

Household production, consumption and CPIs

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Household Production, Consumption and the CPI

This paper examines the complications created for CPIs by the fact that most of the goods and services consumed by households are produced by the households themselves and are not purchased on the market. Households may purchase some of the inputs into such production and the prices of the inputs may be included in CPIs, but the inputs are not consumption goods and services from which households derive utility. The treatment of consumption of own production has attracted some attention in national accounts, but it is comparatively neglected in discussions about CPIs. Moreover, it may not be appreciated how large such consumption may be in practice, not only in developing but developed countries. Recent estimates for the USA suggest that as little as 12% of the goods and services that make up Personal, or Household, Consumption Expenditures may be directly consumed without further processing.

This paper is about the concept of consumption and the domain of a Consumer Price Index, CPI. In 1999, the NBER convened a panel of price index specialists to consider the research agenda for the next 20 years. Zvi Griliches remarked that “there are two big remaining questions. ... The first is the difficult one, and concerns boundaries. What is the commodity and consumer space over which prices are measured?” Zvi Griliches (2001; 100) This paper examines some of the complex issues involved.¹

Because consumption is a primitive economic concept, its meaning is often tacitly assumed to be self evident. However, it may mean quite different things in different contexts and is often not explicitly defined. In this paper, consumption is understood to be an activity, like production. Both activities can be represented by functions. A utility function expresses utility as a function of the quantities of goods and services consumed. A production function expresses outputs as a function of the quantities of inputs used. In both cases, the nature of the activity, and of the variables included, need to be clearly and precisely defined if the functions are to have economic content.

Household final consumption is defined here as an activity in which members of households use goods or services to satisfy to satisfy their needs, wants or desires. Consumption may be active or passive, requiring more or less activity from the consumers. Sometimes, it is sufficient merely to be present at the appropriate time and place, such as attending a football match. In other cases, it may require more physical activity, such as eating or drinking. By definition, a consumption good or service must provide utility, as it must satisfy some need or want. It cannot be defined by its physical characteristics alone, as many goods or services may be used for different purposes: for production or capital formation as well as consumption.

¹ Griliches' second question was about quality change, which he said is “impossible”.

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Household consumption can also refer to the quantities, or values, of the goods and services consumed by households. They are the goods and services that are actually used by consumers to meet needs and wants: the goods and services that figure in the utility function. Consumption in this sense is different from consumption expenditures. Household, or personal, consumption expenditures are defined as expenditures incurred by households to acquire goods and services that they *intend* to use for purposes of consumption. Expenditures are not uses. The difference is not just one of timing. Many of the goods acquired by households for purposes of consumption are subjected to a significant amount of further processing within the household before they are consumed. Many of the services consumed by households are not purchased at all but produced largely within the households. It is difficult to estimate not only their prices but their quantities. Household budget surveys are of only limited help as they record expenditures, not consumption.

This paper starts by examining the different kinds of economic activities that take place within households -- production, consumption and capital formation. As these activities have to be recorded in national accounts, their nature and boundaries have had to be specified in the internationally agreed System of National Accounts, or SNA [1993]. The paper considers how the national accounts deal with them and how relevant and applicable the solutions they adopt may be for CPIs. It may be appropriate for CPIs to adopt conceptually different solutions from the SNA but they should not do so gratuitously, especially when, as in most countries, a single statistical office has responsibility for both. As Griliches also remarked, "it is important to recognize the link between BLS prices measures and the GDP accounts at the BEA, and that there should be consistency between national accounts and price measures." Zvi Griliches (2001; 100).

The paper is an excursion into the darker side of economic statistics. It is a world in which what is measured may not be what many users think is being measured or what many users would like to be measured. It is world in which difficult conceptual and practical problems often have to be by-passed by adopting more or less arbitrary conventions.

Households as consumer units

Households are the consumer units for CPI purposes. A household is defined in the 1993 SNA as "a small group of persons who share the same living accommodation, who pool some, or all, of their income and wealth and who consume certain types of goods and services collectively, mainly housing and food."

A more detailed definition of a household is that used in the 2000 round of population censuses. It is defined by the UN as follows:

either (a) a one person household defined as an arrangement in which one person makes provision for his or her food or other essentials for living without combining with any other person to form part of a multi-person household.

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or (b) a multi-person household, defined as a group of two or more persons living together who make common provision for food or other essentials for living. The persons in the group may pool their incomes and have a common budget to a greater or less extent; they may be related or unrelated persons or a combination of persons both related and unrelated.”

A household is therefore primarily a consumption unit. However, members of households may engage in several kinds of economic and non-economic activities including

- production,
- gross fixed asset formation,
- other activities.

