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Household production, consumption and CPIs

Household Production, Consumption and CPIs

By Peter Hill

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Household Production, Consumption and CPIs

Most of the so-called ‘consumption’ goods and services purchased by households whose prices are used to compile CPIs are not directly consumed by households. Some of the goods purchased are used up as intermediate inputs into household production for own consumption. Some others are actually fixed assets that are used to provide inputs of capital services into future household production. Estimates for the US suggest that only about an eighth of the goods and services conventionally classified as consumers’ expenditures may be directly consumed as they are. Most of the final goods and services from whose consumption households derive utility are produced by the households themselves. The set of goods and services that provide utility is not the same as the set classified as consumers’ expenditures, although the two sets overlap to some extent. Cost of living indices should use the prices of the first set whereas CPIs actually use the prices of the second set.

Introduction

Consumer Price Indices, or CPIs, measure changes in the prices of goods and services whose purchases are classified as *consumption expenditures* in national accounts and household budget surveys. These expenditures provide the weights for CPIs. In the international *System of National Accounts*, or *SNA*, these expenditures are called “Household Final Consumption Expenditures” and in the U.S. *National Income and Product Accounts*, or *NIPA*, they are called “Personal Consumption Expenditures”.¹

However, many of the so-called ‘consumption’ goods and services purchased by households are not in fact directly consumed by them. Many are used to provide inputs into the production of other goods and services within the household. Households actually consume the outputs from this production, not the inputs. A simple example is provided by the production of meals. Foodstuffs such as raw meat, vegetables, rice, flour, sugar, salt, *etc.* whose purchase will have been classified as consumers’ expenditure are used as intermediate inputs into meal production. There may be other kinds of intermediate inputs such as gas or electricity, also classified under consumers’ expenditures. The production also requires inputs of labour services and the capital services of household fixed assets acquired in earlier periods, such as kitchen equipment and the dwelling. Utility is eventually derived from consuming the output, the meal, not the various inputs.

It might be thought that most of the so-called final consumption goods and services purchased by households would be directly consumed and that only a small proportion would be used for purposes of production. However, a recent study of household production and consumption in the United States by Landefeld and McCulla

¹ Conceptually, the *SNA* and the *NIPA* are mostly the same although they may use slightly different terminology and present the accounts differently. The *SNA* provides the international standard that is used by most countries throughout the world.

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(2000) using U. S. Bureau of Economic Analysis data suggests the opposite. They conclude (p. 304) that only “12 percent of the conventional estimate of final consumption expenditures [for 1992 in the *NIPA*] is actually final consumption.” Adding household consumption of own production “to this remaining market consumption yields a new estimate of consumption, 91 percent of which is made up of own consumption.”

The production recorded in national accounts is mostly production for the market. By convention, the production of most of the services that households undertake for their own consumption is deemed to fall outside the system’s production boundary, mainly because there are no monetary transactions involved.² One important exception is the production of housing services by owner occupiers which have traditionally always been included. Most of the value added created by household production does not enter into GDP therefore. Household production can be recorded in satellite accounts, however. These are accounts that are intended to supplement or complement the main national accounts. Satellite accounts respect the accounting rules and conventions of the main national accounts as much as possible but deliberately deviate from them in certain respects in order to record activities or flows of goods and services that are missed by the main system.

There is considerable interest in knowing by how much GDP would be increased if the production boundary were to be extended to include all household production, whether for the market or for own use. Many countries, including the United States, have therefore constructed satellite accounts in order to be able to record household production for consumption. Landefeld and McCulla (p. 300) estimate that “the inclusion of household nonmarket services raises GDP by 43 percent in 1946 and by 24 percent in 1997.” As it is widely believed that the greater part of the unrecorded production may be carried out by women, the national accounts and GDP are continually being criticised as understating the contribution of women to production and their role in the economy.

