Incorporating Gender and Time Use into NTA:

National Time Transfer Accounts Methodology

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**Introduction**

The National Transfer Accounts project examines how people produce, consume, share and save by age for many different nations and times. A natural extension of the NTA perspective is to add gender as an additional characteristic. This involves two distinct efforts: disaggregating the current national accounts-based NTA by gender, and adding a satellite account for time inputs, here called National Time Transfer Accounts (NTTA). Time inputs include productive activity that is not already accounted for in NIPA.[[1]](#footnote-1) We will refer to this as “household production.”[[2]](#footnote-2)

The development of NTTA is conceptually linked with gender due to the prevalence of women’s specialization in production outside of national income. Simply disaggregating NTA profiles by gender without adding the NTTA data on time use would give a misleading picture of productive activity and contributions to the household (Waring, 1999). Beyond the issue of gender representation, however, accounting for time spent caring for others is important for many other reasons.

If we wish to understand the full age-nature of consumption and production, we should include time inputs along with market inputs. For example, the production of a family dinner includes the inputs of food growers, but of home cooks as well. The family consumes not just the food items, but also the time of the home cook. A child at the dinner table receives a transfer of the value of the food, along with a transfer of the time spent cooking it. Time use is also important for accurately valuing human capital investment and the cost of youth and old age dependency. It allows us to examine tradeoffs between money and time: are intrahousehold transfers received by coresident elderly offset by their time spent in child care, cooking, or other home production? Or are coresident elderly even costlier when we include time spent caring for them by younger household members?

We will begin to examine these questions by reviewing some preliminary results in countries that have estimated NTA by gender and/or NTTA by gender as well. Following this general discussion of results, detailed methodology is presented to disaggregate NTA by gender and to estimate NTTA by gender. The methodology is based on the efforts of a working group on gender, chaired by Gretchen Donehower. Several members of that group met in Berkeley on June 13 and 14 to share their research experience and discuss best practices for this work.

As only a few countries have begun research efforts to incorporate gender and time use, this is a work in progress. Please send all comments to Gretchen Donehower at gretchen@demog.berkeley.edu. Also, contact her if you would like to be included in the NTA Working Group on Gender and Time Use.

**Preliminary Results**

At this time, preliminary estimates are available for national income-based NTA by gender in Sweden, for time use-based NTTA by gender in Mexico and for both NTA and NTTA by gender in the US.

The estimates for Sweden in Figure 1 give an example of the lifecycle deficit – consumption minus labor income –based on national accounts for Sweden in 2003, separately for men and women. These are age- and sex-specific average amounts, smoothed over age. The methodology details are provided in the next section, but to summarize very generally, we obtain our estimates from household surveys which include the gender of the household members, and administrative data which are broken out by gender. When surveys give individual-level data, as they often do for income, we can estimate age profiles for the two sexes separately. When surveys give household-level amounts only, we impute spending to individuals by age and gender using data-driven methods for health and education consumption. For private consumption other than health and education, we assume age-specific consumption weights which are equal for same age men and women. This large category of consumption, then, will only reflect sex differences across households, but assumes an equal division of consumption between same-aged persons of different genders in the same household.[[3]](#footnote-3) In Figure 1, we see women producing smaller surpluses during their working years and incurring higher deficits when older. In particular, we see much higher deficits for women than men in their early 20s. This is due to women delaying entry into the labor market while spending heavily on education. This picture may change in future generations if these heavy investments in human capital by younger female cohorts help them command higher salaries when they are older.

At this time, preliminary gender results from Mexico include only profiles based on time use, not monetary units and only labor estimates are shown here. Two types of activities are identified and shown in Figure 2, using data from the Mexican Time Use Survey. “Contracted” time includes time spent in labor that would be included in NIPA and NTA. “Committed” time includes activities that are productive but are not included in NIPA or NTA, such as household care and maintenance, food preparation, and caring for others. Specifics on identifying those activities are given in subsequent sections.

Figure 1. NTA average lifecycle deficit estimates by age and sex, in Swedish krona (Sweden, 2003)

Source: Thomas Lindh, Daniel Hallberg, Jovan Žamac (2010). Intergenerational transfers for men and women in Sweden 2003: A first look at flows in the formal sectors [presentation slides]. Retrieved from <http://ntaccounts.org/web/nta/show/Documents/Meetings/2010%20Conference%20Agenda>.

Figure 2. Average daily contracted and committed time by age and sex (Mexico, 2002). Contracted time is spent working for pay which would be included in NIPA. Committed time is spent on household production – productive activities which are not included in NIPA.



Source: Estela Rivero (2011). *Estimating the monetary value of non-market labor in Mexico* [presentation slides]. Retrieved from [http://ntaccounts.org/web/nta/show/Documents/Meetings/Gender%2c%20Time%20use/FirstTUWorkshop](http://ntaccounts.org/web/nta/show/Documents/Meetings/Gender%2C%20Time%20use/FirstTUWorkshop).