The notion of a household as a single decision taking unit with a single utility function has been criticised as over simplistic. In her review of the set of papers on “*Time Use – Research , Data amd Policy*” (1999) edited by Joachim Merz and Manfred Ehling, Catherine Zich points out that: ”Most recently, bargaining theory has been championed as an alternative organizing principle for household decision-taking because it specifies individual rather than household utility functions. By doing so, bargaining models allow for negotiation and the resolution of conflicts between household members”².

Production

Production is an activity or process, organised and managed by some economic unit, in which inputs are transformed into outputs. It may be represented a production function. In the SNA, interest is focused on those kinds of productive activities that are capable of being organised on a market basis. It must be possible for some or all of the outputs to be traded and for some of the inputs to be provided by units other than that managing the production.

Members of the same household may engage in three quite different kinds of production.

- One or more members of the household may own and operate an unincorporated market enterprise such as a farm, a factory, a shop, a medical or dental practice, a law practice, and so on. Some of the output may be retained for the household.
- One or more members of the household may engage in own account production: that is, production whose output is used by the household itself. Households may produce consumption goods, such as vegetables, bread and cakes, preserved food, cooked meals or clothing. They may also produce capital goods (fixed assets) for their own use. Some households construct their own dwellings or extensions to their dwellings. These assets are used subsequently in production. Households also tend to produce a range of services for their own consumption: for example,

² Zick (2002), p. 435.

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the cleaning and maintenance of household equipment and the dwelling, the care and education of children, care of the sick or infirm.

- One or more members of the household may also work outside the households as paid employees by providing labour services to be used as inputs into processes of production organised and controlled by others.

In principle, unincorporated enterprises should be split from the households that own them, but it can be difficult to disentangle the transactions made by the owner of the enterprise from those made by the same person as a member of the household. The goods and services purchased for business use by a member of a household in his or her capacity as the owner of an unincorporated enterprise are outside the scope of an index designed to measure changes in the prices of goods and services consumed by households.

The goods and services that are produced for own consumption within households can make a major contribution to the total utility that households derive from consumption. Nevertheless, there is considerable reluctance to recognise all of them in both the national accounts and CPIs. The SNA recognises all goods production for own consumption as falling within the production boundary and contributing to GDP. Subsistence agriculture is therefore included, as is the production of foodstuffs or clothing within the household for own use. However, the SNA excludes, by convention, the production of all household services for own use, with one major exception namely the production of housing services by owner occupiers.

Consumption

The SNA draws a distinction between individual and collective consumption. An individual consumption good or service is one that can be used only by one individual household. A collective service is one that can be used or consumed by a group of households simultaneously. A collective service, such as national defence, that may be provided to the entire community is a pure 'public good'.

The use of a good or service for consumption must be clearly distinguished from the acquisition of goods and services by households for purposes of consumption. The goods or services used for individual consumption may be acquired in several different ways.

1. They may be produced by the household itself.
2. They may be purchased for cash or on credit.
3. They may be received as payments in kind: that is, in exchange for the provision of other goods or services, including labour services.
4. They may be received as gifts from other households or charitable agencies.
5. They may be received from governments or social security schemes as 'social transfers in kind'. These consist mainly of health, education, housing and

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transportation services provided free, or at nominal prices, to individual households.

In the SNA, household “*actual consumption*” is defined as the total value of the goods and services consumed under all the five categories above. “*Household consumption expenditures*” are expenditures on goods and services for the purposes of consumption that are incurred by households themselves. They consist of the first three items listed above. Expenditures on social transfers in kind are incurred by governments and social security schemes. Social transfers in kind are part of household actual consumption and at the same time form part of government current expenditures.

Household gross fixed capital formation

In the SNA, gross fixed capital formation is defined as the value of acquisitions less disposals of fixed assets. Fixed assets are in turn defined as durable goods that are used repeatedly or continuously over a long period of time, by convention at least a year, for purposes of production. They provide inputs of capital services into processes of production. Durability is a necessary but not sufficient condition for a good to be a fixed asset. A good such as coal, or a can of drink, may be highly durable, in the sense that it can be held in stock for a very long period of time without deteriorating much, if at all, but it can be used once only.³

A fixed asset is therefore a durable-use good used by a *producer* repeatedly or continuously *in production*. It provides a stream of inputs into production which it is customary to describe as a flow of ‘capital services’.⁴

Fixed assets and consumer durables.

As households engage in production as well as consumption, they can engage in gross fixed capital formation. Their acquisition of fixed assets needs to be distinguished from their acquisition of durable goods for purposes of consumption. The latter are *consumer durables* as conventionally understood.

