The Impact of Demographic Change on Transfers in the form of Caregiving and on the Associated Well-being*

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Abstract

Caregiving is an important component of non-monetary transfers between and within generations. We propose a framework to evaluate the impact of demographic change on "who gives time to whom," using matrices of time transfers by age and sex, and weighing time flows by self-reported indicators of well-being, for activities related to childcare and adult care. The empirical analysis based on the American Time Use Survey (ATUS 2011-2103) and the Panel Study of Income Dynamics (PSID) Disability and Use of Time Module (DUST 2013) reveals that people have more positive feelings and less negative moods when caring for children as opposed to caring for adults. Projections for the next several decades indicate that, although reductions in the care support ratio would be relatively small, population aging implies that an increased proportion of transfers would have negative feelings associated to them, with potentially significant mental health consequences.

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1 Background

Intergenerational transfers of financial and unpaid resources are strongly affected by demographic change, which includes lower and later fertility as well as improved mortality and population aging. Changes in population age structure affect the fraction of the population in each stage of the life course (e.g. school attendance, childbearing, retirement, etc.). Thus population composition has relevant macro social and economic consequences [8].

The National Transfer Accounts (NTA) project, a collaborative initiative led by Ronald Lee and Andrew Mason, has substantially improved our understanding of the generational economy. Members of the NTA network have generated the first estimates of economic flows across age, in a manner consistent with National Income and Products Accounts, for a large number of countries [11]. The NTA database has been used for a number of applications, including the evaluation of the macroeconomic consequences of population aging, the economic cost of childbearing and care for the elderly [8].

One of the main limitations of the NTA project is that unpaid productive activities are not fully taken into account yet. A large quantity of goods and services are produced by household members for their own consumption, without involving market transactions. Despite the economic and social importance of unpaid work, these productive activities are largely invisible to traditional national economic accounts. As a consequence, standard measures of intergenerational transfers typically ignore household production, and thus underestimate the overall value of goods and services produced over the life cycle, in particular, the economic contribution of women. The estimation of non-market productive activities has now become possible thanks to the increasing availability of time use surveys in a number of countries. Recently, there have been some efforts to evaluate the extent of household production, and to integrate it into national accounts [1, 3, 14, 15, 4].

A second important limitation of traditional approaches is that estimates of intergenerational transfers are based on profiles of consumption and production by age and sex, without an explicit and complete estimation of time flows between age/sex groups. Evaluating flows of resources between groups within a population is relevant because the dynamics of transfers are intimately connected to changes in family structures and in the age distribution of the population. Combining estimates of flows of resources with evaluations of the dynamics in the structure of the extended family would allow us to isolate behavioral changes from demographic constraints.

A third relevant limitation of current approaches is that there is no distinction in terms of well-being related to different activities that involve transfers of unpaid resources. Ten minutes spent doing childcare are typically considered equivalent to ten minutes spent doing chores. This assumption may be reasonable in a number of situations. However, in other circumstances, the level of well-being and the health outcomes associated to specific activities may vary substantially.

In this paper, we use data from the American Time Use Survey (ATUS, 2011-2013) and the Panel Study of Income Dynamics (PSID) to estimate flows of time transfers related to caregiving activities, by age and sex, that are weighted by the level of enjoyment and pain associated to the activities. We then use these matrices of time transfers as input for an input-output model in order to evaluate the impact of demographic change in the US on time transfers and quality-adjusted care support ratios.

2 Data

In order to estimate quality-adjusted matrices of time transfers by age and sex, we use data from the American Time Use Survey (ATUS) and the Panel Study of Income Dynamics (PSID).

We estimated matrices of transfers of care time, by age and sex, for the US using data from the American Time Use Survey (ATUS) (2011-2013), the major study of how people spend their time in the US. The data were collected from a representative sample of about 26,400 participants selected annually from the respondents to the Current Population Survey (CPS) conducted by the US Census Bureau. The respondents are asked to provide a chronological account of the activities that they did during a randomly selected day, as well as additional information about who was present, the duration of the activities and where the activities took place.

In addition to the main ATUS questionnaire, we considered two additional data sets that supply relevant information about certain groups of care recipients as well as describe the emotional and physical well-being of informal caregivers while performing their duties: the Eldercare Roster and the Well-being module.

