

REVIEW

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On Defining Real Consumption

Edward C. Prescott

Theory can and should be used to better define real consumption. Bad definitions could very well be the reason for the low growth in consumption. I base this statement on the observation that since 1982 the deflators of the *a priori* badly defined components of consumption have been increasing much more rapidly than the better defined components. If the price of the badly defined components had increased at the same rate as other consumption components, per capita real consumption growth after 1982 would have been in line with historical experiences.

Before suggesting how to better define the consumption commodities and, in the case of owner-occupied housing, how to better define its imputed rental price, I want to emphasize that there is no true concept of real consumption. Real consumption is what it is defined to be—nothing more and nothing less. Saying that any concept is a biased measure of true real consumption makes no sense. Biases can occur, of course, in estimates of the value of the defined concept. However, that is a different matter and cannot even be discussed until real consumption has been defined.

BADLY DEFINED CONSUMPTION COMPONENTS

The current definitions of some consumption components are deficient. Goods have definitional problems; however, such problems pale in comparison with those of some services. For some services, commodities are not even well-defined.

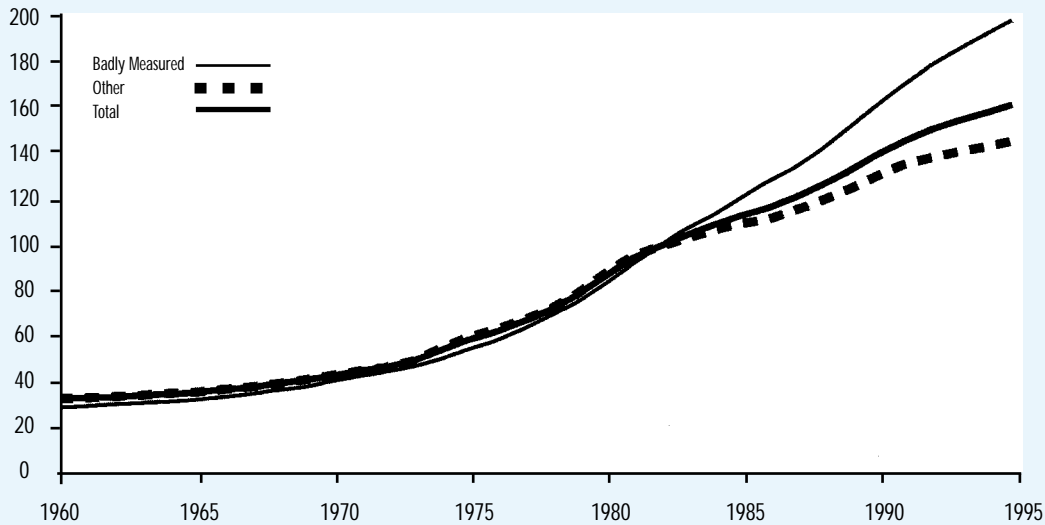
For other services, the current definition does not make sense from the point of view of economic theory. I discuss the first three of the four major services that fall into one or both of these categories: owner-occupied housing, personal business, medical care, and private education and research. Table 1 presents the share of nominal consumption when current definitions are used. These shares have changed little in recent years.

Figure 1 (p. 48) plots the consumption deflator for total consumption, my set of badly defined components, and the set of other components for the 1962–95 period. Figure 1 shows that the deflators of the badly defined consumption components behaved like the aggregate consumption deflator up until 1982. They then began to increase at a much more rapid rate. For the badly defined components, the increase in the deflator is 5.41 percent, whereas it is only 2.95 percent for the deflator of the other components after 1982. If in this 1982–95 period the badly defined components had behaved like the other components, real consumption would have increased by a large number—12.6 percent more than reported. The added growth would have roughly doubled the per capita growth in real consumption and would have made real consumption growth in that period comparable to the average during the preceding 100 years.

Prices of the badly defined components are, on average, increasing much more rapidly than the prices of the reasonably well-defined components. That fact, however, does not establish that the deflators of the badly defined components would have increased less rapidly had these components been better defined. It does suggest that this may well be the case. But even if the opposite is true and the badly defined components had even larger price increases in the 1982–95 period, the better definitions should be used. In that case, Americans should be even more con-

Figure 1

Consumption Deflators: Total, Badly Measured¹ and Other Components²
1982 = 100



¹ Includes personal business and medical care services, private education and research, and housing services—owner-occupied nonfarm space rent.