Figure 3. Selected NTA, NTTA and combined per capita age profiles, US$ (US 2009).



Source: Author’s calculations and personal communication with Iván Mejía Guevara. Notes: The final age category is 85+. The “production” line plotted for panel b. is labor income (wages and benefits plus self-employment income).

Age- and sex-specific average daily time spent by men and women in contracted time is shown in the left-hand panel of Figure 2, and in committed time on the right. While both men and women are performing both kinds of jobs, we see traditional gender roles on average. Men and women are spending similar total hours in productive work, but men are specializing in market work and women in household production.

Preliminary results for the US show the next step towards estimates of NTA and NTTA in the same currency units. The top row of graphs in Figure 3 show household production and consumption valued in US dollars. For the production estimates, age profiles of average time spent in household production from the American Time Use Survey are weighted by an imputed wage for each type of household activity. For the consumption estimates, we assign time spent caring for children or elderly to the children or elderly in the household, while general activities like cooking, cleaning and maintenance are shared equally by all household members. Details on the wage imputations and consumption estimates are given in later sections. The next row shows national accounts-based NTA, labeled “national income.” Finally, the bottom row combines both accounts into a representation of the total economy. We see women specializing in household production, men specializing in market production and their consumption being about equal. This leads to large lifecycle deficits in household production for men and market production for women. When the accounts are combined, however, the sexes look much more similar.

Clearly, an accurate representation of men’s and women’s productive activities is only possible with the inclusion of household production. Furthermore, failing to consider the huge amounts of household production consumed by the very young and very old would considerably underestimate the value of inputs to them and the transfers they require to maintain their consumption.

**NTA by Gender**

1. NTA review and notation

This material is covered in detail in the main NTA manual (Mason, et al., 2009) and on the NTA wiki sections detailing methodology (http://ntaccounts.org/web/nta/show/Documents/Methods). I include a brief review here. Each NTA age profile consists of two parts. First, we need an aggregate measure of an economic activity from national accounts to serve as a macro control. Second, we need a cross-sectional set of age-specific averages of the activity (referred to here as the age shape), giving the relative per capita amount of that activity by age. We then find a multiplicative adjustment factor that shifts the age shape up or down so that the aggregate NTA amount matches the control, given the population age distribution.

To introduce the notation that will be followed throughout, here is the adjustment to the macro control in equation form:

 $a$: age a, ranges from 0 to ω (usually 90+)

 $N\left(a\right)$: population count, age a

 $X$: macro control

 $x(a)$: per capita age shape, age a

 $θ=X / \sum\_{a=0}^{ω}x\left(a\right)N(a)$: adjustment factor

 $\tilde{x}\left(a\right)=θx(a)$: per capita NTA age profile, age a

 $\tilde{X}\left(a\right)=N(a)\tilde{x}\left(a\right)$: aggregate NTA age profile, age a

Separate treatment of gender in these accounts means age shapes and aggregate controls are estimated by sex. Gender-specific items will be indicated with an additional index as follows:

 $N(a,g)$: population count, age a, sex g

 $x(a,g)$: per capita age shape, age a, sex g

1. Aggregate controls

National accounts do not break out flows by gender, so gender-specific control totals must be obtained in other ways. The simplest assumption, and an appealing one, is to let the gender shares of the aggregate age shapes determine the gender shares of the aggregate controls. In other words, the adjustment factor *θ* is found for both sexes combined based on a single sex *x(a)* exactly as shown above and then that *θ* is applied to both the male and female age shapes:

 $\tilde{x}\left(a,g\right)=θx(a,g)$*:* per capita NTA age profile, age a

1. Age shapes when data are available by individual’s age

Data are readily available for many types of economic behavior to estimate age shapes by gender. When age shapes are calculated from individual-level survey data, the survey typically includes gender as a variable along with age. Identify relevant variables that indicate the particular activity and collapse to age- and sex-specific means to get age shapes by sex.

Administrative records are sometimes used to estimate age shapes of public benefits and these are sometimes published by age and sex, or requests for special tabulations can be made to statistical agencies. Generational Accounts, which require many of the same data as NTA public sector accounts, are always estimated by gender as a preliminary data step, so where it is possible to calculate Generational Accounts, it is also possible to find NTA age shapes by gender.

The final age profile by gender may need more statistical smoothing due to the smaller sample sizes but the implementation is straightforward, and researchers can judge and adjust the effectiveness of the smoother by the same means as when estimating single-sex NTA.

1. Age shapes when data are available for households

When the age profile is based on household-level data, NTA uses two main methods to allocate household-level data to individuals by age: 1. data-driven methods like regression or iteration, or 2. assumed relative age shares (equivalent adult consumer weights).

When regression or iteration is used to estimate age shares, gender can be added to the model. The examples given below show models with separate age factors for men and women, but other formulations that include gender could be explored, such as including a single additive or interaction term. If researchers explore these other options, they should decide based on goodness of fit tests which model is the most appropriate.