The Eldercare Roster, used in conjunction with the main ATUS data set is a crucial source of information to estimate inter-household informal caregiving. It consists of detailed records of care recipients, who are classified as elderly or suffer from a condition brought about by aging, and to whom ATUS respondents were caregivers over extended periods of time. While the main questionnaire lacks basic demographic information on non-household care recipients, such as age and sex, the Eldercare Roster contains much of the required data. We used 2011-2013 combined sample to best match the sample of the main questionnaire.

The second data set within ATUS is the Well-being module. Its primary purpose is to measure the emotional and physical impact of participation in a range of activities, whose duration and circumstances are measured in the main questionnaire. Unlike the main ATUS questionnaire, the Activity file of the Well-being module consists of sets of exactly three randomly selected activities from the pool of eligible activities per each respondent. To be selected, activities must be of at least five minutes in length and be categorized as neither sleeping, personal care or grooming, nor as invalid-score entries, such as "Don't know" or "Refused" answers. The six indicators of affect measured across all activities and available in the Well-being module are happiness, meaning, pain, sadness, stress, and tiredness. Each of the aforementioned indicators is on a 7-point scale measure that ranges from 0 through 6, where 0 represents the lowest intensity of emotion or physical state, and score of 6, the highest. In the present study we employ the combined samples of 2012 and 2013 Well-being questionnaires in order to ensure adequate sample size for comparison among sub-groups of care providers, as well as to encompass the greatest possible number of matching respondent attributes from the main ATUS sample and from the Well-being module.

We complemented information from ATUS with data extracted from the Panel Study of Income Dynamics' (PSID) disability module, which details a time diary of respondents age 60 and older in the 2013 PSID, along with their spouses or partners. This module was introduced in 2009 to include a 24-hour time diary supplement and detailed disability measures to the existing PSID questionnaire. The Disability and Use of Time (DUST) module thus provides greater insight into factors that promote subjective wellbeing among older adults experiencing functional loss and also those

providing assistance. The pool of respondents we studied is only limited to those who indicated having engaged in activities of care. From here, we categorized our sample pool into those who have cared for children and those who have cared for adults, based on two binary questions that ask respondents if they had cared for a child or adult respectively. Within the reported list of activities the respondent had engaged in, two to three activities were randomly chosen for a series of more detailed questions pertaining to well-being. This series of detailed questions included questions that required respondents to report their moods associated with the randomly selected activities mentioned above. Within the pool of respondents who had care work randomly chosen for more detailed questioning, we looked at the self-reported levels of moods, which were recorded on a Likert scale of 0-6, associated with child and adult care; these were happiness, calmness, frustration, worry, sadness, tiredness, and pain.

3 Matrices of Time Transfers by Age and Sex

We estimated matrices of intra-and inter-household time transfers using data from the American Time Use Survey (2011-2013) and the methods described in Dukhovnov and Zagheni (2015). Matrices of intra-household flows of caregiving time can be estimated directly from time use diaries, since the respondents record the time dedicated to various caregiving activities as well as the unique identifiers of household members that benefited from the time. Inter-household transfers of caregiving time cannot be estimated directly, since the respondents do not record the age and sex of care recipients. We estimated inter-household flows indirectly by combining available information about time dedicated to inter-household caregiving activities, by age and sex, as they are reported in diaries, with frequencies of care recipients in various age and sex groups listed by the caregivers in the ATUS "Eldercare Roster." The matrices of intra- and inter-household time transfers are then combined into a single tabulation of overall time transfers in terms of caregiving activities, by age and sex. More details about the methodology can be found in Dukhovnov and Zagheni (2015).

Figure 1 shows our estimates of overall flows of caregiving time by age and sex. Several important features emerge. First, we observe that the large majority of time transferred is from parents to young children, with notable sex differences: women spend about twice as much time caring for young children than men. Second, transfers from grandparents to grandchildren are noticeable. In particular, it is relevant to note that gender differences emerge, with grandfathers spending more time with grandsons and grandmothers spending more time with granddaughters. Third, we observe a ridge along the main diagonal of the matrix of transfers for people of the opposite sex. This indicates substantial transfers to spouses. Finally, there are some sex differences in time dedicated to the elderly, and time needed by the elderly. Elderly women seem to have slightly higher care needs than elderly men. Middle-aged women spend slightly more time with the elderly than middle-aged men.