² Total less badly measured components.

cerned with the performance of their economy than they are currently.

BETTER DEFINITIONS

The guiding principle for defining a commodity is that it has a well-defined cost to the person consuming the good or service. The cost must take into consideration the tax consequences of consumption decisions. In the case of a sales tax, even if a purchaser pays this tax, the tax is included in the item's price, as theory says it should be. An implication of this principle is that if a person receives a subsidy or, equivalently, a reduced income tax liability, the subsidy or reduced tax liability should be subtracted from the price. This principle is not followed when it comes to imputing a price to owner-occupied housing and to employer-provided medical insurance. The motivation for this principle is that,

in computing aggregates, the maximizing household equates relative costs to relative marginal values. Without taxes and subsidies, a commodity's cost is just its price. With taxes and subsidies, appropriate adjustments must be made in the price for it to equal the cost to a household.

In the case of a required purchase, for example, of a catalytic converter, the working assumption is that its effective price reflects the aggregate of the relative values to others, resulting from improved air quality. From the point of view of judging the productivity of the private business sector (in particular, the consequences of changes in the legal and regulatory system on the private sector's productivity), the production of catalytic converters should be taken into consideration. It also makes sense to do this from the point of view of assigning some value to improved air quality (a public good).

An important implication of theory is that sometimes part of a commodity's definition must be an index of the type of person consuming the product. People in different risk classes, for example, pay different prices for an automobile casualty insurance policy or a medical insurance policy. Even if the only difference in an insurance policy is that people in different risk classes pay different prices, people in different risk classes consuming that policy are consuming different commodities. As I will show, if modern rental price of capital theory is used to impute a rental price to owner-occupied housing, the nature of the financing and the tax situation of the owner are part of the commodity's definition and its imputed price.

With contracts, a large set of characteristics defines them. Some characteristics can take on a continuum of values. The set that is actually consumed at different points in time changes, which causes a problem for calculating real consumption (using index number theory). This problem exists even if all quantities and prices of goods consumed at every point in time are available. With chain indexes, for example, prices of all commodities traded at date t are needed for dates $t - 1$ and $t + 1$ as well as for date t . With these prices and quantities, index number theory can be used to construct the Fisher idealized price index or some other related price index.¹ In practice, missing prices are determined by using hedonic pricing methods. There can be disagreement about which hedonic pricing formula to use, but hedonic pricing theory is the only way to proceed.² At least, I know of no alternative.

I turn now to better definitions of commodities and their effective prices.

OWNER-OCCUPIED HOUSING

Owner-occupied housing services are an important component of aggregate consumption: They are nearly 11 percent of the total consumption under current definitions. As can be seen in Table 2, during the past 10 years, the relative price of

Table 1

Shares of Badly Defined Components
(In percent)

	1985	1995
Owner-occupied housing	10.5	10.6
Personal business	8.0	7.7
Medical care	13.7	14.9
Private education and research	2.1	2.1
Total	34.3	35.3

Table 2

Percentage Increase in Consumption Component Deflators, 1985-95
(In percent)

Badly defined components	64
Owner-occupied housing	47
Personal business	68
Medical care	76
Education and research	62
Reasonably well-defined components	33
All durable goods	22
All nondurable goods	33
Reasonably-well defined services	40
Total consumption	42

owner-occupied housing has increased much more rapidly than have the prices of durable and nondurable goods and the prices of reasonably well-defined services. With owner-occupied housing services, there are no market prices and, as a result, these prices must be made up. The current procedure of using the rental price of some similar house is seriously flawed. The procedure is inconsistent with the principle that the effective price of a commodity should be its cost to the household consuming it. The cost of the services provided by an owner-occupied house depends on the owner's tax situation—namely, the owner's marginal tax rate and whether the owner itemizes deductions. The cost also depends on the size of the owner's home mortgage. Another major problem with the current rental equivalent approach is that significant moral hazard problems are associated with renting. An

¹ See Diewert (1978).

² See Griliches (1971).

implication of this problem is that the service of a given house is a different commodity, depending on whether it is owner-occupied or rented to someone else. Still another problem is that changes in tax laws in the mid-1980s increased rents of nonowner-occupied housing.

There is no excuse for not having better measures of nominal- and real-housing services. The Hall and Jorgenson (1967) rental price of capital theory can be used to construct a price for the service of an owner-occupied house with a particular type of owner. I emphasize that a given house is a different commodity depending on the financing method and the owner's tax bracket. I define the *imputed rental price* as the additional income an owner would need to receive for both the same end-of-the-year wealth and the same expenditures other than those related to home ownership.