The production of housing services by owner occupiers requires a dwelling which the SNA treats as a fixed asset and not as consumer durable. Owner occupiers consume the housing services, not the dwellings. Similarly, tenants consume housing services,

³ John Hicks introduced the terminology ‘single-use goods’ and ‘durable-use goods’ to emphasize that fixed assets and consumer durables are durable *in use*. He pointed out the single-use goods include some highly durable goods, such as coal, as well as non-durable goods in the sense of goods that are liable to deteriorate over time. He stated that the “common characteristic [of durable-use goods] is that they can go on being used for considerable periods of time.” Hicks (1942: 27 – 30).

⁴ Irving Fisher described capital goods as providing a flow of services over time. He argued “The services of an instrument of wealth are the desirable changes effected (or undesirable changes prevented) by means of that instrument. For instance, the services of a loom consist of changing yarn into cloth, ...” Fisher (1922, 19).

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payments of rent being classified as final consumption expenditures on housing services. The production of housing services may require some intermediate and labour inputs and also the services of other fixed assets, in the form of household machinery and equipment such as lighting, heating and cooling equipment, cookers, ovens, refrigerators, freezers, washers, dishwashers, *etc.* These may be built into the main structure of the dwelling.

The durable goods that should be classified as consumer durables are those that are used directly to satisfy the needs and wants of household members over a long period of time, such as TVs, audio equipment, communications equipment, leisure and sports equipment and so on.

However, neither the SNA nor CPIs make the distinction between consumer durables and household fixed assets proposed here. Apart from dwellings, all durables acquired by households are treated by both as if they were single use consumption goods.

A household production account

In order to get a better fix on household production, it is useful to set up an illustrative production account. Consider the production of a food product such as bread, cake or a cooked meal. The account takes the same format as would the

INPUTS		OUTPUTS
<i>Intermediate inputs</i>		Bread, cake or other output
Foodstuffs used as ingredients		
Electricity, gas or other fuel; water		
Other inputs		
<i>Inputs of labour and capital services</i>		
Labour inputs		
Capital services from fixed assets		
Kitchen equipment		
The dwelling		
<i>Total</i>	=	<i>Total</i>

production account for an enterprise engaged in food manufacturing. If the inputs and outputs were independently valued, their totals would not be identical and an operating surplus or deficit would have to be included as well. Alternatively, the value of the outputs could be estimated as the sum of the production costs. These valuation issues are considered further below.

The first group of intermediate inputs consists of foodstuffs such as flour, eggs, sugar, spices *etc.* These could have been purchased on the market or produced within the households, especially if the household has its own account agricultural production. If they have been purchased on the market they would have been recorded under household final consumption expenditures in the national accounts and also in household budget surveys.

Here, they are seen to be intermediate and not final consumption. Similarly, the electricity could have been purchased on the market or produced for own use by the household's own generator. Alternatively, the oven could have been fired by wood collected by the household.

As several different kinds of productive activities may be carried on within the same household, some of the intermediate inputs, like the foodstuffs or fuel in the example, may themselves have been produced within the household. When there are successive stages of production, they can be vertically integrated for accounting purposes. In the resulting consolidated production account, outputs subsequently used as intermediate inputs into later stages would be cancelled out, leaving as inputs only intermediate inputs purchased on the market and the primary inputs of labour and capital. Similarly, on the output side, only the outputs that are used for final household consumption or capital formation would remain. In the case of completely self sufficient household, such the Swiss Family Robinson on a desert island, there would be no purchases on the market so that the account would reduce to the familiar GDP identity in which the value of the primary inputs of labour and capital equals the value of the final output used for consumption or gross capital formation.

Some estimates of the magnitude of consumption of own production

Interest in production for own consumption as a household activity stretches back several decades. On the theoretical side, it was stimulated by Gary Becker's influential paper on "A Theory of the Allocation of Time" (1965) and by Kelvin Lancaster's "A New Approach to Consumer Theory", (1966). On the empirical side, surveys of time use seem to have been undertaken in an increasing number of countries.⁵ In these surveys, members of households are required to keep detailed diaries of the various ways in which they spend their time throughout all 24 hours of the day. On the basis of this information it is possible to estimate the amounts of time spent on the production of goods and services for own consumption within the household. It is then possible to make estimates the value of the outputs produced for own consumption. Notice that these surveys do not record the quantities of goods and services produced, although exceptionally this may happen. In general, the output values are not estimated by imputing prices for the quantities. Instead, the values of outputs are generally estimated from the costs of producing them. Even valuing the inputs present serious problems, especially the value of the labour inputs.

