

# An input-output approach to unpaid household production and consumption in Norway<sup>1</sup>

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*Measurement of unpaid household work is important in order to achieve more comprehensive estimates of the level of economic activity as well as to model the dependency between the market and non-market sectors of the economy. In this article, we combine data from time budget surveys and consumer expenditure surveys in Norway in order to estimate household production and analyze the connection between consumption expenditure and time use. Through an examination of different methods for allocating consumption expenditure to household activities we study how sensitive the results are for choice of allocation rule, and discuss the need for an international standard.*

## Introduction

Household welfare depends not only on income and consumption of various goods and services, but also on time-use patterns in unpaid household work and leisure. In recent years, the value of unpaid household work has been more explicitly recognized as an economic variable, and shown to be of great significance for the analysis of national income and its distribution. The pioneering research of Margaret Reid (1934, 1947) on valuation of unpaid work has been continued by e.g. Ann Chadeau (1992), Luisella Goldschmidt-Clermont (1993) and Duncan Ironmonger (1996).

Counting household work in the national accounts has a long history in Norway. In 1912, the first estimates of unpaid household work were compiled by A.N. Kiær, then director of Statistics Norway (Kiær 1913). The value of housewives' unpaid work was estimated at 15 per cent of national income, based on census data and wage rates for domestic servants. When after World War II national accounts for the years 1935-43 were compiled, these estimates included the value of unpaid household work (Statistics Norway 1946). For 1943, the value of unpaid household work in Norway was estimated at 15 per cent of net national product, in fact the same percentage as in 1912. The purpose of including the value of unpaid household work in the national accounts was to provide a comprehensive picture of the economic activity in society. In contrast,

the first international standard for national accounts came to be based on a market approach, where only goods and services that were traded or could be traded should be included, and thereby only recognized a limited production within households, such as domestic services buying direct services rendered by other households (United Nations 1953). Concern for internationally comparable national account figures led Norway in 1950 to omit unpaid household work from the national accounts and national budgets.

In the late 1980s Statistics Norway again estimated the value of unpaid household work (see Brathaug 1990), using time budget surveys, which have been conducted three times in Norway, in 1971-72, 1980-81 and 1990-91. Household work included the following activities: housework, maintenance, care, shopping for goods and services, travels related to household work, and other activities (Statistics Norway 1992). The value of unpaid household work has been estimated from the three time budget surveys conducted over the past 20 years. The calculations are based on a "wage rate" for unpaid household work, equal to the wage rate of home helper (home helper is a municipally provided substitute in case of mother's illness or hospitalization). Two alternative valuation methods also tried out are the wage rate of specialized workers (gardener's wage for gardening time, cook's wage for cooking time, etc.), and the opportunity costs corresponding to the individual's wage rate in the labor market (in practice estimated by average wage rates for socio-economic groups). In the national account estimates by Statistics Norway (see Brathaug 1990, Dahle and Kitterød 1992), all three methods have been employed. The results obtained from all three methods are surprisingly similar, yielding a valuation estimate roughly equivalent to the average market wage rate for women. The results show that the value of unpaid household work currently amounts to about 40 per cent of GDP.

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The 1993 revision of the System of National Accounts (SNA) comprises a thorough discussion of the production boundary and recommends that unpaid household work is imputed in satellite accounts, i.e. supplementary accounts that are separate from, but consistent with the national accounts framework (United Nations 1993). Satellite accounts of this kind are compiled in several countries, see Goldschmidt-Clermont and Pagnossin-Aligisakis (1995) for a review. Recently, the dependency between the household production sector and the market production sectors of the economy has been analyzed in a series of articles that investigate the role of household production in business cycle fluctuations, see e.g. Benhabib, Rogerson and Wright (1991), Greenwood and Hercowitz (1991), McGrattan, Rogerson and Wright (1997), and Ingram, Kocherlakota and Savin (1997).