The first cost of home ownership is interest on the mortgage. The particular mortgage interest rate I propose is the adjustable mortgage rate i_m , which I believe is the appropriate rate whether the owner finances using a fixed- or adjustable-rate mortgage. The adjustable rate is the appropriate interest rate because those people with long-term fixed-rate mortgages are gambling with those who own the mortgages with respect to future interest rates. Gambling just results in redistributions. The services of the owner-occupied house must be indexed by the mortgage size, because this number will affect the interest payments on the mortgage. Other costs are property taxes, maintenance, and depreciation.

In addition, forgone interest, capital gains, and reduced tax liabilities must be considered when computing an owner's cost. If the owner is in marginal tax bracket τ and the market value of the house at the beginning of the period is q , the forgone interest is $(1-\tau)(q-m)i$, where i is the indexed interest rate for the most common adjustable-rate mortgages, τ is the owner's marginal tax rate, q is the market value of the house, and m is the size of the mortgage. The period's capital

gain on the house is Δq (the change in the market value of the house). Reduced tax liabilities that result from the deductibility of property taxes and mortgage interest payments are $\tau(i_m m + t)$, where t denotes property taxes. This assumes the owner itemizes deductions. Note that the commodity must be indexed not only by the characteristics of the house but also by the size of the mortgage m , the owner's marginal tax rate τ , and the amount of property taxes t . Each enters into the calculation of the appropriate imputed rental price.

Summing these home ownership costs leads to the following formula for the rental price of an owner-occupied house:

$$(1) \quad c + (1-\tau)t + (1-\tau)qi + (1-\tau)(i_m - i)m - \Delta q,$$

where c is the maintenance costs.

For purposes of a numerical example, consider the owner of a \$200,000 house with a \$100,000 mortgage. This owner itemizes deductions and is in the 30 percent tax bracket. Property taxes are \$4,000, and maintenance costs are \$4,000 as well. The rate on an adjustable-rate mortgage is the index rate of 6 percent plus 2.5 percent. The nominal value of the house increases \$6,000 during the year. With these inputs, the formula yields \$13,950 per year for the rental price of that owner-occupied house.

When capital gains are incorporated into the formula, a tradition of national income and product accounting is violated. An alternative is to replace capital gains Δq in the formula by q times the rate of increase in the consumption deflator and to add depreciation. Such an alternative does not violate the national income and product tradition of not incorporating capital gains. Without taxes, the formula results in a rental price that is a function of the real interest rate and not a function of the inflation rate.

When this definition of an owner-occupied house's rental price is used, a change must be made to subsidies in the national income and product accounts. The reduced income-tax liabilities associated with owning a house must be subtracted from indirect

business taxes in reconciling national income with gross national product.

In this discussion, I have assumed that the transaction costs associated with buying and selling houses are negligible. In fact, they are quite large: They typically are 7 percent to 10 percent of a house's market value. Making the adjustment for these costs is straightforward. The price of a house is the net amount that would be realized if the house were sold plus the transaction costs of both the buyer and the seller. These transaction costs would be depreciated over a number of years, based on the average period of home ownership. This depreciation would be an additional cost.

To construct nominal consumption of owner-occupied housing services, multiply price by the quantity of each type of owner-occupied housing and sum over all types. I emphasize again that these types must be indexed not only by a house's characteristics but also by its property taxes, by the owner's marginal tax rate, by a variable indicating whether the owner itemizes deductions, and by the size of the mortgage on the house. Operationally, it would be necessary to sample a set of owner-occupied houses and obtain the relevant information.

PERSONAL BUSINESS

When it comes to personal business, the problem is defining the commodity. A major part of personal business is imputed financial services. If a customer deposits \$100,000 at a bank that pays 6 percent interest and the bank lends these funds to a business at 12 percent interest, with the current U.S. accounting system, the customer buys \$6,000 worth of banking services and has \$6,000 of imputed interest income for a total of \$12,000 of interest income. Imputed banking services are part of the personal business category of consumption.

An issue is whether these banking services are better imputed to lenders or to borrowers. The choice is important. If use of these services is imputed to lenders,

consumption of personal business services will be significantly reduced. This is true because businesses do the most borrowing from financial intermediaries. If these banking services are imputed to businesses, they become intermediate (rather than final) output.