As figure 1 graphically shows, patterns of transfers are unevenly distributed across the life course, with some ages that are equivalent to "rush hours" of the life course. To quantitatively assess structural characteristics of the distribution of flows, we computed the Gini coefficient for the values of flows represented in figure 1. We obtained that the highest Gini coefficients are for matrices of transfers to the same sex (0.78 for male to male and 0.8 for female to female). The lowest value of the Gini coefficient is for

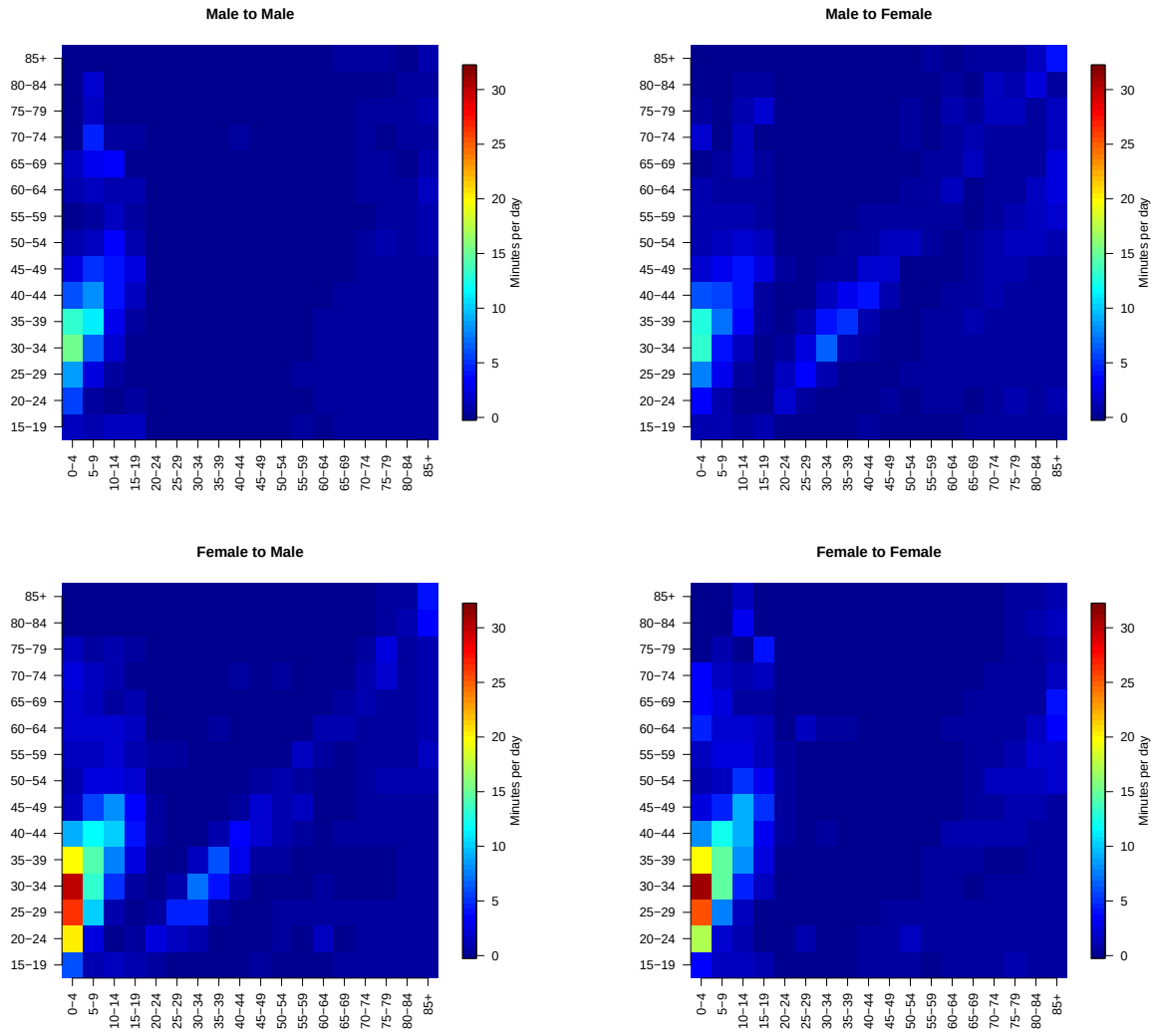


Figure 1: Graphic representation of matrices of time transfers related to caregiving activities in the US, estimated from the American Time Use Survey (2011-2013). In each panel, the color-coded values indicate average per-capita time transfers from the age groups on the rows to the age groups on the columns.

flows from male to female (0.65). The Gini coefficient for flows from female to male is 0.77. In our context, the Gini coefficient is a measure of inequality in the distribution of flows. Flows to the same sex are highly "unequal" in the sense that the highest values are related to childbearing only. Flows to the opposite sex are more diffuse, as they include not only childcare, but also peaks related to care for spouses.

4 The Theoretical Framework: Modeling Time Transfers with Input-Output Models

In this section, we present the theoretical framework that we propose in order to interpret some features of the time transfers matrices. Here, we present a general framework inspired by input-output models.[9, 10] In the next sections, we will combine this approach with measures of well-being associated to various activities.

We can use our estimated matrices of time transfers as input for models for the evaluation of the impact of demographic change on structural patterns of time flows. Consider a population with m age groups, indexed by i. Total time production for age group i, t_i, is written as:

$$t_i = z_{i1} + z_{i2} + \cdots + z_{im} \tag{1}$$

where z_{ij} is the time flow from group i to group j The expression can be rewritten to represent the flows between groups as the fraction of total time production for the receiving group. Thus, if we write:

$$q_{ij} = \frac{z_{ij}}{t_j}$$

the model is expressed as:

$$t_i = q_{i1}t_1 + q_{i2}t_2 + \cdots + q_{im}t_m \tag{2}$$

or, equivalently:

$$-q_{i1}t_1 - q_{i2}t_2 - \cdots + (1 - q_{ii})t_i - \cdots - q_{im}t_m = 0 \tag{3}$$

By letting Q be the $m \times m$ matrix containing all the coefficients q_{ij}, and T the $m \times 1$ vector containing all the transfer t_i terms, the model is written in a more compact form as:

$$[I - Q]T = 0 \tag{4}$$

or, equivalently:

$$QT = T \tag{5}$$

The solution of equation 5 is that T is the eigenvector of Q associated to the leading eigenvalue.

Figure 2 shows the values of the vector T, expressed in percentages, obtained from the eigenvector of Q. The coefficients can be interpreted as the age profile of time production in equilibrium.

In a more general setting, we can include external demand for time so that equation 2 becomes:

$$t_i = z_{i1} + z_{i2} + \cdots + z_{im} + d_i \tag{6}$$

where d_i can be thought of as exogenous demand for time, for group i. For instance, changes in demand may be driven by demographic change in the population. We can think of a situation in which we add to the population a certain number of people in the age group i. In our system of transfers, these people would produce and transfer some time, and receive some time from other people, in accordance to the age group they belong to. If we assume that the coefficients q_{ij} are constant, in other words, that

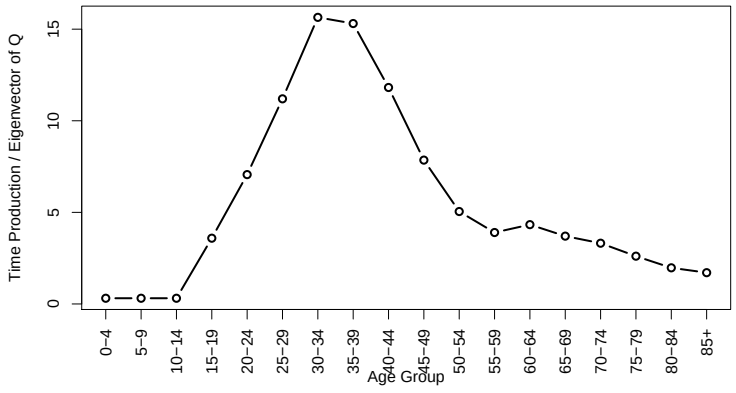


Figure 2: Illustrative example of values of the vector T of time production. The values represent the eigenvector of Q.

