Incorporating Gender and Time Use into NTA:

National Time Transfer Accounts Methodology

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Previous version was October 2011.

New or modified methods or clarifications since the October 2011 version are highlighted.

**Introduction**

The National Transfer Accounts (NTA) 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 not only 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 in June, 2011 to share their research experience and discuss best practices for this work. Since that first workshop, several others have begun to estimate NTA with gender and to add time-use based NTTA accounts. Further refinement of the methodology was possible after sharing results at the Eighth NTA Workshop in Brazil in December, 2011.

As only a few countries have begun research efforts to incorporate gender and time use into NTA, 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**

Preliminary estimates are presented here 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.

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

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.

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| 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 national income. Committed time is spent on household production – productive activities which are not included in national income. |
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| 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). |

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 national income and thus in NTA. “Committed” time includes activities that are productive but are not included in national income or NTA, such as household care and maintenance, food preparation, and caring for others. Specifics on identifying those activities are given in subsequent sections.

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.

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| Figure 3. Selected NTA, NTTA and combined per capita age profiles, US$ (US 2009). |
| 010,00020,00030,00040,00050,00060,00070,00080,00001020304050607080Production, MaleProduction, FemaleConsumption, MaleConsumption, Female-40,000-20,000020,00040,00060,00080,00001020304050607080Lifecycle Deficit, MaleLifecycle Deficit, Female010,00020,00030,00040,00050,00060,00070,00080,00001020304050607080-40,000-20,000020,00040,00060,00080,00001020304050607080020,00040,00060,00080,000100,000120,00001020304050607080**Age**-60,000-40,000-20,000020,00040,00060,00080,00001020304050607080**Age**a.Accounts based on Household Production (NTTA)b.Accounts based on National Income (NTA)c.Combined Accounts |
| 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).  |

**NTA by Gender**

1. Introduction

The discussion in this section starts with a brief review of NTA notation, although it is assumed that anyone working on this topic already has a detailed knowledge of single-sex NTA methodology and has calculated a full set of NTA single-sex age profiles or at least the lifecycle deficit NTA age profiles (consumption and labor income). The two main parts of producing NTA by gender follow: how to find gender-specific indicators of NTA age schedules, and how then how to adjust those schedules so that they are consistent with the single-sex NTA profiles and with macro controls. Finally, a brief discussion recommends several sensitivity tests that produce comparable estimates under different assumptions.

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 a cross-sectional set of age-specific averages of the activity (referred to here as the age schedule), giving the relative per capita amount of that activity by age. Second, we need an aggregate measure of an economic activity from national accounts to serve as a macro control. We then find a multiplicative adjustment factor that shifts the entire age schedule 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 single-sex macro control in equation form:

 $a$: age a, ranges from 0 to ω (usually 85+ or 90+)

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

 $X$: macro control

 $x(a)$: per capita age schedule, 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 schedules and age profiles are estimated by sex. Gender-specific items will be indicated with an additional index *g* as follows:

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

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

To create sex-specific age profiles, you find *x(a,g)* for both sexes, and adjust both age schedules so that they are consistent with the macro-adjusted single-sex age profile $\tilde{x}\left(a\right)$. This means that the adjustment is different at different ages but is the same for both sexes at each age group. More details on this process are given below.

1. Gender-specific Age Schedules
	1. Age schedules when data are available by individual’s age

Data are readily available for many types of economic behavior to estimate age schedules by gender. When single-sex age schedules are calculated from individual-level survey data, the survey typically includes gender as a variable along with age. Use the same variables that are used in single-sex NTA to indicate the age schedule of a particular activity and collapse to age- and sex-specific means instead of just age-specific means, as in single-sex NTA, to get age schedules by sex.

Administrative records are sometimes used to estimate age schedules 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 inputs to Generational Accounts, those same inputs might be used as NTA age schedules by gender.

* 1. Age schedules 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 should 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 term after the age terms. 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 schedule 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.

For some other types of profiles, mainly private consumption, NTA uses assumed relative age shares, also called equivalent adult consumer (EAC) weights. For sex-specific profiles, the same EAC weights should be used for same-aged males as females. Some gender differentiation will still show in the final age schedules 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.[[4]](#footnote-4)

* 1. Age schedules from imputation

Some age profiles are not observed directly, but instead are imputed based on NTA methodology. Specifically, age profiles for intra-household transfers are imputed based on the results of other NTA age profiles and an assumed sharing model, and the private saving profile is computed as a balancing residual of all other profiles. The sex-specific versions of these profiles should be computed in much the same way as for the single-sex profiles.