There are several powerful interests driving the research into household production and consumption. First, there is interest in knowing by how much conventional GDP as defined in the SNA may understate the total output and value added in the economy. Estimates reported by Goldschmidt-Clermont and Pagnossin-Aligisakis (1999) in their survey of investigations undertaken in fourteen countries suggest that the inclusion of household production would increase GDP by amounts

⁵ See, for example, the collection of papers presented at the International Conference on Time Use in Luneberg, Germany in 1998 and published in *Time Use – Research, Data and Policy*, edited by Joachim Merz and Manfred Ehling, (1999).

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ranging from about 25% to 55 %. Recent estimates for the USA based on a set of satellite production accounts constructed by BEA increase GDP by 43 % in 1946 and 24% in 1997: see Steven Landefeld and Stephanie McCulla, (2000), p. 300.

The estimates reported by Goldschmidt-Clermont and Pagnossin-Aligisakis (1999) indicate that for 13 out of the 14 countries covered the total amount of time spent by household members on unrecorded own account production is equal to, or greater than, the total amount of time spent working in production that falls within the national accounts production boundary. Again, in 13 out of 14 countries, men tend to spend most of their time in SNA type production while women tend to spend most of their time on the unrecorded non-SNA type activities. As a result, the contribution of women to the economy is not properly reflected in GDP and there have been repeated criticisms of the SNA on this account.

These examples are sufficient to show that household production makes a considerable contribution to the total production and consumption taking place within the economy. In the present context, the question is what are the implications of these very substantial flows of consumption goods and services for CPIs, or more generally for price and quantity measures for household consumption.

From a CPI viewpoint, a major question is what proportion of the goods and services actually consumed by households are produced within the household and what proportion are purchased in shops or other outlets to be consumed directly without further processing? Is the consumption of own production a peripheral issue for CPIs or is a central one? Recent estimates for the USA provide some answers.

The satellite household production accounts for the USA⁶ as reported by Steven Landefeld and Stephanie McCulla (2000) include an input-output table for household production. For this purpose, it is necessary to identify a new set of 'industries' that correspond to the various kinds of productive activities carried out within households, such as "food preparation", "cleaning", and "child care". A supplementary industry classification is needed to accommodate these activities. The activities consume intermediate inputs purchased from outside the household, labour services provided by members of the household and capital services provided by the fixed assets⁷ owned by the households. The outputs are entirely consumed within the household. They are consumption goods or services as defined here.

⁶ Satellite accounts are outside the central framework of the national accounts but conceptually linked to them. As Landefeld and McCulla state, p. 292: "A satellite account can do two things: highlight or provide more detail on the transactions occurring in a given sector ... or change the concepts underlying the accounts. Perhaps by adjusting the production boundary ... or by using alternative valuation methods. A satellite account for nonmarket household production can do both. First, it can show greater detail than the existing accounts on the marketed output of households. Second, it can extend the definition of production to include the nonmarket production of households." Thus, although the satellite accounts are closely linked to the regular NIPA accounts produced by BEA, they are intended to supplement, and complement, the regular accounts by providing information that cannot be shown by sticking rigidly to the existing accounting rules, conventions and classifications.

⁷ As proposed in this paper, durables are effectively treated as household fixed assets. Households use the capital services they provide to produce goods and services for their own consumption.

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The values of the outputs of household production consumed by households may be compared with the values of household expenditures on the same kinds of goods or services in shops or other outlets. Landefeld and McCulla (2000) give the following examples. The value of household food preparation in 1992 was \$ 717 billion⁸ compared with household food expenditures of \$253 billion on prepared meals in the market place. Household laundry output was valued at \$90 billion, whereas the value of expenditures on cleaning, storage and the repair of clothing and shoes was only \$11 billion.

The numbers in the following tables are derived from the input-output table given on p. 303 of Landefeld and McCulla's (2000) paper. They refer to the US in 1992.

	\$ billion	%
Total personal (household) consumption expenditures, (as recorded in the NIPA) of which	4,209	100
Goods and services subsequently used as intermediate inputs into household production	2,596	62
Purchases of durables (reclassified as gross capital formation)	471	11
Consumption of housing services produced by owner occupiers (reclassified as output of household production)	618	15
Goods and services directly consumed by households without further processing	524	12

Only 12% of the goods and services purchased in shops or other outlets by US households for purposes of consumption in 1992 were directly consumed by households without further processing. The remaining 88% were used either for capital formation or as intermediate inputs into the production of *other* goods and services that were actually consumed by households.

The total value of the goods and services actually consumed by US households in 1992 was \$ 5,713 billion. This is considerably larger than total personal consumption expenditures because of the value added generated in household production for own consumption. Total household consumption may be broken down in the following way.