For example, a regression equation used for estimating the NTA age shape of education consumption when an enrollment indicator is available is as follows:

$$X\_{j}=\sum\_{a}^{}α\left(a\right)E\_{j}\left(a\right)+\sum\_{a}^{}β\left(a\right)NE\_{j}\left(a\right)+ε\_{j}$$

where $E\_{j}(a)$ is the number of enrolled members age *a* and $NE\_{j}(a)$ is the number of unenrolled members age *a*. Note that where appropriate for the variable X, age *a* is grouped in 2- or 5-year groups to reduce noise. The positive $α(a)$ and $β(a)$ coefficients are assigned to the relevant age groups and used as weights to distribute the household amount spent on education. To add gender into this equation, we can double the number of coefficients by estimating $α\left(a,g\right)$ and $β(a,g)$ for each gender *g*:

$$X\_{j}=\sum\_{a}^{}\sum\_{g}^{}α\left(a,g\right)E\_{j}\left(a,g\right)+\sum\_{a}^{}\sum\_{g}^{}β\left(a,g\right)NE\_{j}\left(a,g\right)+ε\_{j}$$

There are several other models described in the NTA manual section on consumption that might be used. To expand those to include gender, follow the same principle that is described above: where an NTA regression equation has one term for a particular age group, expand that to two terms for the age and sex group.

Turning now to the case of assumed relative age shares, the researcher should use the same equivalent consumer weights for same-aged males as females. Some gender differentiation will still show in the final age shapes because different amounts of consumption will be observed depending on the age and gender distribution of households. However, a priori we do not have enough information to assume any differences within households between same-age men and women across all countries involved in NTA.

In the past, some NTA researchers have examined data driven methods to estimate an equivalent consumer scale by sex, but the differences found have been relatively small (Lindh et al, 2010). Researchers outside of the NTA group argue that a unitary sharing model within the household is inaccurate (Browning and Chiappori, 1998) and find that both spousal market income and gender roles contribute to different consumption by gender within the household (Phipps and Burton, 1998). Given these previous studies, we would expect women to receive a lower share than same age men in the household, which would lower their consumption and lifecycle deficits. Examining alternatives to the equal gender weights assumption should be an important priority for future revisions of the methodology. For the current methodology, researchers should be clear on the potential for bias in estimates of women’s versus men’s private consumption.

1. Role of headship

Finally, full accounting of national income-based NTA by gender requires that we examine the gender implications of the existing methodology. The role of headship in NTA is the biggest example of this. Headship is determined in survey data and the household head is assumed in NTA to be the only one in the household who can own assets or go into debt. When we calculate a single-sex asset income profile, the headship assumption will not matter much for the case of two spouses of similar age. One is assumed to have all the assets, the other none, but they are averaged together in the age profile. Separate these age profiles by gender, however, and in many contexts different assumptions about who is the household head will create very different gender-differentiated age profiles.

Headship also plays a role in private transfer profiles for two reasons:

1. Only the head gives or receives inter-household transfers.
2. Only the head makes intra-household transfers based on assets:
	1. Transfers of the services of owned assets like a house or consumer durables.
	2. Transfers financed by asset-based reallocations (asset income, proceeds from asset sales, or going into debt) needed to cover a disposable income shortfall.

Researchers should check several different definitions of headship to determine the sensitivity of results by gender to the headship definition. Some possible definitions of headship are:

1. Survey-defined (this is the NTA default)
2. Highest wage earner in the household
3. Owner or renter of housing unit (if available in survey)
4. Equal headship (assign headship-related roles equally to all adults in the household)
5. Proportional headship (assign all assets and other headship roles to adult in the household based on their wages or some other indicator)

As headship in NTA mainly impacts estimates through the ownership of assets, the ideal would be to identify the head as the owner of the assets in question. For allocations related to housing, the head is the legal owner or renter, divided among any multiple owners. For allocations related to asset income, the head is the owner of the assets. As most surveys will not include this level of information, researchers should examine the default survey definition of headship and then identify at least one plausible alternative definition to establish and report a range of possible estimates. Understanding the role of headship is another priority for future refinements in this methodology.

**NTTA by Gender - Satellite Accounts Based on Time Use Data**

1. Introduction

Using time use survey data, the basic estimation strategy is as follows:

* + 1. identify available time use surveys
		2. identify time spent on household production by age and sex
		3. impute a wage that will be used to value the time spent on those activities
		4. use existing NTA methodology to determine the age shapes of time-based production, consumption and transfers for men and women.

Each step is examined in more detail below. These four steps account only for the labor component of household production. The final section of NTTA by Gender discusses including the capital component of household production.