For intra-household transfers, the procedure should be the same as for single-sex: the sharing algorithm is computed using control-total adjusted microdata. That is, the profile values for the “ingredients” of the intra-household sharing model for each individual (not the age group averages) should be adjusted as described in the section below with the age-specific factor that makes the sex-specific profiles consistent with the macro-adjusted single-sex profiles. Then the same algorithm as for the single-sex version can be run. As for other types of profiles, the results should be collapsed by age- and sex-specific means.

For private saving, the age profile is the final balancing residual for all of the other profiles: labor income plus net transfers plus asset income minus consumption. The only modification for the two-sex version is that the calculation is done separately by sex, using only “ingredient” age profiles for that sex.

* 1. Smoothing

In NTA, we smooth age schedules to reduce noise and produce more informative visual representations. Schedules by gender may need more careful statistical smoothing than those for single-sex NTA due to the smaller sample sizes but the implementation is the same. Researchers must examine and adjust the smoother by the same means as when estimating single-sex NTA, to preserve real discontinuities which might be brought about by public program incentives or age-defined cultural practices, but to eliminate as much as possible statistical noise introduced by sampling or other types of random variation.

1. Adjustment to macro controls and for consistency with single-sex NTA

Once the age schedules have been calculated, researchers must implement an adjustment so that the gender-specific age profiles are consistent with the macro controls and also with the single-sex NTA estimates. Note that we do not have sex-specific national accounts, so instead of adjusting the sex-specific NTA profiles to macro controls, we instead implement an adjustment so that the sex-specific profiles are consistent with the macro-adjusted single-sex profiles.

Specifically, we must adjust both the male and female profiles at each age so that they are consistent with the single-sex profile that has been adjusted to the macro control. The adjustment factor for a profile at age *a* is the ratio of the single-sex macro-adjusted profile value at that age to the weighted average of the unadjusted sex-specific age schedules:

 $θ\left(a\right)=\frac{\tilde{x}\left(a\right)}{x\left(a,mal\right)N\left(a,mal\right)/N(a)+x\left(a, fem\right)N(a, fem)/N(a)}$ : adjustment factor, age a

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

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

This produces an age schedule of adjustment factors which are applied to each age of the male and female age schedules. The factors differ by age, but within age the factor is the same for men and women. After this adjustment, the male and female age profiles will be consistent with the single-sex age profile, and will have a combined aggregate total equal to the macro control.

1. Recommended sensitivity tests

As part of this work, we want to explore different ways to produce gender estimates in NTA. Sensitivity tests can be an important part of this work, examining different implementations to see if we get a different picture of results by gender. Two further studies are recommended here, once researchers are finished with the sex-specific NTA estimates as described above. The first involves experimenting with different techniques to estimate within-household allocations for quantities that we only observe directly at the household level. The second involves changing our assumptions about household headship.

As mentioned above, there are many reasons that the assumption of equal gender weights when using equivalent adult consumer weights may be misleading. These weights are used to allocate private consumption within the household. Researchers should examine the private consumption results using an alternate data-driven method such as iteration or regression to get a different allocation to compare.

The role of headship is the other area where NTA methodology may be having a large role in producing patterns by gender. 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, go into debt, give or receive inter-household transfers, and give or receive intra-household transfers based on owned assets (like owned housing). 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.

Researchers are encouraged to try 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 activities by age and sex
		3. find appropriate wages to impute the value of the time spent on those activities (this creates the NTTA production age profile, the equivalent of labor income in NTA)
		4. use assumptions and time use survey data on household composition to impute the age of the consumers of the household production time
		5. use existing NTA methodology to impute household production time transfers for men and women

Each step is examined in more detail below. These five 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 should be listed[[5]](#footnote-5)
* roughly the same time period as NTA calculations
* able to represent an annual amount of time spent (i.e. time use information includes the impact of weekends, holidays or any other special times)
* complete time use data for at least one person in each household
* 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 may 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.[[6]](#footnote-6)

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, sports and leisure activities would not be included, but any home management or care activities would be.[[7]](#footnote-7) 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.

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 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
 |

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 eleven groups of activities that country teams should follow, data permitting. There is also a column for “quality adjustment” which will be discussed later. As an example, Appendix A included at the end of this document gives the detailed list of activity codes used by the US group to create the eleven activities in Table 3 from the “Activity Lexicon” used in the American Time Use Survey.