⁸ Goldschmidt-Clermont and Pagnossin-Aligasakis (1999) report, p. 521, that in all of their countries except one, "food preparation requires the largest share of non-SNA time."

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	\$ billion	%
The value of total household consumption of which	5,713	100
Personal (households') expenditure on good and services consumed directly without further processing	524	9
Total value of consumption goods and services produced within households, of which	5,189	91
Total personal (households') expenditures on goods and services used as intermediate inputs into household production for own consumption	2,596	46
Total gross value added in household production of which	2,593	45
Labour inputs	1,449	25
Capital services provided by durables and housing	1,144	20

Thus, only 9% of the goods and services consumed by households consist of purchased goods and services that are used for consumption without further processing. 91% are produced by households themselves. Half their value is attributable to the value of the intermediate inputs (*i.e.*, the goods and services purchased by households in retail outlets for purposes of consumption) the other half being the gross value added within households. 56% of the value added consists of labour inputs and 44% of capital service inputs. Neither durables nor houses are treated as being consumed directly, both providing flows of capital services into household production.

Data in satellite accounts cannot be expected to achieve the same standards of accuracy and reliability as those in the regular national accounts, or NIPA. The construction of satellite accounts is typically a research type activity, at least in the early years. In the case of household production, it is particularly difficult to value some of the flows because they are non-market and do not have prices of their own. These valuation problems are considered further below. Nevertheless, the relative orders of magnitude of the various flows are likely to be broadly correct. They present an unfamiliar and striking picture of household consumption.

As Landefeld and McCulla point out, there are various uses for satellite accounts of this kind. They can be used to analyse the functioning of the economy, long term growth of production and productivity, and the distribution of income and welfare. For example, the inclusion of own account consumption produced within the household typically reduces the degree of inequality between households. There are also "gender"

issues because of the important role played by women in household production. However, in addition, the results have implications for the measurement of CPIs.

Recording and valuing own account production and consumption

Most CPIs include owner occupied housing within the scope of the index, although other forms of consumption of own production are not generally included. Although the output flows are often described as ‘imputed’ in a national accounts context, this can conjure up the wrong image. The quantities of the goods and services produced and consumed are not imputed. They are real enough. However, because they are not bought and sold, they do not generate prices of their own. In order to place monetary values on the flows, prices have to be imputed. There are several options.

The first option is to value the outputs at the average prices of the same goods or services on the market, assuming such prices are available. This is the preferred option in the national accounts. In a CPI context, this option is equivalent to assuming that changes in the prices of goods and services produced within the household are the same as for those purchased on the market. This means that the price information already being collected for CPIs can be used for both groups of products.

It must be remembered that CPIs do not actually collect and record the prices paid by households for the goods and services they purchase on the market. Instead, they typically record the prices at which the same kinds of goods and services are offered for sale in retail outlets.⁹ It is then assumed that the prices paid by households move in the same way as the outlet prices move, an assumption that need not always be true. For example, it may not hold when households switch their purchases between outlets selling at different prices.

If the goods and services produced for own consumption are valued in this way, their inclusion increases the weight given to those products for which own account production is relatively high. Obviously, no additional price information is generated or collected by including the consumption of own produce, but the weights attached to the price changes for the different kinds of goods and services can be made to reflect total consumption rather than expenditures. If prices are imputed for the outputs, the prices of the products purchased by households for use as intermediate inputs should be excluded to avoid double counting. As some of these products may also be used for final consumption, their weights would not necessarily fall to zero.

Estimating the weights is a major problem in itself, however, as the values of consumption of own produce are not collected in household budget surveys. In practice, there is usually no information about the *quantities* of the goods and services so that the value of the consumption cannot be estimated by multiplying the quantities by the imputed prices. The weights may have to be approximated by the costs of producing the various goods and services.

⁹ This may change as increasing use is made of scanner data from electronic points of sale. However, at the moment in most countries the prices collected relate to outlets not to actual transactions by households.

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It may appear that, provided appropriate weights can be estimated, own account consumption could be included in CPIs without much difficulty. The problem is that in many cases there are no market products whose specifications match the household products. For example, in the case of the own account production of housing services, it may not be possible to find rented accommodation that has the same specifications as a particular type of owner occupied accommodation. There may be no rental equivalents. In some countries, some kinds of accommodation may be effectively all rented or all owner occupied. In some developing countries, a lot of the owner occupied accommodation may consist of huts in rural areas constructed by the households themselves, while rented accommodation is to be found only in apartment blocks in urban areas. Even when a particular kind of accommodation is found both owner occupied and rented, the rent may cover some services that are additional to the housing services as such. Some difficult quality adjustments may be needed to market rents to make them suitable for valuing housing services produced for own consumption.