An important building block in modelling the relationship between market and non-market production is the reallocation of total consumer expenditure into intermediate goods in household production, which is the main topic of this article. The composition of household production across own-time use and deliveries of intermediate goods from various market sectors can be modelled in a similar framework as an input-output model, see Ironmonger (1989) and Thoen (1993). Placing household production within an input-output framework that is consistent with the national accounts system gives a suitable tool for analyzing the mutual dependencies between the use of purchased goods and time use in household production, just as the mutual dependencies between production sectors are analyzed in conventional input-output tables. This allows household production to be linked to the national accounts system via the development of a satellite account through household consumption expenditures, which are common to both sets of accounts. The complex interdependence between household and market (including public sector) activities can be analyzed within a familiar accounting framework in terms of the raw materials, other intermediate goods and services, or labor inputs required to produce outputs. The impact of macroeconomic policy on the household sector of the economy can be conceptualized in terms of the substitutability of market supplied services for household production, and the household capital/labor ratio and consumer demand can be linked to underlying household activities.

As a first step towards addressing these complex issues, we give in this article a brief review of the framework for developing household production tables, or input-output tables, that show the composition of household production, as divided between time use and commodity inputs. In this context the term household production comprises only unpaid household production. A household production table for Norway in 1990 is presented with a discussion of estimation method. Finally, the need for internationally comparable data and methods is discussed.

## An input-output approach to household production

Household consumption patterns are closely linked to time use patterns both in paid employment, unpaid household work, and in leisure. Many consumption goods are not ready for immediate consumption, but need further work before they can be consumed. An example is groceries in the store that need time input in the form of shopping and cooking before the meal is ready for consumption. In this respect, the household may be seen as a small factory where household members take part in tasks involving transportation, shopping, cooking, cleaning, care etc. Time (and skill) convert "raw materials" into goods ready for consumption. The demand for flour and sugar and the demand for baked goods thus depend on the trade-off between time spent in home baking and time spent in other activities. Similarly, the demand for leisure commodities like videos, books and newspapers depends on the time allocated to leisure activities.

Relations between time use and consumption were modelled thirty years ago as "household production theory" by Becker (1965) and Lancaster (1966). This theory represents a reference point for our analysis. The household production table in this paper may be seen as a simplified version of a linear household production function, and thus as a first step towards a more complex estimation. Household production theory has not yet seen many econometric applications, possibly due to lack of good data. Ironmonger (1989) was the pioneer in developing household production tables, that combine data from time budget and household expenditure surveys and yield estimates of household production and its composition across household production activities. Input-output tables for household production were first developed within the context of satellite accounts for the household sector.

In this article, we use the framework for household production input-output tables as established by Ironmonger and Sonius (1987), Ironmonger (1989, 1994, 1996) and Thoen (1993), with data from time budget surveys and consumer expenditure surveys in Norway. The results build on our previous work (Aslaksen, Fagerli and Gravningsmyhr 1995, 1996). The purpose of household production tables is to give an overview of average time use and consumption patterns in household production activities. The time budget survey gives a detailed overview over how much time different households spend on different activities, and these data may immediately be applied to a household production table. The consumer expenditure survey gives a detailed account of the expenditure on a large number of different goods, but no expenditure data are available for household production activities on a disaggregated level. Hence, total consumption expenditure has to be allocated across the activities with which the commodities are linked. Many consumption goods are used in several of the household production activities, and an allocation method is required for assigning a share of each commodity to the relevant activities.

### Box 1. The TIC method and the time-based method for reallocating consumption expenditures

Both methods are based on time-proportionality in allocating the direct goods. The two allocation methods differ in the way the indirect goods are treated. One method allocates the indirect goods evenly across all activities. If a good is used as both direct and indirect input, e.g. electricity, half of the expenditure is considered direct input, and is allocated to the relevant activities proportionally to the time use in each activity, and half of it is considered indirect input, and is allocated evenly across all activities. This method, applied by Thoen (1993), is characterized by having a time-independent component (TIC) in the commodity allocation, and is denoted by the TIC method.