The logic of economic theory is that if lenders are receiving a market interest rate, these financial services should be imputed to borrowers. Indeed, the United Nations system of national income and product accounts assigns these imputed financial services to borrowers. A simpler and, I believe, better system would be to use the term structure of the interest rate on government debt and modern finance theory to determine how much more interest borrowers pay than does the government for a security with identical liabilities. This difference is the services imputed to borrowers.

Even with the proposed procedure, a sizable part of banking output would be consumption services and not intermediate goods. First, there is the non-imputed part for which fees are paid. Second, households do a significant amount of borrowing. Combining credit card debt, automobile loans, and other consumer borrowing yields a large amount—nearly 15 percent of gross domestic product. Unincorporated businesses, in fact, do some of this borrowing. Many small businesses use credit card debt for short-term financial needs. Any split of consumer debt of households that own an incorporated business between the consumption unit and the business unit is arbitrary. Incidentally, home mortgages are not included in household borrowing. These loans are made to a household *business*, which rents at an imputed rate to the owner of that business. Third, depositors typically earn less than the market interest rate on their checking accounts. Here consumption service must be imputed. With the proposed scheme, the imputed nominal banking service is just the forgone interest.

Defining *nominal* consumption of banking services is not difficult. Defining *real* consumption of these services is. The

procedure that makes sense from the point of view of theory is as follows. First, select some characteristics of a checking account contract in much the same way that characteristics are selected to define an automobile type. These characteristics would include such things as the number of transactions carried out, the convenience of making withdrawals, and the minimum balances required for free checking. Second, use hedonic methods to price contracts that were consumed in some, but not adjacent, years. Finally, use standard index number theory to compute real checking account services.

MEDICAL INSURANCE

I turn now to the problem of how to define the real output of the insurance sector, a topic I have studied.³ The current practice for insurance is as follows: Nominal insurance consumption is the net premiums earned by that insurance sector (that is, gross premium plus net interest earned minus claims paid). The ratio of the date t to the date $t - 1$ deflator D for an insurance type is the following:

$$(2) \quad D_t / D_{t-1} = (R_t / p_t) / (R_{t-1} / p_{t-1}),$$

where R denotes gross premiums and p a price index for that type of insurance. In the case of medical insurance, p is the health care index. This approach implicitly assumes that the real value of the output of the medical insurance is proportional to deflated gross premiums. Hornstein and Prescott (1991b, pp. 198–99) show that this definition can produce numbers that do not make sense. Suppose, for example, that medical insurance companies figure out how to distinguish between those patients who will benefit from a particular treatment and those who will not. Furthermore, this treatment is painful and unpleasant. Any sensible definition would take this into consideration. The current scheme does not.

I believe Ruggles (1983, p. 67) and Sherwood (1997) are right that the nominal output of the insurance sector should be

gross premiums. A complex insurance contract is being traded. As the nature of the contracts changes over time, hedonic methods are needed to determine a date t price for a contract type consumed at date $t - 1$ but not at date t and a date $t - 1$ price for any contract type traded at date t but not at date $t - 1$. Ideally, these made-up prices would be the demand reservation prices—that is, the maximum price a given type of household would pay for the commodity. An added problem is that the demand reservation prices differ across the many household types. Households differ, for example, in their attitudes towards risk or health status. The implication of this fact is that the demand reservation prices in theory should be indexed by household types. A procedure for defining casualty insurance contracts is specified in Hornstein and Prescott (1991a and 1991b).

Another problem with medical insurance is that relevant costs depend on whether the individual or the firm pays for the health insurance. If the employer pays, the cost to the individual is less because the individual is not taxed on this income. Current practice does not take this tax savings into consideration. Therefore, current practice violates the principle that relative costs to individuals should be used to weight different commodities in defining real consumption.

SUMMARY

Theory can and should be used to better define real consumption. Data suggest that current statistics may very well present a distorted picture of real consumption growth since 1982. The reason I say this is that the prices of the badly measured components are the ones increasing most rapidly. In these brief remarks, I have discussed how theory might be used to better measure the quantities and prices of the commodities being aggregated to form these components. Some resources are being devoted to improving the definition of real consumption. Sherwood (1997), for example, has proposed what I think is a

³ See Hornstein and Prescott (1991a).

better definition of the real consumption of property and casualty insurance consumption based upon a gross premium notion. However, I think that significantly more resources should be devoted to improving the definition of real consumption in light of modern economic theory. The social payoff to such an investment would be large, relative to the cost.

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