Welfare Analysis of Childcare and Transport Policies for Married Couples: A Microeconomic Study

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This research elucidates the societal gender disparity in married couple's time use. Our rigid, advanced framework directly measures and compares the within-household gender differences in time use burden and can be readily applied to the contexts of other countries and policy assessment.

This research investigates the societal gender differences in terms of time values by life stage and the effects of transport and childcare policies on welfare for households with a married couple and at least one child in Japan. Based on our intertemporal household model, we empirically show that wives are still primarily responsible for childcare and burdened by limited time available when their first child is of pre-school age, while their husbands' time uses are less affected by childcare tasks. Moreover, some dual-income families may not reconcile work-family lives since their long, exhausting workdays do not allow them to allocate more than the required time to childcare. The simulations show that (1) urban strategies that facilitate travel time reduction and support childcare-chauffeur service can enhance household welfare somewhat, (2) the work-from-home option could be more effective in improving household welfare through alleviating the time and spatial constraints.

Gender difference

Gender difference Household welfare Time allocation Value of time Life stage Childcare

(1) Employed women usually encounter difficulties of balancing work and family lives given stringent time and spatial constraints. To accommodate household tasks, women are likely to trade off ideal jobs for the second-best jobs within their immediate neighborhoods. In this context, women are less likely to fully realize their professional abilities than men so that the education and the career they have attained are wasted. Without solving this problem, the Womenomics goal of recruiting more women back to work cannot be achieved.

(2) We argue that elaborate economic policies that support childcare and improve transport service can enhance work-life balance, and thus improve welfare and gender equality. The improved welfare and equality will steadily and sustainably encourage maternal workforce.

(1) Instead of long-time land use evolution, this research aims to assess the impacts of the short-term policies: how childcare support and better transport service can improve welfare and promote efficiency and gender equality through the reduction of time burden.
(2) By introducing different time constraints for husband and wife, we also aim to understand their different values of time (VOTs) in order to elucidate the societal gender disparity.

(1) Theoretical Model: Intertemporal Household Behavior
We construct an intertemporal model that describes household utility in period t with time-discounted factor τ, $HU_t = HU_t(U_t^h, U_t^w)$, consisting the individual utilities of husband (U_t^h) and wife (U_t^w). For individual m, where $m \in \{h \text{ (husband)}, w \text{ (wife)}\}$, his/her utility in t is a function m's consumption of goods z_t^m, children's utilities v_t, housing size (q_t), time on leisure (l_t^m), individual childcare ($t_{K,t}^m$), and joint childcare ($t_{K,t}^{hw}$), and the number of children (K_t) (Figure 1). v_t is defined by the amount of money spent on a child in t, I_t, $t_{K,t}^m$ and $t_{K,t}^{hw}$, where $v_t = v_t\left(I_t, t_{K,t}^h, t_{K,t}^w, t_{K,t}^{hw}\right)$ (Figure 1).

The household has three constraints. First, its life-span income constrains the budget that can be spent on z_t^m, q_t, I_t (Figure 1). Each individual m allocates his/her total available time in t, to work ($T_{W,t}^m$), commute ($T_{C,t}^m$), l_t^m, $t_{K,t}^m$, $t_{K,t}^{hw}$ (Figure 1). The couple face a technological constraint that describes the minimum required time for them to spend on childcare in t ($\overline{t}_{K,t}$), which reveals whether the married couple together dedicate their time only to addressing the basic needs of their children or they enjoy the time with their children [1] (Figure 1).

Maximize Household Intertemporal Utility
$$\sum_t HU_t\left(U_t^h, U_t^w\right)/\tau^{t-1}$$

- - - Subject to - - -
Individual Utility in t
$$U_t^m = U_t^m\left(z_t^m, v_t, q_t, l_t^m, t_{K,t}^m, t_{K,t}^{hw}; K_t\right)$$
$$m \in \{h(husband), w(wife)\}$$

Children's Utility in t
$$v_t = v_t\left(I_t, t_{K,t}^h, t_{K,t}^w, t_{K,t}^{hw}\right)$$

Constraints
Life-span budget on $\quad z_t^m, q_t, I_t$
Individual's time in t on $\quad T_{W,t}^m, T_{C,t}^m, t_{K,t}^m, t_{K,t}^{hw}$
Minimum required time $\quad \overline{t}_{K,t} \leq t_{K,t}^h + t_{K,t}^w + t_{K,t}^{hw}$

Figure 1. Theoretical model

Maximizing the household's life-span utility from the beginning of their marriage to the end of their lives subject to the constraints, we obtain the first-order Karush-Kuhn-Tucker conditions, which allow us to derive the marginal indirect utility of exogenous variables. The Lagrange multipliers associated with the income/time/technological constraints yield individual m's value of time as a resource (VOTR) and the household's value of childcare time saving (VOCTS) in t.

We focus on household behavior during the periods when the first child is of pre-school age (denoted as tb) and when the first child is six years old or over (denoted as tc). Assuming linearity and life-time equilibrium, we use the marginal indirect utility to derive the household's remaining budget (i.e., the difference between household income and housing expense) as a function of individual m's time spent on work and commute, minimum required childcare time, and number of children in the focal periods (Figure 2). The estimated variables for the work/commute time and the minimum childcare time required correspond to VOTR and VOCTS.