1. Identify available time use surveys

Ideally, we want to estimate NTTA using a time use survey with characteristics similar to the household surveys we use to calculate NTA:

* nationally representative
* each household members’ age and sex listed
* roughly the same time period as NTA calculations
* able to represent an annual amount (i.e. includes the impact of weekends, holidays or any other special times)
* time use data for all in household, or at least all who produce time inputs
* hours in a day add up to 24, or omitted hours are understood to be non-productive

There are far fewer time use surveys than household consumption or income surveys, so researchers will likely have to compromise on some of these characteristics. Your time use survey may end up being for a particular sub-region of the country, or not list household members or time use activities in sufficient detail to allow for the calculation of the complete NTTA system of production, consumption and transfers. Even if you are only able to calculate production of time for some portion of the population, it will still be useful to compare to NTA results. Also, NTA results can be calculated differently to facilitate comparability with NTTA, for a particular sub-region, for example.[[4]](#footnote-4)

1. Identify time spent on productive activities not included in national income

We want to include in these satellite accounts those activities that would be included in national income were they performed for wages instead of by non-market labor. One way to determine if an activity meets this standard is the “third party criterion”: you can pay someone else to do it (Reid, 1934). Thus activities like sleeping, eating and leisure activities would not be included, but any home management or care activities would be. The activities we are interested in recording are not included in national income, but could be if they were contracted for instead of unpaid.

There are many different ways to classify activities, and you will have to work with your own survey, but here are two examples of classifications and where to look for household production activities. The first example is in Table 1, showing the trial International Classification of Activities for Time Use Statistics (ICATUS), maintained by the UN (<http://unstats.un.org/unsd/methods/timeuse/icatus/icatus_2.htm>). Major activity groups are shown and those which are not included in national income but would be if they were contracted for are shown in bold and starred. Note that categories 1-3 represent contracted time already included in national accounts. Categories 0 and 7-9 represent activities that could not be performed by someone else for you, so they do not meet the third party criterion.

Table 1. Major groups in the ICATUS. Categories of productive activities not in national income are bold and marked with \*.

|  |
| --- |
| 1. Personal care
 |
| 1. Employment for establishments
 |
| 1. Primary production activities not for establishments
 |
| 1. Services for income and other production of goods not for establishments
 |
| 1. **Household maintenance, management and shopping for own household \***
 |
| 1. **Care for children, the sick, elderly and disabled for own household \***
 |
| 1. **Community services and help to other households \***
 |
| 1. Learning
 |
| 1. Social, cultural and recreational activities
 |
| 1. Mass media use
 |

If your survey does not follow the classification in Table 1, see the UN documentation for more details on what is included in the three relevant categories. Another example is the classification of time used in the American Time Use Survey (ATUS), shown in Table 2. There the major groups of activities we are interested in are bold and starred, but for some activity groups, some of the activities are relevant and others are not. These are marked with a dagger.

Table 2. Major activity categories in the ATUS. Categories of productive activities not included in national income are bold and marked with a \*. Categories which contain such activities along with other types are marked with a †.

|  |
| --- |
| 1. Personal care (mostly sleep)
 |
| 1. Household activities †
 |
| 1. **Caring for and helping household members \***
 |
| 1. **Caring for and helping non-household members \***
 |
| 1. Work and work-related activities
 |
| 1. Education
 |
| 1. Consumer services †
 |
| 1. Professional and personal care services †
 |
| 1. **Household services \***
 |
| 1. Government services and civic obligations †
 |
| 1. Eating and drinking
 |
| 1. Socializing, relaxing and leisure
 |
| 1. Sports, exercise and recreation
 |
| 1. Religious and spiritual activities
 |
| 1. **Volunteer activities \***
 |
| 1. Telephone calls †
 |
| 1. Traveling †
 |

As you can see in Table 2, there is more mixing of activities by productive and national income status in the ATUS classification. There, a researcher must go through each type of activity and decide one by one whether it meets the criteria for inclusion (not in national income, but could be if paid for, and meets the third party criterion). However, we all want to end up with the same general list of activities. Table 3 shows the overall list of ten groups of activities that country teams should follow, data permitting. There is also a column for “quality adjustment” which will be discussed later.

Table 3. Grouping of household production activities in NTTA.[[5]](#footnote-5)

|  |  |
| --- | --- |
| **Time Use Activity** | **Quality Adjustment** |
| 1. Cooking (food and drink preparation) | 0.75 |
| 2. Cleaning | 0.75 |
| 3. Laundry (includes sewing and clothing repair) | 0.75 |
| 4. Household repair and maintenance | 0.75 |
| 5. Lawn & garden | 0.75 |
| 6. Household management (incl. finances, scheduling, coordinating) | 0.75 |
| 7. Shopping | 1 |
| 8. Childcare | 1 |
| 9. Eldercare and care outside the home (includes volunteering) | 1 |
| 10. Travel | 1 |

Some activities in Tables 1 and 2 represent human capital investments that we might be interested in, except that they are done for oneself, such as education or attending to one’s health. While we would be interested in these categories for an analysis of total human capital investment, we would not consider them in NTTA accounts because they do not meet the third party criterion and could not be traded in a market.