the relative ratio of transfers received compared to production is constant for each age group, then equation 6 can be rewritten as

$$[I - Q]T = D \tag{7}$$

where D is the $m \times 1$ vector of 'added demand' for the age group i. This way, given the vector of added demand, and the matrix of coefficients Q, the vector of time production by age is obtained as:

$$T = [I - Q]^{-1}D \tag{8}$$

As an experiment we will mimic population aging, by increasing the relative size of the elderly in the population. We would observe that, in the overall structure of flows, increasing time production of the elderly (or equivalently, increasing the number of elderly) has a large leverage on the whole system of flows, since most groups transfer to the elderly. Conversely, an increase in the relative size of young adults would have less impact on the overall size of transfers, under the assumption that the general pattern of flows does not change. In an analogy to an economy, young adults are the 'raw' material for the transfer system. An increase in demand from other groups would have a multiplier effect on demand for young adults.

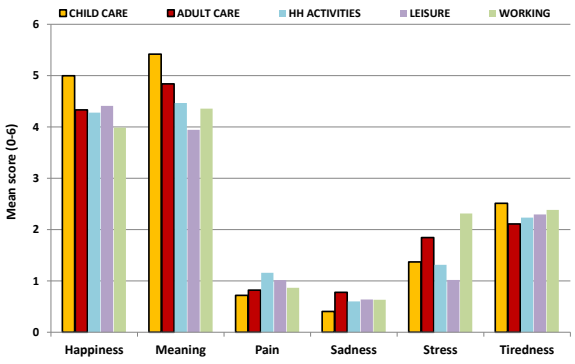
5 Well-being associated to childcare and adult care

The existing body of research has examined the effect of adult caregiving and child caregiving on the wellbeing of the caregiver, albeit the two forms of care have only been studied separately. Child care has been associated with significant levels of self-reported depression (Hamre and Pianta 2004), higher levels of exhaustion and frustration (Pollman-Schult 2014), and even anxiety associated to worries about the child's wellbeing and the public perception of childcare as a profession (Gerstenblatt

et al 2013). On the other hand, adult care comes with its own set of implications, especially when caring for the elderly with physical or mental disabilities, which is associated with higher levels of depression among the caregivers (Baumgarten et al 1992). Both forms of care, however, can provide the caregiver a sense of meaning which can potentially improve their wellbeing (Raschick and Ingersoll-Dayton 2004; Hammersmith and Lin 2015). It is possible then, that both forms of care differ in how they affect the caregiver's wellbeing. It is hypothesized that caring for children is actually more rewarding due to the fact that the caregiver's efforts might be seen to have a meaningful impact with the child as the child grows, while the elderly's condition typically deteriorates. This difference between the two will in turn have a differential effect on the quality of time spent on caring for children versus the elderly.

5.1 Evidence from the American Time Use Survey

In terms of well-being and emotional affect, informal caregivers engaging in childcare report very high levels of happiness and meaning, 5.0 and 5.42, respectively. The scores associated with adult care are lower, trailing on average about 0.66 and 0.58 scale points below childcare, for the respective moods. When we consider negative feelings, we observe that respondents report higher levels of emotions, such as pain, sadness, and stress when doing adult care than when engaging in childcare. While these measures are not rated high on average, below 1.0 for pain and sadness and 2.5 or less for stress and tiredness on the 0-6 scale, levels of negative emotions and dissatisfaction across adult care activities are higher than in childcare activities. Finally, tiredness in childcare is rated higher with a mean score of 2.51, whereas adult care activities are on average somewhat less tiring with a lower score of 2.11. In contrast to several other types of activities, such as household work, leisure, and main job activities, childcare is thus rated higher than all in terms of happiness and meaning, but, at the same time, is more tiring than any of the mentioned activities.