In our previous work, we found that the time-independent allocation of the indirect goods in the TIC method led to some less intuitive results (see Aslaksen, Fagerli and Gravningsmyhr 1995). Detailed calculations of time use and commodity input in some activities, such as baking bread, suggested that the TIC method overestimated commodity input in household production. A consequence of evenly allocating indirect inputs to all activities, is that activities where little time is spent, are assigned a disproportionately high commodity intensity. Time and commodity intensity are defined as the percentage share of time input and commodity input in each household activity. The allocation of clothing expenditure is a typical example of this bias. In the TIC method, equal amounts of the clothing expenditures (107 kroner per activity) are allocated to all activities, regardless of the actual time use in these activities. Hence, the activity "baking bread" (in which on average 1.73 minutes per day are spent) and the activity "cooking, laying the table and serving" (in which on average 1 hour and 6 minutes per day are spent), receive the same amount of indirect commodity input, and the activity "baking bread" becomes unreasonably commodity intensive as compared to the activity "cooking, laying the table and serving".

As an attempt to overcome this bias, we have in this article supplemented the TIC framework with calculations which allocate both direct and indirect goods proportionally to time use in the activities where these goods are used as inputs. We will refer to this as the "time-based" method. It distributes the indirect expenditures in a way that decreases the commodity intensity of activities that only has a small proportion of total time use. The two methods differ only in the allocation of indirect goods to household activities.

We apply two different approaches (the TIC method and the time-based method, see box 1) to allocating household consumption expenditures to different productive activities in the household. Both methods are based on the distinction made between direct goods and indirect goods. Direct goods are commodities that are used as inputs in household production activities, such as apples in making apple pie. These commodities are allocated to the various production activities in proportion to time spent in each activity where they are inputs. Indirect goods are commodities that are not directly related to any specific activities, such as

clothing, rent, insurance, heating and lighting. Nevertheless, these goods are necessary for household production to take place, so they are classified as indirect goods. Some commodities (electricity is the most obvious example) are both direct and indirect goods, as a direct good used e.g. in the activity "food preparation", and as an indirect good, in residential heating and lighting. The allocation of direct and indirect goods to the various activities yields an estimate for the value of commodity input in household production.

In this framework, total consumption expenditure is allocated across all time use categories, i.e. not only unpaid household work, but also paid work, leisure, education, and personal care. Non-household activities are kept track of in auxiliary accounts to secure adding-up to total consumption expenditure. However, in this article we present the commodity composition of household production activities only. We consider the following categories of household work as applied in time budget surveys: household work, maintenance, shopping, travels in connection with household work, care for children and others (not including own personal care), and other activities. Caretaking is defined as all child care, including reading and helping with school work, as well as care for sick and disabled persons.

### Household production tables for Norway

The organization of work and consumption varies among households with different compositions. Consumption expenditure patterns are different for single men and women, for families with and without children, and for single parents, reflected in different time use patterns, and the combined data provide interesting illustrations of household production and welfare in various household types.

Table 1 shows hours per year, value of time and commodity input in unpaid household work in Norway for selected household types: single women, single men, couples without children, couples with small children (0-6 years), and couples with older children (7-17 years). The data source is the 1990 time budget survey. In order to assign a value to the time spent in unpaid household production, we have used the wage rate for a home helper, which is consistent with the imputation of unpaid household work in the satellite accounts (see Brathaug 1990 and Dahle and Kitterød 1992). This implies that the same wage rate is applied for all persons.