Table 3. Grouping of household production activities in NTTA.[[8]](#footnote-8)

|  |  |
| --- | --- |
| **Time Use Activity** | **Quality Adjustment** |
| 1. Cleaning | 0.75 |
| 2. Laundry (includes sewing and clothing repair) | 0.75 |
| 3. Cooking (food and drink preparation) | 0.75 |
| 4. Household maintenance and repair | 0.75 |
| 5. Lawn and garden care | 0.75 |
| 6. Household management (incl. finances, scheduling, coordinating, and related telephone calls) | 0.75 |
| 7. Pet care (not veterinary care) | 1 |
| 8. Purchasing goods and services | 1 |
| 9. Childcare | 1 |
| 10. Eldercare and care outside the home (includes volunteering) | 1 |
| 11. Travel (related to care activities and purchasing goods and services) | 1 |

Note that the care variables (9 and 10 in Table 3) involve care of those inside or outside of the household. While these are shown as one category in the table because we will use one imputed wage for the whole category, researchers should estimate the care variables in two parts: one where the care is of persons inside the household, the other is where the care is going to persons outside of the household. This will be important when we impute the age profile of consumption of care.

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 probably have made that decision for you at the time the survey respondent decides whether the activity was “going to the movies” or “childcare.” (If your survey allows for classifying one unit of time by multiple activities, see the next paragraph on “multitasking.”) As a general principle, we would like to recognize this as childcare instead of leisure because you could pay someone else to take your child to the movies. Also, if you did not spend that time with your child, you would have to get someone else to provide that care, even if the care is just sitting next to the child. Pet care is another potentially ambiguous task. While you may walk your dog or play with him as a leisure activity, you could pay someone else to do it, so we include it as a productive activity. As a final related argument, there may be many pleasurable aspects to one’s paid employment, but the market does not deduct from your wages if you are having too much fun at work. Household accounts should not do this either.

A final note about gathering up the relevant activities pertains to “multitasking.” In some surveys, more than one activity can be reported for a unit of time. For example, in the American Time Use Survey, respondents report a primary activity but are also asked if any of the time spent on that activity was concurrent with childcare or with eating and drinking. If any of the activities listed for a unit of time are productive activities, the entire time unit should be assigned to the productive activity. If the unit of time is assigned to more than one productive activity, researchers should divide the time unit equally among the multiple activities. In other words, no unit of time can be counted more than once, but it should be divided among productive activities. For example, if someone spent an hour cooking while taking care of children, those are both productive activities, so it should count as a half-hour of cooking and half-hour of childcare. If the hour was spent cooking and watching television, that is one productive activity and one leisure activity, so the hour is counted as one hour of cooking.

Several examples of time use show the justification for handling multiple tasks in this way. First, while working at a paid job, a worker is paid for an hour at work even if she was not being productive every minute of that hour or even if she was concurrently doing a leisure activity like listening to the radio. Also, paid breaks or lunch hours are often part of paid work because an employee is still “on the job” at the time. Second, if someone is doing a leisure activity while responsible for housework or childcare, the time is considered productive because if that adult was not also performing the housework or childcare while doing the leisure activity, he would have to pay someone else to do those productive tasks.

After identifying relevant activities, researchers should do a good bit of exploration of the time 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. Often those results will be the most interesting to any audience because while we all may have different jobs in the marketplace, we all have to accomplish the same basic tasks at home. Also, the greater the specialization in time use by gender, 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. This should be stated upfront in any papers or presentations.

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. Valuing inputs versus outputs

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 units. 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.[[9]](#footnote-9)

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 identify a comparable price in the market 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.

* 1. Valuing time inputs: specialist replacement method

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, because men’s wages in the market are generally higher than women’s, 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, NTTA will use the replacement method – 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.[[10]](#footnote-10) Consult a study or survey on labor and earnings for the time period in question and find the average hourly wage relevant to each activity in Table 3. Most labor surveys produce tables of average wages by job or occupation and it is likely much easier to use these tables than the microdata from the surveys. A babysitter or childcare worker wage would apply to time spent doing child care; a maid or janitorial service wage would apply to time spent cleaning; and a cook’s wage would apply to time spent making food. Be careful to 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. Be sure to keep a table of the wages used and what occupations or job classifications they represent, as that will be an important table to report in any published work and an important piece of information for the NTA project to gather so we can compare and possibly modify this part of the methodology. As an example, Appendix B presents the wage table used in the implementation of this methodology for the United States, 2009 NTTA accounts shown in Figure 3. We will use the same imputed wage for men and women doing the same task.[[11]](#footnote-11)

* 1. Modifications to the specialist replacement method: quality adjustment factors and age gradient of productivity

We want to implement two modifications to the basic specialist replacement. Quality adjustment factors adjust for differences between market and household production. Age productivity adjustment compensates for the age-gradient of productivity which is obscured by the need to use an average wage for different activities. The following paragraphs discuss these modifications more specifically.

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.