Also, when we think of some aspects of time spent on caring for others, it is unclear whether those activities should be considered productive work or leisure. Is taking a child to the movies leisure for the parents or care for the child? While this is conceptually ambiguous, the time use survey instrument will have already made that decision for you. If care data is broken out in such a way as to allow different definitions of care versus leisure, researchers should estimate the size of these activities relative to total childcare and report the impact of varying definitions. In most cases, however, this will not be possible. The only recourse in this case is for and researchers to read deeply into time use survey data documentation, understand the details of the survey instrument, and be aware of the potential for bias in care estimates.

A final note about gathering up the relevant activities pertains to “multitasking.” In a few surveys, more than one activity can be reported for a unit of time. Researchers may divide the time unit equally between the multiple activities, or if there is an indication that one activity was primary and the other secondary, the time unit could be allocated to the primary activity alone. If your survey indicates multiple activities, you should estimate production with several different strategies, to show how sensitive results are to the method. We must maintain time unit equivalence, however. For example, an hour of watching children while cooking must only be counted as one hour. The hour can be divided between cooking and childcare as the researcher deems appropriate and as the survey data indicate.

After identifying relevant activities, researchers should do a good bit of exploration of these data by age and sex before moving on to the next step of imputing a wage. Age profiles of productive time use alone are worth exploring in their own right and indicate the degree of specialization by gender in an economy. The greater the specialization, the harder it will be to impute a proper wage because there will be greater differences between the economy represented in national accounts and that within the household.

Finally, the time should be estimated at an annual level to be consistent with the annual amounts estimated in NTA. If the survey represents one week, it should be multiplied by 52. If it represents a day, multiply by 365, and so on.

1. Impute a wage to productive activities not included in national income
	1. Overview

While time-based differences are crucial for understanding the gendered nature of production, the ultimate goal is to compare NTTA with NTA, so we must transform time units into monetary unit. If these activities were included in national income, how much would they be worth? The method used here has a very big impact on the final NTTA accounts.[[6]](#footnote-6)

National income includes the total value of production, which is determined in the market when the produced good is bought by someone for a particular price. The inputs to production are labor and capital. The value of the labor inputs is indicated by wages and the value of the capital services is what is left over from selling goods after the labor has been paid. To make NTTA comparable to NTA based on national income, we would ideally want to value what is produced in the time spent (Abraham and Mackie, 2005). What would the price of each service be? But that is very difficult from a data perspective. We would need additional data sources on the price and quality of each *output* activity. Instead, we choose to estimate the value of the labor *inputs* only in NTTA, and value the time spent by the wage that would be earned by someone doing the activity, instead of the price that someone would pay to have that activity performed. This decreases the data burden and removes many other methodological problems such as how to avoid double counting production that involves purchased and un-purchased inputs. An example of this would be valuing a home-cooked meal: national accounts already include the value of the raw food inputs, so how do we find a price for just the cooking inputs? Thus, the time inputs will be valued by their wage value, not their production value. This may mean that NTTA estimates are biased downwards – if a person is doing home production rather than working in the market, then the value of time in home production must be higher than the value of time in the market – but there seems to be no other way to produce estimates.

There are two main valuation methods for imputing wages: opportunity cost and replacement cost. The opportunity cost method values a person’s time by the opportunity cost of it. This tends to give a very high estimate because it imputes skilled inputs to jobs that may not require those skills or that require completely different skills. It would also often lead to valuing an hour of home production time by a man as more valuable than by a woman, whereas the woman might produce a superior output more quickly. A load of clean laundry is likely not worth more if the launderer is more highly educated or commands a higher market wage. For this reason, the replacement or substitution method is preferable – if the person had to pay someone else to perform the task, how much would it cost? This can be done using the “specialist replacement” method: finding a wage for each activity in Table 3, with a different wage for cleaning, cooking, childcare, etc. It can also be done using the “generalist replacement” method: finding a housekeeper wage that would but used for all household production activities.

For the specialist replacement method, we want to recognize the fact that performing some tasks in the market may be more efficient than in the household. Specialized equipment and training is used in the market but probably less so in the household. Unfortunately, there have been no systematic efforts to estimate the differences in productivity between the market and the household, so we will follow other researchers in adopting ad hoc estimates of relative efficiency for particular tasks (Landefeld et al., 2009). These ad hoc assumptions are represented in the “Quality Adjustment” column of Table 3. When using market wages for the activities listed in Table 3, they should be multiplied by the quality adjustment factor to take relative efficiency into account.

Going from opportunity cost to specialist replacement to generalist replacement will give high, in-between and low estimates respectively. While the preferred NTTA method is specialist replacement with adjustments for relative efficiency, it can be helpful for the project to calculate all methods and see the entire range of outcomes.

Before moving on to more specifics, a final note about selection bias is warranted. Any imputation of wages for unpaid work based on data from paid work is bound to have selection bias: a sample of experience in the market is bound to be different from the conditions outside of the market. There may be systematic differences in productivity, use of capital, and investment between the paid workplace and the household, and different people with different skills and abilities may choose to do home production versus market production. As much as possible, these considerations should be included in our wage imputation methods and adjustments made to correct for bias when feasible.