		Mean	SD	T-score	P value	95% CI	
HAPPINESS	CHILDCARE	4.997	1.305	8.68	0.0000	4.952	5.042
	ADULT CARE	4.334	1.671			4.191	4.477
		Mean	SD	T-score	P value	95% CI	
MEANING	CHILDCARE	5.419	1.194	7.38	0.0000	5.378	5.460
	ADULT CARE	4.839	1.734			4.690	4.988
		Mean	SD	T-score	P value	95% CI	
PAIN	CHILDCARE	0.718	1.449	-1.46	0.1454	0.668	0.768
	ADULT CARE	0.819	1.478			0.692	0.946
		Mean	SD	T-score	P value	95% CI	
SADNESS	CHILDCARE	0.406	1.114	-5.29	0.0000	0.368	0.444
	ADULT CARE	0.777	1.546			0.645	0.909
		Mean	SD	T-score	P value	95% CI	
STRESS	CHILDCARE	1.371	1.693	-5.34	0.0000	1.313	1.429
	ADULT CARE	1.845	1.916			1.681	2.009
		Mean	SD	T-score	P value	95% CI	
TIREDNESS	CHILDCARE	2.513	1.930	4.30	0.0000	2.446	2.580
	ADULT CARE	2.110	2.003			1.938	2.282

Figure 3: Average scores of emotional affect associated with a number of time use activities, and summary of the test of significance for differences in the average scores of emotional affect related to childcare and adult care. Source: own elaborations on ATUS data.

The difference in distribution of weighted means of childcare and adult care across various emotions and physical states is highly statistically significant ($|t| > 4$, $p < .001$) for all but pain ($t = -1.46$, $p = .145$). As such, there is overall a high degree of confidence in the above comparison. Figure 3 summarizes the descriptive results. It shows average

scores of emotional affect associated with a number of time use activities, and the outcome of the test of significance for differences in the average scores of emotional affect related to childcare and adult care.

5.2 Evidence from the Panel Study of Income Dynamics

Data from the Panel Study of Income Dynamics (PSID) confirms the result obtained from ATUS that there is indeed a difference in the moods individuals feel when engaging in childcare and adult care. On an aggregate level, respondents tended to report more positive feelings (happy and calm) and less negative feelings (frustrated, worried, sad, tired, pain) when caring for children below 18, as opposed to caring for adults (see Table 1). However, with small sample sizes of 243 and 264 for respondents who participated in adult care and childcare respectively, a difference-in-mean test indicated that only the differences in happiness, calmness, and pain were statistically significant at a level of 0.05.

	Moods	**Adult** (N=243)	**Child** (N=264)
*	Happy	4.728	5.221
*	Calm	5.156	5.383
	Frustrated	1.029	0.773
	Worried	0.556	0.367
	Sad	0.490	0.361
	Tired	2.140	1.924
*	Pain	1.601	1.019

Table 1: Average mood scores by type of care activity. Source: own elaborations on PSID data. Asterisks indicate that differences between adult care and childcare are significant at 5% level.

We also explored gender differences in moods associated with care work. On the whole, women had higher mean values for happiness, calmness, sadness, tiredness and pain when caring for children, while they had higher mean values for frustration, worry, sadness tiredness and pain when caring for adults. Further selecting gender groups from within our sample pool, however, meant that the sample sizes for further analyses was even more limited. Within the adult care group itself, only 82 respondents were male while 161 were female. Within the childcare group, there were only 58 males and 206 females. A difference-in-mean test only detected a statistically significant difference in pain between males and females who performed adult care, while the childcare respondents significantly differed only in sadness.

The respondents were further divided into 9 age groups ranging from 45 years of age to 85 and above. With childcare, there seems to be a general increase in happiness and calmness as the age of the caregiver increases. Frustration, however, initially decreases with age but spikes back up once the caregiver is past the age of 75. A similar trend

is seen with tiredness, and this is perhaps due to the fact that as caregivers get older, they become physically less able to engage in high-energy activities that might be part of childcare. The other negative feelings such as worry, sadness and pain, seem to generally decrease on the whole as the age of the caregiver increases.

Because of the small sample size in PSID data, we could not provide a definitive answer about the relationship between moods and key demographic variables like age and sex. However, we plan to combine the samples in PSID and ATUS to improve statistical power.

6 The impact of demographic change on quality-adjusted care time

In this section, we evaluate the effect of expected changes in the composition of the US population, according to United Nations projections, on quality-adjusted indexes of dependency.