< IT IS NOT YET CLEAR IF AND HOW WE SHOULD IMPLEMENT AN ADJUSTMENT FOR DIFFERING PRODUCTIVITY BY AGE. THE METHODOLOGY WILL BE INSERTED HERE IN THE FUTURE IF AN AGE-PRODUCTIVITY CORRECTION IS NECESSARY. >

Note that overall NTTA results will be **very** sensitive to the method chosen for wage imputation. See the later section on “Sensitivity Tests” for suggestions to evaluate this impact.

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 specialize in 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. Taxes and Other Adjustments for Total Labor Costs

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. As a default, NTTA accounts will be based on pre-tax imputed wages.

One exception for this will be in the case of mandatory employer-contributed payroll taxes. If an employer must pay an additional amount to the government for each employee for social protection insurance, for example, we would consider that part of the employees value of time, even if that employee does not see that cost on his paycheck as part of his wage. For example, in the United States, employers match the contributions of employees to Social Security and Medicare schemes, although that is not part of the wage the employee sees on his paycheck. So, the imputed wages used to value household production are increased to reflect that, were this activity done in the market, the labor input would be higher than just the average wage as observed in a labor force survey. A similar correction should be implemented if there are large fringe benefits accruing to market wage-earners that would not be observed in a paycheck.

1. Estimate age schedules
	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 schedules for production. Make sure to include zeros in the average for people who do not perform the activity.

Researchers may want to aggregate the eleven 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 1-8 and 11) will be calculated differently from those targeted to specific individuals (Table 3 activities 9 and 10).

* 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. Often in time use surveys, we know the age and sex of everyone in the household, but only have the time production of one person in the household, and only have sample weights provided to produce accurate point estimates based on age and sex of the person who gave the time use information. Thus, after the estimates of time production are completed, in units of time and money, estimating the consumption of that time (and transfers, in the following sections) involves several more steps:

1. For each time respondent age A and sex G, create variables for each activity assigning the time produced to the age A’ and sex G’ of the consumer
2. Using survey weights, collapse to age-sex group averages, so that the each line in the data is for age A and sex G and each variable indicates the average time consumed of a particular activity produced by persons age A and sex G consumed by persons age A’ and sex G’
3. Multiply each row of the collapse data by the number of persons age A and sex G to get an aggregate matrix of production and consumption.
4. Divide each column by the number of persons age A’ and sex G’ to get a matrix of average consumption of activities produced by persons age A and sex G
5. Sum each column to get the total consumption of persons age A’ and sex G’

 In step i. in the list above, we have different rules for imputing the consumption depending on the type of activity and whether it benefits those within the household or outside of it. For age-targeted care activities in the household (childcare or eldercare), the time produced is divided equally among those in the target age group. The target age group will be determined by how the survey was conducted. If the survey defines “childcare” as care for those aged 0-18, then divide the time spent in care equally among all of those age 0-18 listed in the household roster. 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.[[12]](#footnote-12) 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. Design the computing of this to/from matrix carefully as it is also used in the calculation of transfers.

Once all of the production is allocated as consumption, then steps ii. through iv. are straightforward. A “toy” example with a five household sample population and a reduced list of activities and age groups is worked through in a spreadsheet that has been uploaded to the NTA wiki, on the page for the Working Group on Gender and Time Use (http://ntaccounts.org/web/nta/show/Gender%2c%20Time%20use). It is accessible here: <http://ntaccounts.org/doc/repository/Methodology%20Example%20Spreadsheet.xlsx>. Note that this document is currently accessible to members of the NTA network only.

* 1. Inter-household transfers

For inter-household transfers, start with the same matrix of production and consumption of care as described in the section on consumption above, but only for those activities where the target of the care is outside of the household. These are the activities in Table 3, items 9 and 10, whose targets are outside of the household. Take all of the production based on this time caring for persons outside of the household as the transfer outflow for the person performing the care. Similarly, all of the consumption of that time is the inflow. The calculations of inter-household transfers are also shown in the “toy” example spreadsheet mentioned above and available on the NTA wiki page for the Working Group.

* 1. Intra-household transfers

There are two types of intrahousehold time transfers: targeted care (Table 3 activities 9 and 10, where the targets are household members) and time spent benefitting everyone in the household (Table 3 activities 1-8, 11). The intra-household flows for targeted care activities are calculated just as inter-household flows: the production of these activities is the outflow and the consumption of these activities is the inflow.

For general household activities, you create the same to/from matrix of production and consumption, but leave out the time that one spends producing for one’s own consumption. For example, if I spend one hour making dinner for my family of four, I produce an hour of time and we each consume one quarter of an hour. However, I only transfer 45 minutes of that hour because 15 of the minutes was for my own consumption, which does not involve a transfer. These calculations are also shown in the “toy” example spreadsheet.