* 1. Opportunity cost

Valuing an hour of time by the persons’ opportunity cost can be implemented using the person’s hourly market wage if they also have a paid job, or imputing an hourly wage based on their characteristics if not. The imputation takes place in two steps. First, a regression is estimated using the wages and characteristics of those who receive wages:

$$log⁡(W\_{i})=β\_{0}+β\_{1}(age\_{i}^{2})+β\_{2}(educ\_{i})+β\_{3}(age\_{i}×educ\_{i})+ε\_{i}$$

where $W\_{i}$ is wage rate of person *i*,and $age\_{i}$ and $educ\_{i}$ are the age and education. Second, the estimated model is used to predict the wage rate of persons not receiving wages, based on age and education.

While it may seem like sex should be included in this equation as well, that would introduce the same gender bias found in the paid work world into the unpaid work world. In fact, it could be just this gender bias that explains some of the gender-based specialization in paid or unpaid work. Of course, some of the gender differences in paid work may be ascribed not to discrimination but to observed patterns in attachment to the paid labor force. In a US study of professionals, similar women earned less than men because they worked fewer hours and had periods of withdrawal from the labor force, due to childbearing and raising young children (Bertrand, et al.2010). It is unclear how this result from the market work world should be reflected in imputing wages to work that is done in the household.

* 1. Replacement

As discussed previously, the replacement method can be calculated assuming that the replacement is a general domestic worker (a generalist), or someone who performs only that task (a specialist). The generalist replacement method is the simplest. Consult a study or survey on labor and earnings for the time period in question and find the average hourly wage for a general domestic worker such as a housekeeper, a nanny, or a maid. Check several of these categories to see if the wages are roughly similar. If there are large disparities, try to understand why and choose the wage that would best indicate what an average household would pay for domestic service.

For the specialist method, identify a particular specialist wage for each activity in Table 3. A babysitter or childcare worker wage would apply to time spent doing child care; a maid’s wage would apply to time spent cleaning; and a cook’s wage would apply to time spent making food. Then use the “Quality Adjustment” factors in Table 3.

Be careful that you choose wages for jobs which an average person could actually do. For example, time spent fixing the house should be valued at a handyman’s wage instead of a skilled carpenter’s wage, or an electrician’s or a plumber’s, depending on the job. Certainly some persons fixing their own houses may have the skills of a trained carpenter, electrician or plumber, but most will not. Similarly, we would value time spent making food at a short-order cook’s wage instead of an executive chef’s. Researchers should use their country-specific knowledge to imagine what kind of worker a householder would hire to replace his or her own time inputs. As more countries gain experience implementing this methodology, we hope to find a standardized way to identify occupations for imputing wages.

As for the opportunity cost method, we recommend using the same imputed wage for men and women doing the same task. This assumes that men and women will be equally productive at the same task, which is most likely a poor assumption. Home production tasks are delineated by gender in many contexts and we would expect any gender specialization in a task contributes to that gender’s efficiency and productivity at that task. At this point in the research, we do not include any estimates of these effects, but in future revisions, we will investigate methods to adjust imputed wages for men versus women based on the degree of sex-specialization in an activity. For example, if 90% of the household cleaning is done by women, we might estimate some factor by which men’s productivity at household cleaning is lower than women’s. This is a conceptually difficult idea, however. Would we also consider a man’s hour spent doing childcare to be less efficient than a woman’s hour in a context where women do most of the childcare? It is more difficult here to justify an idea of relative efficiency or productivity.

* 1. Taxes

One other issue in valuing time is whether the valuation should be on a pre-tax or post-tax basis. Pre-tax values will be relevant to questions involving the total cost of care. Post-tax valuations will be more relevant when the research question is about the choices individuals face to pay for an activity to be performed or to do it themselves. One could argue that an individual will not engage in home production unless the marginal value of the time spent in home production is no less than the after-tax market wage that could be earned. Hence, studies using opportunity cost wage values would be more logically done on a post-tax basis, those using replacement costs on a pre-tax basis.

1. Estimate age shapes
	1. Production

If you have gotten this far, with activities identified and wages assigned to those activities, then take the average wage-weighted time spent in each group of activities, by age and sex, to create the NTTA age shapes for production. Make sure to include zeros in the average for people who do not perform the activity.

Researchers may want to aggregate the ten activities in Table 3 for reporting and analysis, but for calculating other age profiles down the line, you need to maintain the activities in separate profiles. The consumption of general household activities (Table 3 activities 1-7 and 10) will be calculated differently from those targeted to specific individuals (Table 3 activities 8 and 9).