The qualities of the market products may differ significantly from those produced within household, especially if the volume of the market production is small in comparison with the household production, as in the case of some household services. If the market and the own account products are not really the same, there may be little justification for assuming that their price movements are the same.

Sometimes there may be market equivalents, but the share of the market production in the total may be very small: say 10 % or less. In such cases, the use of 'marginal' market prices to value large non-market flows is questionable, because it is difficult to estimate what the market price would be if there were to be a massive shift from non-market to market production.

Valuing output by costs

When there are no market prices that can be used, the SNA recommends, as a second best procedure, to value the output at its production costs (para. 6.85, 1993 SNA). This is stated to be equal to the sum of the following four items:

- Intermediate consumption
- Labour services (compensation of employees)
- Depreciation (consumption of fixed capital)
- Any taxes payable on the production

To be consistent with general SNA principles, the labour services should be valued using the market wage payable to employees doing the same kind of work, but a case can also be made for valuing at opportunity costs: that is, what the person could have earned by taking paid employment.¹⁰ Notice that the SNA does not include the full value of the

¹⁰ Valuing at opportunity costs is not favoured in the studies on household production because it makes the value of the labour inputs depend on who does the work rather than the nature of the work done.

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capital services, the user costs, but only the depreciation component. It is a flaw in the System that should be rectified.

The second option may be expected to provide a fairly close approximation to the total value of the output in *a single period of time* and may therefore provide satisfactory estimates of weights for own account production and consumption. However, while current values and weights can be estimated this way, changes in the current values over time still have to be factored into their price and quantity components. This is a major problem for both national accounts and CPIs. For CPI purposes, what is needed is the change in the average cost of a unit of output produced, not the change in the total costs of producing outputs whose quantities may be changing over time. The unit cost is used as a proxy for the price. In order to estimate the unit cost it is necessary to know the quantities of outputs, and this information is usually not available. Moreover, the output concepts are vague and obscure for most household service production. There are typically no data available on quantities of services produced, as distinct from the inputs used to produce them.

The problem is the same as the more familiar problem of estimating the growth of real output and the rate of inflation for government services. The costs of producing government services may provide a satisfactory proxy for the current value of the output produced in a single period of time¹¹, but to factor the changes in the current values over time into their price and quantity components, information is still needed on either the prices or the quantities of the outputs.

In the case of government services, an alternative approach is to estimate the real growth of the inputs, particularly the labour inputs, and then to make an assumption about the growth, or lack of growth, of labour productivity. The growth of real output can then be derived from the growth of the labour input adjusted for the assumed productivity change. The rate of price change for government services can then be obtained by deflating the change in the total costs by the estimated growth in the real output.

The same approach might be tried for own account household production, provided the growth in the labour inputs can be measured. This would be several degrees harder than trying to estimate the real growth of the labour inputs in government. There are market transactions for the labour inputs into government so that their real growth can be measured using actual payroll data deflated by wage rate indices. Labour inputs into household production have to be estimated from time use surveys. There seems to be next to no evidence about the growth of labour productivity in household production. Assuming it to be zero could introduce the same sort of significant systematic bias as the same assumption does for government services. This method would appear to be considerably less attractive for household production than for government production where it is generally acknowledged to be less than satisfactory.

¹¹ Although, as just noted, the SNA systematically underestimates the costs by omitting the capital costs on government fixed assets.

Using input prices

In a CPI context, estimating the change in the prices of outputs from own account production by changes in the input prices might appear to provide a possible solution. Changes in the prices of the intermediate inputs should already be collected and included in the CPI. These are products such as raw foodstuffs, materials, electricity and other fuels, *etc.* Changes in the prices of the labour inputs might be imputed on the basis of changes in market wage rates. However, this method encounters exactly the same problems as just discussed in the previous section. The change in the price of the output will not equal the average change in the input prices when there are changes in technology and productivity.

Over the short term, a weighted average of the price changes for the intermediate inputs, which are already covered by CPIs, and some appropriate wage rate index might track short term movements in the output prices fairly satisfactorily. Over the longer term, however, there would be a risk of a serious upward bias in the estimated output price change if the efficiency of household production is continually increasing.