Studies of household production and consumption focus on the quantity side rather than the price side. There is good reason for this. The quantities of goods and services produced and consumed are real and do not have to be imputed. They can be observed and recorded. They have a significant impact on household welfare. On the other hand, as the outputs from production for own use are not bought or sold there are no prices to be observed for them. If the outputs are to be valued, shadow prices have to be at imputed for it. While statistical agencies are obliged to impute prices in order to value household production and consumption in satellite accounts, they are generally extremely reluctant to include hypothetical imputed prices in official price indices that are to be used for policy and indexation purposes. In practice, CPIs tend to measure only changes in prices observed on the market.

Finally, satellite household accounts tends to focus more on the production than the consumption . In this paper, however, the focus is switched to the consumption.

² In principle, the production of goods for own use within households is included within the boundary of production but, in practice, most countries do not attempt to measure it in their main accounts.

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Satellite accounts for various countries have shown conclusively that the quantities consumed are substantial and must have a major impact on household welfare or utility. The question is therefore what are the implications of all this consumption for CPIs, especially those that are meant to be Cost of Living Indices, or COLIs,

The terminology used to describe consumption is often imprecise and ambiguous. The first step is therefore to clarify some basic concepts and definitions.

Consumption and consumption expenditures

Consumption is a basic economic concept whose meaning is often taken to be self evident. However, it may mean quite different things in different contexts. In the *SNA*, consumption and production are both treated as types of economic activity. Consumption is an activity in which goods and services are used up. Production is an activity in which an economic unit uses intermediate and primary inputs of labour and capital to produce outputs. More precisely, household final consumption is an activity in which members of households use goods or services to satisfy to satisfy their needs, wants or desires. By definition, a final consumption good or service provides utility to the person or household that uses it. A utility function that expresses utility as a function of the quantities of goods and services consumed may always be associated with the activity of final consumption. A final consumption good or service cannot be identified, by its physical characteristics alone, as many goods or services may be used either for intermediate or final consumption.

The term ‘household consumption’ is also used in a different sense to refer to the quantities, or values, of the goods and services consumed by households. As it is not possible to change long established usage, there is always a potential ambiguity between consumption as an activity and the goods and services consumed by that activity³. In a specific context, however, the meaning is usually quite clear. On the other hand, a clear distinction must be drawn between ‘consumption’ (in either sense) and ‘consumption expenditures’.

Household consumption expenditures may be defined as expenditures incurred by households to acquire goods and services that they intend to use for purposes of household final consumption. They constitute one of the major flows in national accounts. Most countries also conduct periodic household budget surveys to collect information about household consumption expenditures that may be used to obtain expenditure weights for CPIs.

The set of goods and services that make up household consumption expenditures is not the same as the set of final goods and services consumed by households in the same period, although the two sets may overlap. Many of the goods and services purchased by households may be used as intermediate inputs into household production rather than being consumed directly as they were bought. Some of the goods purchased may also be

³ There is a similar ambiguity between ‘production’ as an activity and ‘production’ meaning the output from that activity.

fixed assets that are used to provide capital services in future periods. Most of the goods and services that make up household final consumption are produced by the households themselves and are not purchased on the market.

A further complication is that not all of the goods and services consumed by households may have been purchased or produced by themselves. Some goods and services are acquired by households as *social transfers in kind* such as health or education services that are provided free, or at reduced prices, to individual households by governments or non-profit institutions⁴. In some countries, social transfers in kind, mostly services such as health, education or housing, may be important for some households. There are no market prices to be observed or collected for these transfers which tend to fall outside the scope of CPIs in practice. As households may have no choice about the amounts of social transfers they receive, this paper focuses on the two major flows of consumption expenditures and consumption of own production, both of which are discretionary.

Finally, it is worth noting that that the ‘C’ in *CPI* stands for ‘Consumer’ and not ‘Consumption’. A CPI could be interpreted as price index covering goods and services purchased by consumers, *i.e.*, persons or households, not all of which need be consumption goods or services. To avoid possible confusion on this point, the international *Consumer Price Index Manual* (2004) states (para. 3.4) that “A CPI is generally understood to be a price index that measures changes in the prices of consumption goods and services acquired, or used, by households.” Of course, more precise definitions may be given depending on the purpose or use of a particular index.