* 1. Consumption

We do not directly observe people consuming the value of the time in the NTTA production account. Instead, we use assumptions to allocate the value of time in production to consumers in the household. For age-targeted care activities in the household (childcare or eldercare), the time produced is divided equally among those in the target age group. For general activities within the household (cleaning, maintenance, etc.), the time produced is divided equally among all household members. For time caring for persons outside of the household, if there is no indication of the age and sex of the person being cared for, distribute the production equally to all persons in the population. If there is an indication of who is being cared for outside of the household, assign the production to that person.[[7]](#footnote-7) For care activities in general, if the survey indicates the recipient of the care, the consumption should be assigned to the target individual. If the survey indicates only the broad age characteristics of the recipient, the consumption should be assigned to all those in the targeted age group, to the sexes in proportion of their representation in that age group. If nothing is known about the care targets, the care should be divided equally among all potential recipients.

Once all of the production is allocated as consumption, then take age- and sex-specific averages to find the age shapes.

* 1. Inter-household transfers

Calculating inter-household transfer inflows and outflows is straightforward. All of the production based on time caring for persons outside of the household is a transfer outflow for the person performing the care. All of the consumption of that time is the inflow.

* 1. Intra-household transfers

There are two types of intrahousehold time transfers: targeted care (Table 3 activities 8 and 9) and time spent benefitting everyone in the household (Table 3 activities 1-7, 10). The intra-household transfer inflows and outflows are handled differently for these two types.

Intra-household targeted care is similar to inter-household transfers: all of the time spent caring is an outflow by the person producing the care, all of the care received is an inflow to the person receiving the care.

For general household activities, we use the same unitary model for transfers as we do for intra-household transfers in NTA. Each person’s production and consumption of general activities is known, so we can estimate a surplus or deficit of the value of general activities. People transfer their production of general household activities to others, except that portion that they consume themselves. A person has surplus when he produces more general value than he consumes. He has a deficit when he consumes more than he produces. All those in the household with a surplus make an outflow in the amount of their surplus and it goes into a “common pot.” All those in the household with a deficit receive an inflow in that amount from the common pot. Once the inflows and outflows are calculated, the age shapes are the age- and sex-specific averages.

In NTTA, we only infer inflows and outflows based on the surplus or deficit in a time period. This will be an annualized amount based on the period of observation in the time use survey. These inflows and outflows can be estimated for the ten different general household activities in Table 3, or they can be estimated for general household activities as a single category. The more categories, the higher the gross flows but the net flow will be the same. This is because the more we combine activities, the more the trading off across activities or over time will cancel out. The number of gross flows will be up to country teams depending on their research questions, but only net flows should be used for comparative purposes across different countries. This may become more standardized as we gain experience in producing estimates.

The calculations for a particular inflow/outflow pair in NTTA are much simpler than in NTA intra-household transfers because there is no saving, dis-saving or public transfers to worry about in general household production. If a person has a household production general activity deficit, he receives an inflow in the amount of the deficit and his outflow is zero. If he has a surplus, he makes an outflow in the amount of the surplus and his inflow is zero.

* 1. Other profiles

The only other profile to be considered is asset income. For the NTTA, this is the income derived from consumer durables. It is the analog to NTA asset income – the portion of income derived from the role of capital in the production process. Some countries will have data estimated on the flow of services generated by consumer durables. If so, the annual amount should be allocated using the same age shape as household headship, following the NTA assumption that the head owns all assets. As mentioned previously, to consider the full impact of gender on NTA, various definitions of headship should be studied.

While this is meant to fill in the capital share of household production, it is very different from the way capital’s share of self-employment income is included in NTA. There, we assume 1/3 of the total income of businesses owned by households is generated by capital and 2/3 by labor. However, for NTTA we don’t have an output value of household production to divide between labor and capital or a developed literature indicating reasonable default shares of labor and capital attributions. In countries that do have estimates of the flow of services of consumer durables, it will be interesting to compare these amounts to the total labor inputs we estimate and evaluate the shares we find.

Most countries, however, will not have data on the flow of services of consumer durables. If not, they will not be able to estimate this profile. Their NTTA production account, then, will be comparable to NTA labor income, not NTA labor income plus asset income.

As far as other profiles found in NTA, they have no analog in NTTA. There is no saving or dissaving of household production, and no public sector. There are instances where one could imagine public time-based production – serving on a jury, community service as a penalty for law breaking or other compelled unpaid service to the government – but these will be very small compared to the private amounts in most contexts.

1. Finalizing age profiles
	1. Smoothing

You may need more smoothing with NTTA profiles than NTA because of the generally smaller time use surveys compared to consumption ones. You may also need to group ages instead of taking profiles by single years of age to dampen some of the noise in the time use data.