This system for general activities represents the same unitary model for transfers in NTTA that we use in intra-household transfers in NTA, but simplified because there is no saving, dis-saving or public transfers of household production. Consumption must equal production in the household, and inflows must equal outflows.

* 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 schedule 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

As mentioned in the section on gender-specific NTA, you may need more smoothing with NTTA profiles than NTA because of the generally smaller time use surveys compared to consumption ones and splitting the population up by gender. 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 national accounts, so we have no true macro control. We do know that paired profiles must sum to zero, so aggregate consumption must equal production and aggregate inflows must equal outflows. If the methodology is followed correctly, that result must be obtained at least for the case of the unsmoothed profiles, but this should be checked to make sure that the equality holds. By construction, unsmoothed total production must equal unsmoothed total consumption in NTTA, and unsmoothed total transfer inflows must equal unsmoothed total transfer outflows, for both intra- and inter-household transfers.

Once profiles are smoothed, small discrepancies between paired profiles will arise. To correct for this, use the same adjustment as we do for NTA intra-household private transfers to restore the net aggregate balance. These adjustments are 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:

$$θ= \frac{I\_{agg}}{O\_{agg}}$$

The adjustment factors should be small (less than 5%). If they are too large, something may be wrong with the smoothing procedure, or the calculation of the unsmoothed profiles.

* 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.

1. Sensitivity tests

As for sex-specific NTA accounts, the results for NTTA accounts may be very sensitive to the choice of methods and the specific implementation of a method in a particular context with a particular data source. Sensitivity tests should be used to evaluate just how sensitive results are to these choices. For NTTA, it is important for researchers to implement alternative estimates using opportunity cost wage imputation (instead of specialist replacement) because this will most likely produce the largest difference in results.

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.

One other sensitivity test is recommended for all researchers. If your survey includes information on multiple activities for a single unit of time, an alternative production age profile including only a primary activity should be calculated, to contrast with the NTTA “official” method of including information on multiple activities if they are productive.

**References**

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Appendix A. ATUS codes used in the 2009 US classification ([www.bls.gov/tus/lexiconwex2009.pdf](http://www.bls.gov/tus/lexiconwex2009.pdf))

|  |  |  |
| --- | --- | --- |
| **Unpaid household work category** | **6-digit activity codea** | **Description** |

|  |  |  |
| --- | --- | --- |
| 1. Cleaning
 | 020101 | Interior cleaning |

|  |  |  |
| --- | --- | --- |
| 1. Laundry
 | 020102 | Laundry |
| 020103 | Sewing, repairing and maintaining textiles |

|  |  |  |
| --- | --- | --- |
| 1. Cooking
 | 020201 | Food and drink preparation |
| 020202 | Food presentation |
| 020203 | Kitchen and food clean-up |
| 020299 | Food and drink prep, presentation, and clean-up, n.e.c. |

|  |  |  |
| --- | --- | --- |
| 1. Household maintenance and repair
 | 020301 | Interior arrangement, decoration, and repairs |
| 020302 | Building and repairing furniture |
| 020303 | Heating and cooling |
| 020399 | Interior maintenance, repair and decoration, n.e.c. |
| 020401 | Exterior cleaning |
| 020402 | Exterior repair, improvements, and decoration |
| 020499 | Exterior repair, improvements, and decoration, n.e.c. |
| 020701 | Vehicle repair and maintenance (by self) |
| 020799 | Vehicles, n.e.c. |
| 020801 | Appliance, tool, and toy set-up, repair, and maintenance |
| 020899 | Appliances and tools, n.e.c. |

|  |  |  |
| --- | --- | --- |
| 1. Lawn and garden care
 | 020501 | Lawn, garden, and houseplant care |
| 020502 | Ponds, pools, and hot tubs |
| 020599 | Lawn and garden, n.e.c.\* |

|  |  |  |
| --- | --- | --- |
| 1. Household management (includes related telephone calls)
 | 020104 | Storing interior household items, including food |
| 020199 | Housework, n.e.c. |
| 020901 | Financial management |
| 020902 | Household and personal organization and planning |
| 020903 | Household and personal mail and messages (except e-mail) |
| 020904 | Household and personal e-mail and messages |
| 020905 | Home security |
| 020999 | Household management, n.e.c. |
| 029999 | Household activities, n.e.c. |
| 160103 | Telephone calls to/from education service providers |
| 160104 | Telephone calls to/from salespeople |
| 160105 | Telephone calls to/from professional or personal care service providers |
| 160106 | Telephone calls to/from household service providers |
| 160107 | Telephone calls to/from paid child or adult service providers |
| 160108 | Telephone calls to/from government officials |