Households as consumption units

Households are autonomous economic units. A household is defined in the *1993 SNA* (paragraph 4.132) 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.” Similar definitions are used in population censuses and budget surveys.⁵

A household is therefore primarily a unit created for purposes of consumption. However, members of households also engage in other kinds of economic and non-economic activities including

⁴ See the *1993 SNA* paragraphs 8.19 to 8.23 for a fuller explanation of social transfers in kind.

⁵ For example, the following definition of a household is recommended by the UN for use in population censuses:

“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.

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.”

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

Household production

Production is an activity or process managed by some economic unit in which inputs are used to produce outputs. It may be represented a production function in which outputs are a function of the inputs, the form of the function depending on the technology used. In order to be 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 work in enterprises outside the household as paid employees.
- One or more members of the household may own and operate their own unincorporated market enterprise such as a farm, a factory, a shop, a medical or dental practice, a law practice, and so on. By definition, production for the market by members of a household is not part of household own account production.
- One or more members of the household may engage in *own account production*: that is, production whose output is retained by the household to be used within the household. Households may produce intermediate goods such as vegetables or other agricultural goods and also final consumption goods such as 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, the cleaning and maintenance of household equipment and the dwelling, the care and education of children, and the care of the sick or infirm.

In principle, the activities and accounts of unincorporated enterprises should be separated from the households that own them, but it can often be difficult to disentangle the transactions made by the owner of a small 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 not part household consumption expenditures and are outside the scope of a CPI index.

Household gross fixed capital formation

Gross fixed capital formation is defined as the value of acquisitions less disposals of tangible and intangible fixed assets (see paragraph 10.33 of the *1993 SNA*). Tangible 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. 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.⁶ A tangible 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 in the form of capital services.⁷

A distinction may be drawn between *consumer durables* and *household fixed assets*. A *consumer durable* may be defined as a durable from whose use a person derives utility directly, such as leisure and sports equipment. A *household fixed asset* is then defined as a durable that households use to produce other goods and services from which utility is derived. Household fixed assets include household machinery and equipment such as lighting, heating and cooling equipment, cookers, ovens, refrigerators, freezers, vacuum cleaners, washing machines, dishwashers, *etc.* and also vehicles.

The only type of household fixed asset recognized as an asset in both national accounts and CPIs is a dwelling. Owner occupiers use dwellings to provide a flow of capital services into the own account production of other kinds of services such as protection, shelter, light, warmth, comfort, *etc.* This production typically also requires inputs of capital services from other kinds of household fixed assets, such as furniture, lighting, heating and cooling equipment, cookers, ovens, refrigerators, freezers, *etc.*

Light is an interesting example of a final consumption good. It is consumed directly by persons and affects their utility and way of life. It can also be measured objectively and precisely. Households today produce electric light by a process that requires intermediate inputs of electricity and consumables such as light bulbs and inputs of capital services from the dwelling including lamps, light fixtures, wiring and other equipment built into the dwelling. William Nordhaus (1994) has argued convincingly that the price of a unit of light must have fallen considerably over the last century and a half as a result of revolutionary changes in the technology of producing light. Its price must have moved very differently from the prices of the various goods classified as

⁶ 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: pp. 27 – 30).

⁷ 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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consumers expenditures, ranging from candles to halogen bulbs and electricity, but which are actually used as inputs into the household production of light or other goods.

In practice, it may not be feasible to maintain a clear distinction between consumer durables and household fixed assets. Even durables such as TV, video and audio equipment may require some inputs of electricity and housing services to be enjoyed. As the great majority of durables seem to be used for production, it seems preferable to treat all household durables as fixed assets.

Households may engage in gross fixed capital formation by purchasing fixed assets or by producing them themselves. It is common for households to carry out major improvements to their dwellings, including extensions, that count as gross fixed capital formation. In some countries, many households construct their own dwellings.⁸

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 final consumption good such as bread, cake or a cooked meal. The account takes the same format as would the production account for an enterprise engaged in food manufacturing. If the inputs and outputs are independently priced, the total values of the inputs and outputs are not identical and an operating surplus or deficit would have to be included as a balancing item. However, if the value of the outputs is estimated as the sum of the production costs there is no balancing item. These valuation issues are considered further below.