It is significant that no price and volume measures are provided in the satellite accounts for US household production. Landefeld and McCulla (2000) comment as follows (p.300, footnote): “Given the absence of output price data for household production, no real inflation adjusted estimates are presented here. The use of wage rates or other input costs to deflate household production would result in low or zero productivity in the household sector and bias real growth in household relative to market production.” Goldschmidt-Clermont and Pagnossin-Aligisakis (1999) also conclude, p. 528, that: “... valuation will have to be output based, i.e., it will have to start with the physical measurement of household output and value it at market prices. ... Unfortunately, very little experience is available, as yet, with this approach at national levels. It is, however, not more difficult to develop than the refined strategies developed for the traditional sectors of the national accounts.” As already noted, however, not much progress has been made with developing price and output measures for one traditional sector of the national accounts, namely the government sector, despite efforts over several decades.

It may be concluded therefore that the prospects for calculating a CPI that covers the goods and services actually consumed by households -- the goods and services that enter into household utility functions -- are not good. The information available about their prices and the quantities is not sufficient to make it possible to compute price or quantity indices for them.

Some special cases

As already noted, in the US input-output tables for household production it was necessary to recognise some new kinds of products that do not figure in existing classifications of consumers' expenditures and to create a supplementary classification to accommodate them. It is possible that such classifications might be further refined and

developed. One possibility would be to treat light as an output from household production. Light is consumed directly by persons and affects their welfare. Light has the advantage that its quantities can be measured objectively and precisely. Households produce electric light by a process that requires intermediate inputs of electricity and the use of durable goods or fixed assets in the form of light fixtures, wiring and other equipment incorporated in the dwelling. William Nordhaus (1994) has argued convincingly that the price of a unit of light must have fallen over the last century and a half as a result of revolutionary changes in the technology of producing light. The output price must have moved very differently from the input prices.

Another example could be the temperature and humidity of the room space occupied by the household. Like light, these are produced and directly consumed by households. Changes in the technology of controlling temperature may not have been as revolutionary as those in the production of light, but they have still been considerable. The situation of households in which the heating, or cooling, is produced in well insulated dwellings by thermally efficient boilers using built-in heating equipment with thermostatic controls is very different from that of households living in draughty damp houses producing heat by means of open fires burning logs or coal, a process that may require a lot of work.

Summary and conclusions

Personal, or household, consumption is an activity in which members of households use goods and services to satisfy their needs and wants. The set of goods and services consumed in this way is not the same as the set purchased by households for purposes of consumption and recorded as consumer expenditures in national accounts and household budget surveys. The difference is not just one of timing. Much more important is the fact that most of the goods and services purchased by households are subjected to a substantial amount of further processing within the household before being used to satisfy needs and wants. These goods and services constitute intermediate inputs into the production of other goods and services for household consumption. Household production adds value to the goods and services purchased on the market. Data for the US in the paper by Steven Landefeld and Stephanie McCulla (2000) indicate that, on aggregate, the value of the outputs of consumption goods and services produced within households is roughly double that of the expenditures on the intermediate inputs purchased on the market and classified as final consumers' expenditures in the national accounts. This household production is not recognised in national accounts and in order to estimate it is necessary to construct special 'satellite accounts', as explained in the Landefeld and McCulla paper. When the activity of household production is explicitly recognised and recorded, consumer durables and dwellings have also to be recognised as being fixed assets. The flows of services provided by most durables are not consumption services but flows of capital services used as inputs into household production.

The estimates in the Landefeld and McCulla paper paint a picture of household production and consumption that is very different from that implicitly assumed by most

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CPIs. Households do not consume most of the goods and services recorded under consumers expenditures. The estimates for the US suggest that only 12% of the goods and services recorded as final consumer expenditures are directly consumed by households without further processing. Of the rest, 62% are used as intermediate inputs into household production, the remainder consisting of gross capital formation (purchases of durables) and housing services produced within the household.

The problem for CPIs, therefore, is that the goods and services that make up consumers' expenditure are mostly not the ones that households actually consume. In practice, CPIs collect prices for the goods and services sold in the outlets in which households make their expenditures. These are the same expenditures that provide the weights for CPIs. However, the prices of the goods and services that are actually being consumed are different from the prices paid in retail outlets because they refer to a quite different set of products that overlaps only marginally with the set purchased on the market. Moreover, the prices of the outputs produced within households cannot be observed because there are no market transactions taking place.

CPIs may be based on the theory of consumer behaviour in which rational utility maximising individuals react by adjusting the relative quantities they consume in response to changes to changes in relative prices. The relevant prices and quantities are those of the goods and services that are actually consumed and provide utility and not those for products such as gasoline or electricity that figure prominently in consumers' expenditures.