* 1. Adjusting to the macro control

The handling of macro controls for NTTA is similar to that of intra-household transfers in NTA: these accounts do not exist in NIPA, so we have no true macro control, but we do know that paired profiles must sum to zero. Total production must equal total consumption in NTTA, and total inflows must equal total outflows, for both intra- and inter-household transfers. If when calculating the age shapes, survey weights cause small discrepancies between paired profiles, use the same adjustment as given for intra-household private transfers to restore the net aggregate balance. As in NTA, these adjustments will be done for both sexes combined, and a single adjustment factor applied to both sexes. The adjustments should be done by the following pairs of profiles which must match are as follows:

* Total production must equal total consumption
* Total inter-household inflows must equal total inter-household outflows
* Total intra-household inflows must equal total intra-household outflows

For convenience, we will follow the same procedure for NTA transfer profiles and adjust only the outflows (treat production as the outflow and consumption as the inflow for that pair of profiles). Mathematically, if *Oagg* is aggregate outflow and *Iagg* is the inflow, the multiplicative adjustment factor on outflows, θ, is calculated as follows:



* 1. Documenting and archiving estimates

Teams should preserve as much of the detail of lower-level profiles as possible, even if they report only aggregated profiles for analysis. Preserving the lower-level profiles helps in the case of a revision in the methodology for a lower level profile – the researcher can fix that profile and not have to re-estimate all of the other ones. In addition, age-targeted care variables, such as for children or the elderly, will be particularly relevant to many research questions and should be separable from the overall profiles.

1. Summarizing and comparing

Summarizing NTTA results will be similar to procedures for summarizing NTA age profiles. Graphs of per capita age profiles are the main starting point, and the complexity of the entire age profile can be reduced using average age calculations, or graphical summaries. NTTA accounts will be of interest for many research questions. Here are just a few:

* Combining with NTA to see true nature of transfers, by age and by sex.
* Studying human capital investment including care.
* Grandparents as care givers and receivers.
* Examining shares of time-based versus market-based production in poor and rich countries.
* Changes over time, across countries.
* Changes in time-production at time of life course changes: having children, starting work, retiring, etc.

Depending on the particular research project, different summary techniques will be relevant. At this time, not enough countries have estimated NTTA to provide solid comparative material.

**References**

Abraham, K.G. and Mackie, C. (2005). *Beyond the Market: Designing Nonmarket Accounts for the United States*. Washington, D.C., National Academies Press.

Bertrand, M., Goldin, C., and Katz, L.F. (2010). "Dynamics of the Gender Gap for Young Professionals in the Financial and Corporate Sectors." *American Economic Journal: Applied Economics*, 2(3): 228–55.

Browning, M. and Chiappori, P.A. (1998). “Efficient Intra-Household Allocations: A General Characterization and Empirical Tests” *Econometrica,* 66(6): 1241-1278.

Landefeld, J. S., Fraumeni, B.M., and Vojtech, C.M. (2009). “Accounting for household production: A prototype satellite account using the American Time Use Survey.” *The Review of Income and Wealth,* 55 (2): 205-225.

Mason, A., Lee, R., Donehower, G., Lee, S.-H., Miller, T., Tung, A.-C. and Chawal, A. (2009). *National Transfer Accounts Manual, V 1.0*. NTA Working Papers 09-08.

Phipps, S.A. and Burton, P.S. (1998). “What's Mine is Yours? The Influence of Male and Female Incomes on Patterns of Household Expenditure.” *Economica*, 65: 599-613.

Reid, M. (1934). *Economics of Household Production*. New York, Wiley.

Waring, M. (1999). *Counting for nothing: what men value and what women are worth.* University of Toronto Press.

1. Time inputs not accounted for in NIPA should not be confused with unpaid family work that is already part of national income. [↑](#footnote-ref-1)
2. While the name “household production” has become common, note that some of the included activities are performed outside of the household for non-household members. An example is care for persons outside of the household. [↑](#footnote-ref-2)
3. While there is a robust literature working on such estimates within households, the cross-time and cross-sectional nature of NTA estimates make these variations beyond the scope of NTA at this time. [↑](#footnote-ref-3)
4. Keep in mind that macro controls may not be available for sub-regions. If they are not, survey-based shares of aggregate activities can be used to apportion national macro controls to sub-regions. [↑](#footnote-ref-4)
5. In future revisions of this methodology, this table may change as more countries contribute information on categories relevant to their context. Also, in future methodology revisions, we would like to investigate international occupation coding schemes to standardize the wage imputations discussed in the next section. [↑](#footnote-ref-5)
6. While it has a very big impact on the aggregate value of NTTA accounts, preliminary research indicates that it does not make a huge difference in relative age profiles by sex. [↑](#footnote-ref-6)
7. If, for example, you know that the time is being spent caring for a non-co-resident elderly parent, and you know the age and sex of the parent, assign that production equally to all in that age and sex group. Or you could assign the value to just one person in that age/sex group and when the data is collapsed to age- and sex-specific means the averaging will be done there. It is more likely, however, that you will not know the exact age and/or sex of the elderly parent. In this case, assign the care to the producer’s age plus a mean generation length. If you do not know the sex of the recipient, divide the amount proportionally based on the sex distribution of the target age group. [↑](#footnote-ref-7)