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>

⁸ It may be argued that members of households engaged in full or part time study are producing intangible fixed assets in the form of knowledge and skills whose acquisition should be treated as own account gross fixed capital formation. However, this type of activity is typically not recognized as production and capital formation even in household satellite accounts.

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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 household, especially if the household has 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 many decades, at least to Margaret Reid's 1934 book on the *Economics of Household Production*. On the economic theoretical side, it received a considerable boost from Gary Becker's influential paper on "A Theory of the Allocation of Time" (1965). On the empirical side, estimates of household production for own use can be made by utilising information derived from surveys of the amounts of time spent by household on various kinds of activities, both economic and non-economic. These *time-use* surveys also stretch back to the inter-war years. They are being undertaken in an increasing number of countries.⁹ In time-use surveys, members of households are usually required to keep detailed diaries of the various ways in which they spend their time throughout all 24 hours of the day.

Estimates reported by Goldschmidt-Clermont and Pagnossin-Aligisakis (1999) in their report on time use surveys undertaken in fourteen countries indicate that for 13 out of the 14 countries covered the total amount of time spent by household members on

⁹ 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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unrecorded own account production is equal to, or greater than, the total amount of time spent working in *SNA* type 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 understated relatively to men in GDP measures and there have been repeated criticisms of the national accounts on this score.

A major new ongoing survey in the United States, the *American Time Use Survey* or *ATUS*, has recently been started by the US Bureau of Labor Statistics. This survey is administered using computed assisted telephone interviewing, rather than the paper diaries used in most other countries. A full description and some summary results for 2004 are published in the paper by Frazis and Stewart (2006).

Table 1

*Where Does the Time Go? Hours Spent in Major Activities
(USA: 2004)*

	Men	Women
Activity		
Personal Care Activities (including Sleeping)	9.13	9.54
Working on <i>SNA</i> Type Production	4.57	2.87
Household Productive activities outside the <i>SNA</i> Production Boundary	4.61	6.42
Leisure, sports, religious activities	5.70	5.18
Total	24.0	24.0

Source: This table condenses some of the data in Table 1 in Frazis and Stewart (2006).

These data are averages covering both the employed and the unemployed. Employed men spend an average of 6.26 hours per day at work. The results in Table 1 are broadly consistent with the generalizations made above on the basis of the survey undertaken by Goldschmidt-Clermont and Pagnossin-Aligisakis (1999)

Time-use surveys are one the principal sources of data for the construction of household satellite accounts. Estimates of the value of household production for own use may be derived by using information collected in time-use surveys although the surveys usually do not try to record actual quantities of goods and services produced. In general, the values of the outputs are estimated from the input side by summing the estimated

costs of production, the value of the labour inputs being one of the principal costs. Even valuing the outputs on the basis of the inputs presents serious difficulties, and these valuation problems are considered in more detail below as they are relevant to the possible compilation of price indices covering own account consumption.

Goldschmidt-Clermont and Pagnossin-Aligisakis (1999) also report on the effects on GDP of including household production within the SNA production boundary. For the 14 countries surveyed, the inclusion of household own account production would increase GDP by amounts ranging from about 25% to 55%. As already noted, the estimates for the USA by Landefeld and McCulla, (2000, p. 300) increase GDP by 43% in 1946 and 24% in 1997. All the evidence indicates that household production makes a considerable contribution to the total production and consumption taking place within the economy in both developing and developed countries.

One problem is that existing classifications of productive activities, such as standard industrial classifications, have been developed in relation to market production. However, some of the productive activities carried on within households may not have exact market equivalents or counterparts. Similarly, some of outputs produced by may not be exactly the same as commodities traded on markets. Good classifications are a pre-requisite for useful analysis and the lack of internationally agreed classifications in this area is an obstacle. Researchers into household production and consumption usually devise their own classifications of both the activities and their outputs.¹⁰

Household Consumption versus Consumption Expenditures in the US

The set of satellite household production accounts for the US compiled by Landefeld and McCulla (2000) include an input-output table for household production. The data in this table make it possible to examine, and illustrate, the inter-relationship between household consumption and consumers' expenditures in some detail. Of course, the construction of household satellite accounts is typically still a research type activity in most countries and data in satellite accounts cannot be expected to achieve the same standards and reliability as those in the regular national accounts, such as the US NIPA. Nevertheless, the data provide invaluable insights into the somewhat grey area of household production and consumption.