The total value of household production (output) is the sum of the value of time (corresponding to value added in the satellite account) and the value of commodity input (intermediate consumption). For the average household, Table 1 shows that the value of household production is 242 859 kroner (= 164 766 kroner + 78 093 kroner) with the TIC method, and 226 396 kroner (= 164 766 kroner + 61 630 kroner) with the time-based method. When using the time-based method rather than the TIC method, commodity input into household production for the average

**Table 1. Time and commodity input in household production in different household types in Norway, 1990. Kroner and per cent**

	Hours per year	Value of time	TIC method		Time-based method	
			Commodity input	Commodity input, per cent	Commodity input	Commodity input, per cent
Average (1.73 persons)	2275	164766	78093	32.2	61630	27.3
Single women	1179	85359	36833	30.3	29477	25.8
Single men	897	64910	41561	39.1	30528	32.0
Couple without children	2589	187454	77736	29.4	61426	24.7
Couple with small child(ren)	3836	277753	123185	31.6	105980	28.4
Couple with older child(ren)	3027	219132	115720	34.6	95421	30.4

**Table 2. Commodity intensity in different household activities and household types with time independent allocation for indirect goods (TIC method). Per cent**

	House-work	Maintenance	Care	Shopping	Other household work	Travels
Average	36.4	36.3	26.7	16.0	19.5	36.5
Single women	31.2	45.1	18.4	20.3	27.3	20.4
Single men	43.2	42.9	45.7	17.4	24.5	39.5
Couple, small children	37.4	44.0	16.9	13.9	21.6	43.1
Couple, older children	36.5	43.8	29.3	18.2	19.9	44.0
Couple, no children	30.7	25.5	38.4	18.0	17.0	35.2

**Table 3. Commodity intensity in different household activities and household types with the time dependent method for both direct and indirect goods (Time-based method). Per cent**

	House-work	Maintenance	Care	Shopping	Other household work	Travels
Average	34.0	25.1	14.5	14.1	16.3	35.4
Single women	28.7	26.4	1.9	18.7	22.4	19.8
Single men	39.5	28.8	10.9	16.1	22.0	37.6
Couple, small children	34.8	29.8	15.6	11.3	16.5	42.8
Couple, older children	35.1	31.8	19.0	15.5	16.4	43.0
Couple, no children	29.0	17.7	9.3	16.6	13.5	35.0

household is reduced by about 16 500 kroner, or about 20 per cent. The commodity intensities, i.e. the percentage share of commodity input in household production, are 32.2 and 27.3, respectively, with corresponding time intensities of 67.8 and 72.7.

Table 1 shows that for all household types, the value of household production (output) is considerably higher with the TIC method than with the time-based method. This is a consequence of the fact that more time is spent in paid work, leisure and personal care than in household work, and these non-household activities thus "receive" a greater share of commodity inputs when all commodity inputs are allocated according to time use. This means for e.g. clothing expenditure, more is allocated to activities like paid work and leisure, and less is allocated to household activities like baking bread, gardening etc., contributing to a lower value of commodity input in household production. Using the time-based allocation method thus decreases the total value of household production as well as the com-

modity intensity in household production. When fewer commodities are allocated as indirect inputs in household activities, household production estimates become less commodity-intensive and more time-intensive.

Both allocation methods show that the household production of single women is higher than of single men. As we can see from the table, single women spend much more time in household work than single men, but single men have higher commodity input, reflecting the fact that average income of men is higher. However, the difference in commodity input between single men and women is much smaller with the time-based method than with the TIC method. The TIC method actually allocates relatively more commodity to household production for single men than for single women. The reason is that when indirect goods are evenly allocated across all activities, activities where little time is spent are assigned a disproportionately high commodity intensity. As single men spend less time than single women in household production activities, the TIC

method seems to overestimate considerably the commodity intensity of their household production.

Couples without children produce less in the household than couples with children, and as expected, couples with children 0-7 years of age produce more than couples with older children.

Tables 2 and 3 illustrate commodity intensity in different household production activities for different household types for each method. This enables us to take a closer look at the difference between the two methods for allocation, as it is easier to interpret and evaluate commodity intensity for separate activities such as care work, shopping and maintenance.

