. To restore, at least in part, the heterogeneity in car values, we add to the fitted prices from equation (3) and error drawn from a normal distribution with mean equal to zero and standard deviation equal to the standard deviation of the residuals from the estimation of (3).

Notes

Introduction

1. The trends of the second part of the 1990s and early 2000s seem qualitatively different from what happened in the 1980s and in the early 1990s. Several authors have observed that inequality increased more slowly over the later period and that this increase was more in inequality within than across skill groups. Moreover, as documented in Autor, Katz, and Kearney (2007), the change in inequality that did happen over this period is mainly driven by inequality in the top part of the distribution (for instance, the 90th/50th percentile ratio increases, while the 50th/10th is constant).

2. See Meyer and Sullivan (2004) for single mothers in the United States and Attanasio, Battistin, and Leicester (2006) for couples in both the United Kingdom and the United States.

3. For some measures of inequality, these decompositions may not be possible. It is, however, worth noting that Battistin, Blundell, and Lewbel (2009) provide convincing evidence that the distribution of consumption expenditures is roughly lognormal. This makes the informational content of any index of inequality equivalent to that of the variance of logs, and the study of between and within group components of inequality equivalent to that of a standard analysis of variance. The same result does not apply to the distribution of income, which is instead characterized by a marked departure from log-normality.

4. Interestingly, in developing countries usually the opposite is true: consumption is much easier to measure than income. This is both because the consumption basket is remarkably simple and because income can be derived by multiple and disparate sources. To a certain extent this is also true in the bottom of the income distribution for developed countries. Meyer and Sullivan (2004) argue that the consumption of poor single mothers can be measured with more precision than their income.

Chapter 2: Measurement Issues

1. The most important exceptions are Cutler and Katz (1991), Attanasio and Davis (1996), Slesnick (1993, 2000, 2001), Attanasio, Battistin, and Ichimura

(2007), and Meyer and Sullivan (2004). We elaborate on some of these studies under Further Readings at the end of this chapter.

2. One important exception is the question for food at home in the interview survey, which underwent significant changes in 1982 and then again in 1987.

3. The level of aggregation is different across the two samples, however. Food, for instance, is extremely detailed in the diary survey, while it is only available as food at home and food away from home in the interview survey.

4. Battistin and Padula (2009) show how many households are excluded from the diary and the interview samples if one drops those with incomplete income responses, non-urban households, those aged less than twenty-five and more than sixty-five, and households headed by a self-employed individual.

5. A first evaluation of the CPI was conducted by the Stigler Commission in 1961.

6. A discussion of the biases of the CPI in this context is contained in Slesnick (2000, 2001).

7. The family is the consumer unit. A consumer unit comprises: (1) all members of a particular household who are related by blood, marriage, adoption, or other legal arrangements, (2) a person living alone or sharing a household with others or living as a roommate in a private home or lodging house or in permanent living quarters in a hotel or motel, but who is financially independent, or (3) two or more persons living together who use their income to make joint expenditures. Financial independence is determined by the three major expense categories: housing, food, and other living expenses. To be considered financially independent, at least two of the three major expense categories have to be provided entirely or in part by the respondent.

8. As an extreme example, consider the case of two households both spending $200 in a month for public transportation, and suppose that the expenditure for one household is concentrated in the first week, and for the other in the third week of the month. The variance of expenditure for public transportation at the monthly level is zero using interview data, where households are asked how much they have spent for public transport in a month. However, when both households fill a diary for the first two weeks of the month, there will be a positive variance for the diary data.

Chapter 3: Recent Trends on Wages and Household Income Inequality

1. Wages can only be computed for individuals who work. If retirement (or more generally unemployment) is not random and uncorrelated with the level of wages, this implies that the age-profile we plot does not represent an unbiased estimate of the average wages faced by an individual over his or her life cycle.

2. Under log-normality, the difference between the 90th and the 10th percentile and the standard deviation of logs wages exhibit the same rate of growth over time, and the coefficient of variation of wages is approximately equal to the standard deviation of logs.

3. Furthermore, if the inflation rate is biased upward by 0.8 over the whole period, the decrease in real wages between 1982 and the early 1990s would be very much attenuated.

4. Pencavel (2006) investigates the connection between changes in earnings inequality at the individual and at the family level in the United States and shows that the growth in wives' relative employment has partly offset the increase in husbands' earnings inequality.

Chapter 4: Expenditure and Consumption

1. On top of these issues, as we mentioned above, if one wants to assess the evolution of economic well-being, one also needs to address the issue of what deflator to use to express consumption in real terms. As we discuss above, the CPI might be overestimating inflation.

2. As the log is a non-linear function, to combine the two datasets is not as easy as in the case of the means of levels. We need an assumption about the distribution of total consumption in the cross-section. In appendix 1, we show how this procedure works.

3. Biases in the CPI arise from quality changes and the substitution effects. It is arguable that the demand price elasticity varies with education, which might affect the adoption of new products and the substitution between products. Discussing how differences in the demand elasticity across education groups translate into differences in the CPI bias is beyond the scope of this work. It seems unlikely, however, that differences in CPI biases could account for the reported changes across groups.

4. Data limitations prevent us from focusing on other durables beyond cars. If the time evolution of services from other durables, such as household appliances, is similar to that of cars, one might argue that the exclusion of such durables reduces the observed changes in real consumption.

5. In appendix 1, we compare the standard deviation of log nondurable consumption computed with the two different measures of the covariance, namely that from the interview survey and that from the diary survey. The difference is not large, so that using the latter (which is the only one available before 1986) should not affect the results much.

Chapter 5: Income and Expenditure Poverty

1. Here, we focus on total pre-tax and transfers earnings and therefore define saving as pre-tax and transfers earnings minus consumption.

2. Contingency tables are designed to measure the degree of association between categorical and also ordinal random variables. Since the focus here is on percentiles, we use the contingency table to assess the association between distributions.

3. To quantify the association between consumption and income (wages), we use the Goodman and Kruskal's gamma, which counts the difference between concordant and discordant pairs in the comparison between ranks of two distributions.

Chapter 6: Relating Consumption and Income Inequality

1. The average wage is measured using the CEX sample. The "instrument" we use is the same average measured in the CPS sample. As the two samples are independent, there is no reason to believe that the errors in the two measures are correlated.

Appendix 2: Estimating Services from Cars

1. It is worth noticing at this stage that it might happen that some cars appreciate, that is, their value may increase with age.

2. This procedure consists of computing a within-group average, where the group membership is first with respect to age and then with respect to time.

3. We also tried different specifications, adding make-model dummies in the equation, interacting the age term with make-model dummies, or replacing the polynomial in age with a full set of age dummies. The overall fit of the equation, as measured by the adjusted R-squared, does not change much across specification and lies around 65 percent.

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