|  |  |  |
| --- | --- | --- |
| 1. Pet care
 | 020601 | Care for animals and pets (not veterinary care) |
| 020602 | Walking, exercising, playing with animals |
| 020699 | Pet and animal care, n.e.c. |

|  |  |  |
| --- | --- | --- |
| 1. Purchasing goods and services
 | 070101 | Grocery shopping |
| 070102 | Purchasing gas |
| 070103 | Purchasing food (not groceries) |
| 070104 | Shopping, except groceries, food and gas |
| 070105 | Waiting associated with shopping |
| 070199 | Shopping, n.e.c. |
| 070201 | Comparison shopping |
| 070299 | Researching purchases, n.e.c. |
| 070301 | Security procedures related to consumer purchases |
| 070399 | Security procedures related to consumer purchases, n.e.c. |
| 079999 | Consumer purchases, n.e.c. |
| 080101 | Using paid childcare services (time spent facilitating use of paid services) |
| 080102 | Waiting associated with purchasing childcare services |
| 080199 | Using paid childcare services, n.e.c. |
| 080601 | Activities related to purchasing/selling real state |
| 080602 | Waiting associated with purcahsing/selling real state |
| 080699 | Using real state services, n.e.c.\* |
| 080701 | Using veterinary services |
| 080702 | Waiting associated with veterinary services |
| 080799 | Using veterinary services, n.e.c.\* |
| 090101 | Using interior cleaning services |
| 090102 | Using meal preparation services |
| 090103 | Using clothing repair and cleaning services |
| 090104 | Waiting associated with using household services |
| 090199 | Using household services, n.e.c.\* |
| 090201 | Using home maint/repair/decor/construction services |
| 090202 | Waiting associated with home main/repair/decor/construction |
| 090299 | Using home main/repair/decor/construction services, n.e.c.\* |
| 090301 | Using pet services |
| 090302 | Waiting associated with pet services |
| 090399 | Using pet services, n.e.c.\* |
| 090401 | Using lawn and garden services |
| 090402 | Waiting associated with using lawn and garden services |
| 090499 | Using lawn and garden services, n.e.c.\* |
| 090501 | Using vehicle maintenance or repair services |
| 090502 | Waiting associated with vehicle Maint. or repair services |
| 090599 | Using vehicle Maint. and repair services, n.e.c.\* |
| 099999 | Using household services, n.e.c.\* |
| 100103 | Obtaining licenses and paying fines, fees, taxes |

|  |  |  |
| --- | --- | --- |
| 1. Childcare
 | 030101 | Physical care for household children |
| 030102 | Reading to/with household children |
| 030103 | Playing with household children, not sports |
| 030104 | Arts and crafts with household children |
| 030105 | Playing sports with household children |
| 030106 | Talking with/listening to household children |
| 030108 | Organization and planning for household children |
| 030109 | Looking after household children (as a primary activity) |
| 030110 | Attending household children's events |
| 030111 | Waiting for/with household children |
| 030112 | Picking up/dropping off household children |
| 030199 | Caring for and helping household children, n.e.c. |
| 030201 | Homework (household children) |
| 030202 | Meetings and school conferences (household children) |
| 030203 | Home schooling of household children |
| 030204 | Waiting associated with household children's education |
| 030299 | Activities related to household child's education, n.e.c. |
| 030301 | Providing medical care to household children |
| 030302 | Obtaining medical care for household children |
| 030303 | Waiting associated with household children's health |
| 030399 | Activities related to household child's health, n.e.c. |
| 040101 | Physical care for non-household children |
| 040102 | Reading to/with non-household children |
| 040103 | Playing with non-household children, not sports |
| 040104 | Arts and crafts with non-household children |
| 040105 | Playing sports with non-household children |
| 040106 | Talking with/listening to non-household children |
| 040108 | Organization and planning for non-household children |
| 040109 | Looking after non-household children (as a primary activity) |
| 040110 | Attending non-household children's events |
| 040111 | Waiting for/with non-household children |
| 040112 | Dropping off/picking up non-household children |
| 040199 | Caring for and helping non-household children, n.e.c. |
| 040201 | Homework (non-household children) |
| 040202 | Meetings and school conferences (non-household children) |
| 040203 | Home schooling of non-household children |
| 040204 | Waiting associated with non-household children’s education |
| 040299 | Activities related to non-household children’s education, n.e.c. |
| 040301 | Providing medical care to non-household children |
| 040302 | Obtaining medical care for non-household children |
| 040303 | Waiting associated with non-household children’s health |
| 040399 | Activities related to non-household children’s health, n.e.c. |