Landefeld and McCulla distinguish 13 household production activities and commodities: namely, food preparation, cleaning, laundry, household management, animal and plants, repair, yard work, child care, health care, shopping, services, travel and other. 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 assets owned by the households. As proposed in this paper, household durables are treated as household fixed assets. The outputs from the activities are entirely consumed within the household.

¹⁰ In a recent study, Gronau and Hamermesh (2006, p.4) propose the following eight outputs in addition to sleep : lodging, appearance, eating, childcare, leisure, health, travel and miscellaneous.

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Landefeld and McCulla compare the values of the outputs of household production consumed by households with the values of household expenditures on the same kinds of goods or services purchased in shops or other outlets. They give the following examples. The value of household food preparation in 1992 was \$ 717 billion¹¹ 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 figures in Table 2 are given on p. 304 of Landefeld and McCulla's (2000) paper.

Table 2
*Breakdown of household consumption expenditures
by type or use
(US 1992)*

	\$ billion	%
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 household value added)	618	15
Goods and services directly consumed by households without further processing	524	12

Only 12% of the goods and services purchased on the market by US households for purposes of consumption in 1992 were directly consumed by households without further processing. Of the remaining 88%, 62% were used as intermediate inputs into household production of other goods and services for own consumption while the remaining 26 % were reclassified either as capital formation or as household valued added.

¹¹ Goldschmidt-Clermont and Pagnossin-Aligasakis (1999, p. 521) report that in all of their countries except one, "food preparation requires the largest share of non-SNA time."

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Using data from the input-output table on p. 303 of Landefeld and McCulla's (2000) it is possible to construct an aggregate production account for all households shown in Table 3.

Table 3

Aggregate Production Account for Household Production for Own Consumption (US 1992)

Inputs	\$ billion	Outputs	\$ billion
Total value of households' personal expenditures on goods and services used as <i>intermediate inputs</i>	2,596	Total value of consumption goods and services produced and consumed by households	5,189
<i>Gross value added</i> produced within households, of which,	2,593		
Labor services provided by household members	1,449		
Capital services provided by household fixed assets including dwellings	1,144		
Total	5,189	Total	5,189

It should be noted that the total value of household consumption is actually 5,713 comprising the 5,189 produced by households *plus* the expenditures of 524 shown in Table 2 on goods and services that were consumed directly. Thus, only 9% of the final consumption of households consisted of goods and services purchased by households that were directly consumed without further processing.

The 5,713 of total household consumption exceeds the 4,209 of total household consumption expenditures by 1,504 which is largely explained by the additional value created by the labor services provided by household members. The difference is also affected by various reclassifications, however, as neither durables nor housing services are treated as being consumed directly, both being treated as providing flows of capital services into household production.

Valuing household consumption

As no monetary transactions occur for goods and services which are produced and consumed within the same household, no prices are generated. In this situation, there are two alternative ways of valuing the non-market output of household production. One is

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to try to find market prices that can be used to value the outputs and the other is to value the outputs by their costs of production. The problem is by no means peculiar to household production. It also occurs in the main national accounts with the output of non-market services produced by government enterprises or non-profit institutions.

If the same goods and services are sold on the market and market prices can be found for them, they can be used to value the goods and services produced by households for own use. For example, market rents may be used to value the output of housing services produced by owner occupiers. However, the qualities of the goods and services produced within households tend to systematically differ from those of similar kinds of goods and services sold on the market, if any. In general, there seem to be very few cases where appropriate market prices can be found to value the output of household production so that other valuation methods have to be adopted.

The alternative is to value the outputs by their costs of production. This method is widely used in national accounts to value all kinds of non-market output. For example, in the production account in Table 3, the figure of \$ 5,713 billion for the output of household production is obtained as the sum of the intermediate and primary inputs on the left side of the account. There is assumed to be no net operating surplus. This method shifts the problem of valuation from the outputs to the inputs.