We developed a tentative approach to combine information about moods in the ATUS and in the PSID. We calculated indices to weigh the production of care time according to the type of emotions experienced by caregivers. Between the ATUS and PSID moods reported, we defined two categories: positive emotions and negative emotions. For each datasets, we calculated the mean of each mood reported by the respondents. To get a measure of positive moods in general, we added the mean values of positive moods (ATUS: happiness, and meaningfulness; PSID: happiness and calmness) to 6 minus the mean values of negative moods (ATUS: pain, sadness, stress, tiredness; PSID: frustration, worry, sadness, tiredness, pain), since 6 is the maximum possible value of each mood scores, on a scale of 0-6 – in this way, 6 minus the mean values of each negative mood gave us an indication of the mood's score in a lack-of-negativity, or positive terms. After summing up the moods in a positive scale, we obtained the average positivity of each dataset by dividing our obtained sum by the number of moods recorded in each dataset (ATUS: 6; PSID: 7). We then added the two averages together, multiplied by the sample size of each dataset (ATUS: 3225 for adult care, 526 for childcare; PSID: 243 for adult care, 264 for childcare) and then divided by the total sample size across both datasets in order to obtain a combined average of positive moods weighted by each dataset's sample size. Finally, we calculated a positivity ratio by dividing the previously obtained combined average by 6. This entire procedure was done once for each adult care and childcare, and repeated to obtain a negativity ratio. For the negativity ratio, the only difference is that we used the mean values of negative moods added to 6 minus the mean values of positive moods; this was followed by similar steps described above. In the end, we produced four ratio values: adult care positivity, childcare positivity, adult care negativity, childcare negativity. The negativity and positivity ratios were calculated such that adult care negativity and adult care positivity summed up to 1, and the childcare negativity childcare positivity also summed up to 1. The overall indices for mood related to childcare and adult care, when we combine ATUS and PSID data are reported in Table 2.

Using matrices of intergenerational time transfers by age groups and gender previously calculated by Dukhonov and Zagheni (2015), we multiplied all care time consumed by age groups 0-4, 5-9, and 10-14 by the positivity/negativity ratios

Adultcare Indices		
	Positive	Negative
Mean	4.687	1.219
Ratio	0.794	0.206

Childcare Indices		
	Positive	Negative
Mean	4.921	1.079
Ratio	0.820	0.180

Table 2: Average indices of positive and negative moods associated with childcare and adult care obtained by combining data from ATUS and PSID.

generated for childcare, and all other age groups by the ratios for adult care in order to split the matrices of total time transfers into two matrices: one for 'positive' time and one for 'negative' time. We then summed the weighted care time produced by each age group and multiplied these sums by population estimates generated by the United Nations from years 2010 – 2060. Due to the fact that each gender produces care time differentially, we had to ensure that aggregate care time production values had to be calculated separately for each gender before we added the values of both genders together to obtain aggregate care time production for the entire population. We only weighted the production of care time, while leaving the consumption of care time as the same as those values previously calculated by Dukhonov and Zagheni (2015), because the moods that we used to generate weights were reported only by the caregivers, or the producers of care time. To obtain care support ratios, we then divided the aggregate weighted care time production values by the aggregate care time consumption values for each year. Therefore, the positive care support ratio reflects the fraction of care time in which the caregiver experiences positive emotions, over the total care time consumed. Similarly, the negative care support ratio reflects the fraction of care time in which the caregiver experiences negative emotions, over the total care time consumed. By adding the two together, we would also obtain the total care support ratio, which reflects the total care time produced over the total care time consumed.

Figure 6 shows our estimated care support ratios where time dedicated to caregiving is weighted by positive and negative moods associated to the caregiving activities. The indicators are designed so that the sum of the positive and negative care ratios is equal to the total care ratio. The figure shows what would happen to the ratio between overall time 'produced' by caregivers and time 'consumed' by care receivers, if people behaved like today on a per-capita basis, and the only change in the future is a demographic one, with population age structure changing according to UN projections. This hypothetical scenario indicates that the overall care support ratio is expected to decline, although not dramatically. However, population aging also implies that an increased proportion of transfers would have negative feelings associated to them, with potentially significant mental health consequences. In other words, even though the needed re-adjustments in terms of 'production' of care may not be extremely large in terms of total time, the composition of the time transfers indicates an expected deterioration in overall of well-being associated to caregiving.