Suppose, however, that the objective is to go beyond the flows of goods and services recorded as final consumers' expenditures and to try to construct an index for the goods and services actually consumed by households, most of which are produced within households with very substantial inputs of both labour and capital services. This is equivalent to expanding the traditional boundary of production in national accounts to include all household production. There is an important asymmetry between the prices and the quantities. The quantities of goods and services are real and also observable, in principle. The prices are hypothetical, however, as there are no market transactions to generate transaction prices. The prices have to be estimated, or imputed. As the national accounts tend to be more interested in flows of real goods and services, they can afford to be tolerant towards imputing prices in order to get the real quantities reflected in the accounts. However, when the focus is the prices themselves, heavy reliance on large scale imputations may not be so acceptable to some users.

Assuming that prices are to be imputed for the outputs of household production, there are a number of options. The first is to value the outputs at the prices of the same products on the market: for example, to value outputs of housing services produced for own consumption by owner occupiers at the rents of the same type of accommodation on the market. In practice, however, this is often not feasible as there may be no market equivalents, or not enough of them to provide acceptable estimates of prices that can be used to value large volumes of non-market household production. Indeed, some of the outputs produced by households may be peculiar to household production, as illustrated

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by the need to create supplementary activity classifications to embrace household production.

In the national accounts the fall back position is to estimate the value of the output of household production by its costs of production. In practice, this may provide an acceptable estimate of the *current* value of the output in a given period. Time series of current values may be generated by this method, and it has been used to produce the estimates for the US that have been utilised in the present paper. However, in order to factor the changes in current values over time into their price and quantity components it is necessary to have estimates either of the changes in the price or of the changes in the quantities of the outputs. Obviously, estimates of the changes in prices are not available because, if they were, they could be used directly for CPI purposes, thereby avoiding the need to resort to estimates based on production costs. Unfortunately, estimates of the changes in quantities are also not available. This is a practical more than a theoretical problem, although defining the outputs from household production raises conceptual problems also.

There is a clear parallel with the problem of measuring the rates of growth and inflation for the outputs of government production. The values of non-market government outputs have to be imputed on the basis of their costs of production. However, without information on either the output prices or the output quantities, the changes in current values cannot be satisfactorily factored into their price and quantity components. Second best procedures such as estimating the real growth of output on the basis of the real growth of the inputs produces unsatisfactory results unless there are reliable independent estimates of the growth of productivity. Such estimates are not available either for government production for own consumption for household production for own consumption. Without such estimates, estimating the rates of change in the prices or quantities of outputs from the rates of changes in the prices or quantities of the inputs is almost bound to produce unacceptably biased results, at least over the longer term.

The conclusion to be drawn, therefore, is that with the information available, or rather the lack of information available, on the prices *and* quantities of the outputs from household production for own consumption, it is not feasible to calculate price indices for consumption goods and services that could be used for purposes of economic analysis and policy. So where does this leave CPIs?

What CPIs actually measure is the average change in prices of goods and services purchased by households for purposes of consumption. The price changes refer mostly to the prices at which the goods and services are offered for sale in retail outlets and the weights refer mostly to consumers' expenditures in the outlets. Such indices may serve useful purposes, but there may be a serious gap between what they actually measure and what users may assume they measure or want them to measure. They do not measure changes in the prices of the goods and services from which households derive utility. In the short term, there may not be much difference between the two types of index, but over the longer term the gap between them could be considerable if there are significant

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shifts in the technology of household production and improvements in household productivity. When the prices do not refer to goods and services actually consumed, it is also more difficult to provide an economic theoretic underpinning for the indices.

Finally, it is clear that certain controversial CPI issues should not be treated on an *ad hoc* basis. For example, there are still debates about the treatment of owner occupied housing in CPIs. However, owner occupied housing is not a special case requiring special treatment. It is just one of the more conspicuous examples of household production for own consumption. It is necessary to address the general issue of the treatment of the consumption of outputs from household production. Once this is decided, the appropriate treatment of owner occupied housing should follow.

In practice, CPIs have tacitly adopted the same kind of uneasy compromise as the national accounts. In both cases, instead of including the whole of household production and consumption, both choose to include only a small part, and the same part, the production of housing services by owner occupiers, although the national accounts for some countries may also include a small amount of own account production of goods. The SNA has come in for considerable criticism from some quarters for failing to cover the whole of household production.

On the other hand, apart from the difficulties created by lack of data about the outputs from household production, there are also some users of both national accounts and CPIs who are primarily interested in market activities. There is a demand for statistics that are confined to market production and market prices. Some users of CPIs may be more interested in changes in the market prices paid by households for the goods and services they intend to use for consumption, whether consumed directly or as inputs into household production, than in the imputed prices of the outputs.

As stated at the outset, the treatment of non-market flows is a grey area. Statistical offices should clarify exactly which flows of goods and services their CPIs are meant to cover, both in principle and in practice.

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