There are significant differences between the commodity intensity in different household activities, and the difference between the two methods is quite large. A striking result is that the commodity intensity for single men in care activities is reduced from 45.7 per cent to 10.9 per cent with the time-based method. For single women the commodity intensity in care activities is reduced from 18.4 per cent to 1.9 per cent with the time-based method. As care is one of the activities one should expect to be relatively labor intensive, the reduction in commodity intensity from the unreasonably high level of 45 per cent to 10 per cent for single men, is in our opinion a clear indication that the time-based method is a considerable improvement over the TIC method. The very high commodity intensity for single men in care work reflects that some of them are divorced fathers, who spend some time in caring for children, implying that a portion of their total commodity expenditure is allocated to this activity. Divorced mothers, on the other hand, will mostly be classified in the category single parents (not shown in the table), while the category single women mostly comprises women without child care responsibilities. This explains why single women have low time use and hence low commodity intensity in child care.

Having children obviously leads to large changes in consumption and time use patterns, and it is important that the allocation methods reflect the high time intensity of child care. The problem with the TIC method is illustrated by the following example. Consider two households with the same income, one with and one without children. The household with children has a higher disposable income than the household without children, because it receives a child benefit and tax reductions. The higher income leads to higher expenditures for indirect inputs, hence the production of all household goods where there are indirect inputs will be higher, and these activities will be more commodity intensive and less labor intensive in the household with the higher income. This again illustrates that the TIC method for allocating consumption expenditure does not yield reasonable estimates, and the labor-intensity of household tasks in families with children is concealed by disproportionately high commodity intensities. Although the time-based method gives more reasonable results than the TIC method, it has not resolved the conceptual diffi-

culty of allocating indirect costs, and it remains to model a better relationship between expenditure and time use.

## Concluding remarks

Along with the compilation of satellite accounts for household production, several countries have analyzed the composition of household production in the form of input-output tables. In preparation for the UNDP Human Development Report 1995, estimates of the value of labor in household production were compiled for various countries by Goldschmidt-Clermont and Pagnossin-Aligisakis (1995). They give a thorough discussion of the different valuation criteria used in previous studies, and give a valuable contribution to a standardization. Work has also started at OECD on satellite accounts for household production in collaboration with Eurostat. However, many countries in the meantime continue to use inconsistent definitions of time use.

Another source of inconsistency is the method of allocating household consumption expenditure across various household production sectors. As we have shown in this paper, estimates of the value of the goods and services produced by the households are rather sensitive to the choice of allocation rule. Studies reallocating parts of household consumption as input into household production include Aslaksen, Fagerli and Gravningsmyhr (1995, 1996), Ironmonger (1994), Statistics Sweden (1995), Federal Statistical Office of Germany (1995), Thoen (1993), and Viha-vainen (1995). In these studies, the time intensity (labor input) amounts to between 61 per cent and 81 per cent of household production, while the commodity intensity varies between 19 per cent and 39 per cent. As we have shown, some of this variation may be due to the choice of allocation method, and reflect different allocation of indirect goods as well as different treatment of time-use activities. Our analysis has shown that the time-based method gives results with a more intuitive interpretation than the TIC method. This may be seen as a first step towards estimating a household production function.

The treatment of capital goods is another difficulty in household production estimates. In the above mentioned estimates of household production in Norway, as well as in this article, capital goods are assumed to be consumed at the time of purchase, i.e. they are treated as intermediate consumption. As more and more capital goods are applied to household production over time, the case is strengthened for including capital goods in imputations of household production. Ironmonger (1996) suggests that in addition to the major items of household equipment, clothing is another item of household goods that could be considered for inclusion as a capital item rather than as an intermediate input. This might actually improve some of the bias caused by the allocation of indirect goods to activities.

Internationally, standardized guidelines for the construction of household production tables could greatly facilitate comparisons across countries and prove useful in many policy contexts, but the data currently available may limit

the possible methods for making input-output tables for household production. In order to facilitate future research and policy discussion, it would be beneficial to have internationally coordinated methods for allocating consumption expenditures, as well as definitions of time use for household production activities.

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