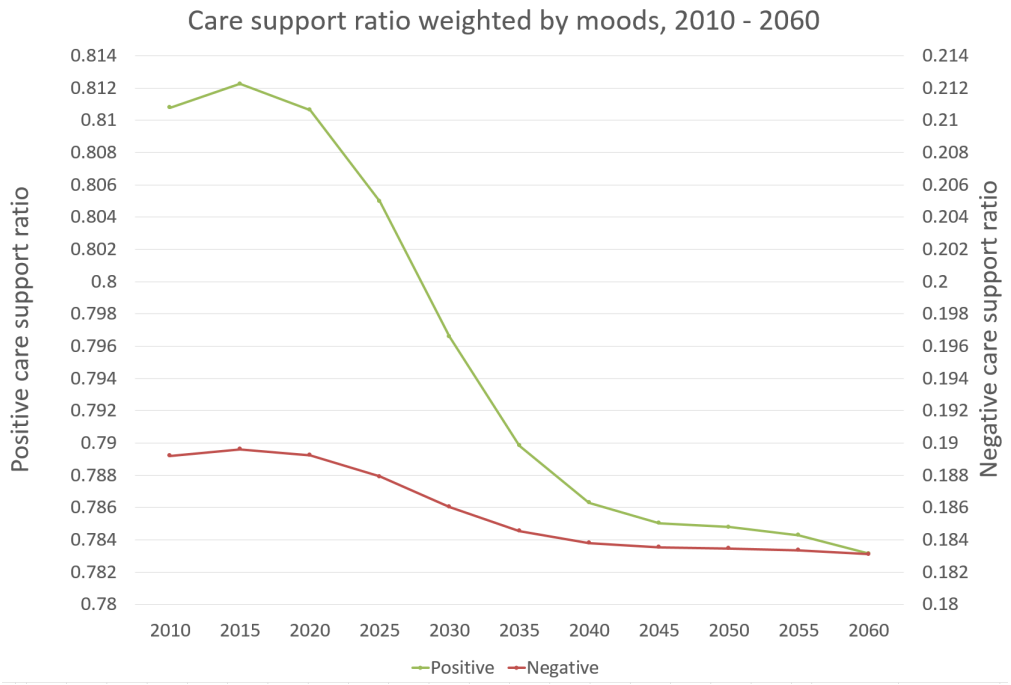


Figure 4: Care support ratios where time dedicated to caregiving is weighted by positive and negative moods associated to the caregiving activities. The sum of the positive and negative care ratios is equal to the total care ratio.

7 Tentative Conclusions

In this article, we proposed a framework to evaluate the impact of demographic change on "who gives time to whom." From a methodological point of view, we developed an approach, inspired by input-output economic models, to evaluate the consequences of demographic change on transfers in the form of caregiving. We then estimated the core input quantities for these models: matrices of who transfers time to whom, by age and sex. One of the innovative aspects of our work is that we weighed time flows by self-reported indicators of well-being, for activities related to childcare and adult care. The empirical analysis based on the American Time Use Survey and the Panel Study of Income Dynamics (PSID) Disability and Use of Time Module revealed that people have more positive feelings and less negative moods when caring for children as opposed to caring for adults. Projections for the next several decades indicate that, although reductions in care support ratio would be relatively small, population aging implies that an increased proportion of transfers would have negative feelings associated to them, with potentially significant mental health consequences.

This paper is an initial draft for submission to the annual meeting of the Population Association of America 2016. As we continue to work on the paper, we plan to refine our methods, expand the background and discussion of relevant literature, as well as fully apply the theoretical input-output approach, that we developed, to matrices of time transfers weighted by positive and negative feelings associated to childcare and adult care. In particular, we expect that the formal model based on matrices will be useful to evaluate the sensitivity of key indicators of dependency to changes in population composition, to changes in behavior reflected in per-capita age profiles of 'production', and to changes in health and disability rates reflected by per-capita age profiles of 'consumption.'

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