|  |  |  |
| --- | --- | --- |
| 1. Eldercare and care outside the home (includes volunteering)
 | 030401 | Physical care for household adults |
| 030402 | Looking after household adult (as a primary activity) |
| 030403 | Providing medical care to household adult |
| 030404 | Obtaining medical and care services for household adult |
| 030405 | Waiting associated with caring for household adults |
| 030499 | Caring for household adults, n.e.c. |
| 030501 | Helping household adults |
| 030502 | Organization and planning for household adults |
| 030503 | Picking up/dropping off household adult |
| 030504 | Waiting associated with helping household adults |
| 030599 | Helping household adults, n.e.c. |
| 039999 | Caring for and helping household members, n.e.c. |
| 040401 | Physical care for non-household adults |
| 040402 | Looking after non-household adult (as a primary activity) |
| 040403 | Providing medical care to non-household adult |
| 040404 | Obtaining medical and care services for non-household adult |
| 040405 | Waiting associated with caring for non-household adults |
| 040499 | Caring for non-household adults, n.e.c. |
| 040501 | Housework, cooking, and shopping assistance for non-household adults |
| 040502 | House and lawn maintenance and repair assistance for non-household adults |
| 040503 | Animal and pet care assistance for non-household adults |
| 040504 | Vehicle and appliance maintenance/repair assistance for non-household adults |
| 040505 | Financial management assistance for non-household adults |
| 040506 | Household management and paperwork assistance for non-household adults |
| 040507 | Picking up/dropping off non-household adult |
| 040508 | Waiting associated with helping non-household adults |
| 049999 | Helping non-household adults, n.e.c. |
| 150101 | Volunteer, Computer use |
| 150102 | Volunteer, Organizing and preparing |
| 150103 | Volunteer, Reading |
| 150104 | Volunteer, Telephone calls (except hotline counseling) |
| 150105 | Volunteer, Writing |
| 150106 | Volunteer, Fundraising |
| 150199 | Volunteer, Administrative and support activities, n.e.c. |
| 150201 | Volunteer, Food preparation, presentation, clean-up |
| 150202 | Volunteer, Collection and delivering clothing and goods |
| 150203 | Volunteer, Providing care |
| 150204 | Volunteer, Teaching, leading, counseling, mentoring |
| 150299 | Volunteer, Social service and care activities, n.e.c. |
| 150301 | Volunteer, Building houses, wildlife sites, other structures |
| 150302 | Volunteer, Indoor and outdoor maintenance, repair, clean-up |
| 150399 | Volunteer, Indoor and outdoor maintenance, building and clean-up activities, n.e.c. |
| 150401 | Volunteer, Performing |
| 150402 | Volunteer, Serving at volunteer events and cultural activities |
| 150499 | Volunteer, Participating in performance & cultural activities |
| 150501 | Volunteer, Attending meetings, conferences, and training |
| 150599 | Volunteer, Attending meetings, conferences, training, n.e.c. |

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| --- | --- | --- |
| 10. Eldercare and care outside the home (includes volunteering), continued | 150601 | Volunteer, Public health activities |
| 150602 | Volunteer, Public safety activities |
| 150699 | Volunteer, Public health and safety activities, n.e.c. |
| 150701 | Volunteer, Waiting associated with volunteer activities |
| 150799 | Volunteer, Waiting associated with volunteer activities, n.e.c. |
| 150801 | Volunteer, Security procedures related to volunteer activities |
| 150899 | Volunteer, Security procedures, n.e.c. |
| 159999 | Volunteer activities, n.e.c. |

|  |  |  |
| --- | --- | --- |
| 11. Travel (related to care activities and purchasing goods and services) | 180201 | Travel related to housework |
| 180202 | Travel related to food & drink |
| 180203 | Travel related to interior maintenance, etc. |
| 180204 | Travel related to exterior maintenances, etc. |
| 180205 | Travel related to lawn, garden and houseplant care  |
| 180206 | Travel related to care for animals and pets (not veterinary care) |
| 180207 | Travel related to vehicles care and maintenance |
| 180208 | Travel related to appliance, tool and toy set-up, repair and maintenance |
| 180209 | Travel related to household management |
| 180299 | Travel related to household activities, n.e.c. |
| 180301 | Travel related to caring for and helping household children |
| 180302 | Travel related to household children’s education |
| 180303 | Travel related to household children’s health |
| 180304 | Travel related to caring for household adults |
| 180305 | Travel related to helping household adults |
| 180399 | Travel related to caring for and helping household members, n.e.c |
| 180401 | Travel related to caring for and helping non-hh children |
| 180402 | Travel related to non-household children’s education |
| 180403 | Travel related to non-household children’s health |
| 180404 | Travel related to caring for non-household adults |
| 180405 | Travel related to helping non-household adults |
| 180499 | Travel related to caring for and helping non-household members, n.e.c |
| 180701 | Travel related to grocery shopping |
| 180702 | Travel related to purchasing gas |
| 180703 | Travel related to purchasing food (not groceries) |
| 180704 | Travel related to shopping, ex. groceries, food and gas |
| 180799 | Travel related to consumer purchases, n.e.c. |
| 180801 | Travel related to using childcare services |
| 180802 | Travel related to using financial services and banking |
| 180803 | Travel related to using legal services |
| 180804 | Travel related to using medical services |
| 180805 | Travel related to using personal care services |
| 180806 | Travel related to using real estate services |
| 180807 | Travel related to using veterinary services |
| 180899 | Travel related to using professional and personal care services, n.e.c. |
| 180901 | Travel related to using household services |
| 180902 | Travel related to using home maint./repair/decorator/construction services |
| 180903 | Travel related to using pet services (not veterinary) |
| 180904 | Travel related to using lawn and garden services |
| 180905 | Travel related to using vehicle maintenance & repair services |
| 180999 | Travel related to using household services, n.e.c. |