There are three main inputs: intermediate inputs, labour services and capital services. In a household production account, the value of the intermediate inputs is given straightforwardly by their market value as they form part of personal, or household, expenditures.

The value of inputs of capital services is given by the user costs incurred: that is, by the sum of the depreciation and interest costs on the household fixed assets. The value of the capital services is calculated in the same way as if they were business assets. Durables and dwellings are both treated as fixed assets that provide *inputs of capital services* into the production of other consumption goods and services. The services of consumer durables and dwellings are not treated as if they were consumption services directly consumed by households.

The main problem with the input approach is the valuation of the labour inputs. The labour inputs themselves are non-market, like the outputs they are being used to value. The valuation of labour inputs into household production is one of the more controversial topics in household production accounting.

The quantities of labour inputs can be estimated by using data on hours worked from time-use surveys. To be consistent with general national accounts principles, the labour inputs should be valued using the market wages payable to employees doing the same kind of work. However, a case can also be made for valuing at opportunity costs: that is, what the person could have earned by taking paid employment. Valuing at opportunity costs is not generally favoured in studies on household production because it makes the value of the labour inputs depend on who does the work rather than the nature

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of the work done. In any case, most paid employees are not able to vary the amount of paid work they do to suit their own preferences. If they take on a second job they are likely to be paid less than in their main job. A further complication is that people may engage in certain household productive activities, such as child care, because they like it. Certain types of work may be undertaken as a form of leisure activity. For example, many people undertake do-it-yourself activities ranging from gardening to constructing extensions to dwellings because they derive satisfaction from the work itself and not merely from the output produced. The trade off may not be between do-it-yourself activities and paid employment but between do-it-yourself activities and other forms of leisure activities such as watching TV or sports activities.

Price indices for household consumption

Notwithstanding the difficulties of valuing the labour inputs, estimating the value of the output of household production and consumption by summing the values of the inputs is likely to produce estimates of the right order of magnitude for a single period of time. From a CPI perspective, however, it is necessary to factor changes over time in the current values of household consumption into their price and quantity components. This is an altogether more difficult undertaking.

Although the total values of inputs and outputs may be identical for a single period of time, there is no corresponding identity between changes in the real values of inputs and outputs over time or between average changes in input and output prices. They diverge because of changes in productivity. Thus, even if satisfactory price indices could be compiled for each of the inputs, a weighted average of the price indices for the inputs into household production would not provide a satisfactory estimate of the price index for the outputs.

The problem parallels the well known problem of measuring real growth and inflation for government non-market output. However, the problem is even more acute for household production because the values of the labour inputs have to be imputed whereas the values of the labour inputs into government production can be measured by the compensation of employees paid, a set of market transactions.

It is only possible to estimate the real growth or rate of inflation of non-market output from input data if there is an independent estimate of the rate of growth of productivity. However, there is little or no hard evidence about changes in productivity for household production. It may be conjectured that household productivity has been rising over the long term because, as the general standard of living rises, households tend to equip themselves with more and better quality household fixed assets, while the technology of household production is also likely to be improving over time. Thus, estimating the rate of growth or inflation of the output from household production from the rates of growth or inflation of the inputs cannot be acceptable in the absence of information about household productivity growth.

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It may be concluded that there is not much possibility of constructing a satisfactory price index for the consumption of own production within households whether the price changes are estimated on the basis of movements in equivalent market prices, or whether they are imputed from changes in input prices. Certainly, it is unrealistic to imagine that such an index could be compiled on a regular monthly basis and used for policy purposes.

No price or volume indices are provided in the satellite accounts for US household production referred to above. Landefeld and McCulla (2000) comment as follows in a footnote on p.300: “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, p. 528) conclude 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.”

Summary and conclusions

In the last two decades or so, satellite accounts for household production have been constructed for a number of countries which make it possible to obtain a fairly clear and precise picture of the scale and nature of household production for own use, both for own consumption and own gross fixed capital formation. These accounts draw upon information in time-use surveys which are also being conducted in a number of countries. The accounts show that a surprisingly large proportion of the goods and services purchased by households and classified as final consumption expenditures in national accounts, household budget survey and CPIs are not in fact consumed directly.

According to the illustrative data for the US in 1992 shown in Table 2 nearly two-thirds of the goods and services classified as final consumption expenditures may be used as intermediate inputs into household production. A further tenth of final consumption expenditures are purchases of durables which should be treated as gross fixed capital formation. It has long been argued on economic grounds that national accounts and CPIs should treat the flows of services provided by the durables as consumption instead of the expenditures on the durables. However, as most durables appear to be household fixed assets that households use for purposes of production, their services are also not consumed directly. In the context of a household production account, durables can be seen to provide flows of capital services into various kinds of household production alongside the flows of capital services provided by dwellings. Although it is common for CPIs to treat housing services as if they provided consumption services, dwelling are fixed assets that provide capital services into household production.

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The production account in Table 3 suggests that in the US the value of total household consumption may exceed the value of total final consumption expenditures by about a third, the difference being largely explained by the estimated value of the labour inputs into household production for own consumption. The problem from a CPI perspective is that there are no market prices to be observed for the outputs of household production that are consumed by the households. In satellite household production accounts the values of the outputs are usually estimated by summing the values of the inputs, a procedure that generates absolutely no information about the prices or quantities of the individual outputs. The same problem arises for government output when the values of the outputs are estimated from the values of the inputs. It is not feasible therefore to compile price indices for the outputs of household production, especially detailed indices on a frequent basis.

In practice, CPIs are calculated using the market prices of the goods and services that households purchase and that are classified as household, or personal, final consumption expenditures in national accounts. If a purely pragmatic approach is adopted, an index using these prices can be interpreted as a consumer (or a consumption) price index on the grounds that these are all goods and services that households intend to use directly *or indirectly* for purposes of consumption: that is, to satisfy their personal needs or wants. They are used indirectly when they are used as inputs into the production of goods and services that are consumed directly. A Lowe index¹² can be calculated for a specified basket of such goods and services, and most CPIs are in fact Lowe indices of this type, at least over the short run, even though some countries may use chain indices that update the baskets annually.

However, from a conceptual view point it is not satisfactory to use the prices of goods and services purchased if the objective is to calculate a cost of living index defined as the ratio of the minimum expenditures needed to maintain given level of utility. The economic theory underpinning COLIs utilizes the theory of consumer behaviour in which rational utility maximising individuals react to changes to changes in relative prices by adjusting the relative quantities they consume. However, as argued earlier, ‘consumption’ is a vague ambiguous term that is not suitable for rigorous theorising. In a specific application, it is necessary to define exactly what is meant by ‘consuming’ and exactly which goods and services are being consumed. The goods and services whose prices are used to estimate a COLI should be those of the goods and services from whose consumption households derive utility. Most of them are produced within the household and are not purchased from retail outlets. There are no prices to be observed and collected for them.

Even when the requisite prices are available, a COLI cannot be calculated directly and can only be approximated by a superlative index¹³ such as Fisher. The question then

¹² The name “Lowe index” is introduced in the international *CPI Manual* (2004) to describe an index that measures the change in the cost of a specified basket of goods and services. Laspeyres and Paasche indices are special cases of Lowe indices. See paras. 1.16 – 1.34 of the *CPI Manual*.

¹³ The concept of a superlative index was introduced by Erwin Diewert (1976). It equals the cost of living index for flexible expenditure functions. Examples of superlative indices are the Fisher and Törnqvist indices that treat both time periods symmetrically.

becomes how closely a Fisher index, for example, calculated for the set of goods and services that households purchase can be expected to approximate to a Fisher index for the set of goods and services they actually consume. This is a matter that requires further research. The main conclusion to be drawn from the data on household production and consumption is that the two sets appear to be sufficiently different for it to be possible for the two Fishers to diverge significantly. The goods and services purchased are, of course, ultimately incorporated into the goods and services finally consumed but not without a significant amount of transformation in some cases.

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