aThese 6-digit activity codes correspond to the ATUS 2009 lexicon.

n.e.c. stands for "not elsewhere classified".

Appendix B. Average wages used to impute value to household production activities, United States, 2009

|  |  |  |  |
| --- | --- | --- | --- |
| **Time Use Activity** | **Workers’ Wage Used for Imputation** | **Average Hourly Wage US, 2009** | **Quality Adjustment** |
| 1. Cleaning | Janitorial services | 10.00 | 0.75 |
| 2. Laundry (includes sewing and clothing repair) | Drycleaning and laundry services | 9.91 | 0.75 |
| 3. Cooking (food and drink preparation) | Food services and drinking places | 9.97 | 0.75 |
| 4. Household maintenance and repair | Personal and household goods repair and maintenance (handyman) | 17.32 | 0.75 |
| 5. Lawn and garden care | Landscaping services | 11.53 | 0.75 |
| 6. Household management (incl. finances, scheduling, coordinating, and related telephone calls) | Average of accounting, tax preparation, bookkeeping and payroll services, administrative and support services, management occupations | 30.41 | 0.75 |
| 7. Pet care (not veterinary care) | Non-farm animal caretakers | 10.18 | 1 |
| 8. Purchasing goods and services | Personal care and service occupations | 11.53 | 1 |
| 9. Childcare | Child care workers | 9.46 | 1 |
| 10. Eldercare and care outside the home (includes volunteering) | Individual and family services (social workers) | 20.15 | 1 |
| 11. Travel (related to care activities and purchasing goods and services) | Taxi and limousine service | 10.93 | 1 |

1. Time inputs not accounted for in national income should not be confused with unpaid family work. Unpaid family work does not generate earnings for the unpaid family laborer, but it does generate income for the family that is already part of national income. Time inputs are those for which the value of the time is never paid to anyone and is not included in national accounts measures such as Gross Domestic Product or Gross Domestic 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. Examples are care for persons outside of the household and volunteer activities. [↑](#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. 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. [↑](#footnote-ref-4)
5. Often, time use surveys have a full time diary for only one person in the household. If you only have information about the age and sex of the time respondent in the household, you will be able to produce a household production age profile based on the methodology here, but not to impute consumption or transfers. We may try to work on a methodology to do this when household rosters are not available, if that is the case for many NTA countries’ time use surveys. If you have full time diary information for one person in the household, but also have the age and sex of others in the household, you will be able to computer household production, consumption, and transfers using the methodology here. [↑](#footnote-ref-5)
6. 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-6)
7. Some household management activities may be productive but not meet the third party criterion because they must be done in person. The management of some financial and legal matters might seem like they could be outsourced to a personal assistant, for example, but for activities like applying for bank loans or consulting with lawyers must be done face to face for the most part. Interactions with government entities will also be mixed up between tasks that could be “outsourced” and those which must be done in person. You could have someone else drop off forms or submit tax payments at government entities for you, but for things like applying for a drivers’ license you must present yourself in person to verify your identity. Researchers should examine coding resources closely and make the best guess as to what could be outsourced and what could not. [↑](#footnote-ref-7)
8. 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-8)
9. 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-9)
10. It can also be done using the “generalist replacement” method: finding a housekeeper wage that would but used for all household production activities. The NTTA methodology is for specialist replacement, but in some countries there may not be sufficient wage data to identify different wages for all of the different tasks. In that case, country teams may use the generalist method and use a housekeeper wage for all household production. [↑](#footnote-ref-10)
11. 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 may 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. [↑](#footnote-ref-11)
12. 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-12)