Welfare simulation for transport & childcare policies

Empirical Analysis
Household Remaining Budget $= \beta_0 + \sum_{t=tb,tc} \beta_t K_t +$
$VOTR_{tb}^h \sum_{tb}\left(T_{W,tb}^h + T_{C,tb}^h\right) + VOTR_{tb}^w \sum_{tb}\left(T_{W,tb}^w + T_{C,tb}^w\right) + VOCTS_{tb}\sum_{tb}\overline{t}_{K,tb}$
$VOTR_{tc}^h \sum_{tc}\left(T_{W,tc}^h + T_{C,tc}^h\right) + VOTR_{tc}^w \sum_{tc}\left(T_{W,tc}^w + T_{C,tc}^w\right) + VOCTS_{tc}\sum_{tc}\overline{t}_{K,tc} + \varepsilon$

Data
2004-2018 Japan Household Panel Survey

Methods
- Clustering analysis
- Two-instrumental variables analysis
- Bootstrapping

Figure 2. Empirical analysis

(2) Empirical Data and Methods
Based on the theoretical derivation from (1), we examine the behavior of households comprising a married couple and at least one child in Japan, using the 2004-2018 Japan Household Panel Survey conducted by the Panel Data Research Center at Keio University (Figure2). We obtain our study sample of 249 households that provide at least one year of data of household remaining budget, work/commute time, number of children, and childcare time in tb and tc, respectively.

To characterize the household's minimum childcare time required, $\overline{t}_{K,t}$, we utilize the k-means algorithm to group households into clusters of households with similar numbers of infants and toddlers and of preschoolers. Based on the clustering results, we define $\overline{t}_{K,t}$ as the 5th percentile of the clustered
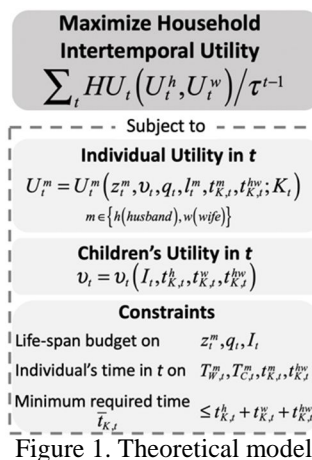
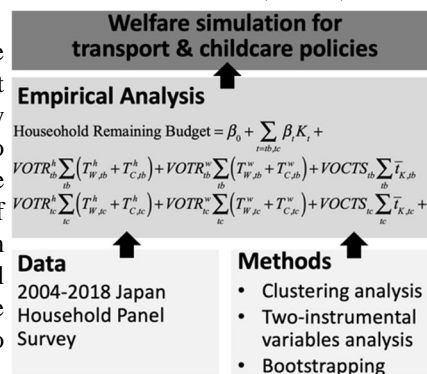households' childcare time in study period t (=tb, tc) (Figure 2).

We conduct a two-stage stage instrumental variable (IV) analysis that first predicts the married couple's commute time, and then substitutes the observed commute time in the second stage analysis of the household's remaining budget to cope with endogeneity due to unobserved characteristics (Figure 2).

The first stage analysis separately predicts the commute time of the sample husbands and wives in t based on Tobit models that regresses the one-way commute time on the IVs (i.e., regional ratio of waitlisted children, regional road density, and prefectural car density) in t. Using the OLS model for the second stage estimation, we then regress the household remaining budget on the total predicted commute time in t as well as other independent variables. To obtain robust inferences, we also calculate bootstrap standard errors and the associated 90% confidence intervals [2] for the estimated results (Figure 2).

Using the estimated time values, we simulate household welfare to examine the effects of three urban policies that aim to reduce people's time use burden and to encourage husbands' participation in childcare, including transport service improvement, work from home, child-chauffeur service provided by the city [3].

(1) Results of the estimated VOTRs and VOCTSs and the associated interpretations

Wives have a higher VOTR in tb but a lower VOTR in tc We find that the wives' average VOTR in tb is statistically significant and greater than 4,400 yen/hour; however, the value in tc drastically drops to around 400 yen/hour and becomes insignificant. This is consistent with the previous research which reveal that the presence of young children could tighten a mother's schedule and increase her time burden as well as her time value but the effect diminishes in the presence of older children [4,5].

The presence of children merely affect husbands' time uses   The husbands' average VOTR in tb is around 1,200 to 1,700 yen/hour but insignificant. The value slightly decreases to nearly 1,100 yen/hour in tc and remains significant. The results, together with the average times on work, commute, and childcare for the husbands in our sample, indicate that husbands' time uses are merely affected by the presence of children, unlike their wives.

Wives experience greater changes in VOTRs compared to the husbands   This finding reveals that the presence of young children has greater influences on the wives' time allocations than on the husbands'. Along with the average daily childcare time of our sample households, we also confirm that the wives take the primary roles of childcare giver in their families. This result corresponds to the available evidence that wives who are responsible for childcare are stressed out because they need to run between work and family tasks [6,7]. Their male counterparts, in contrast, are not influenced by these responsibilities much.

VOCTS in tc is greater than VOCTS in tb The results suggest that households in tc tend to be burdened by childcare than in tb. Indeed, the sample households who only spent the minimum required time on childcare are dual-income couples, who may not be able reconcile work-family lives since their long, exhausting workdays do not allow them to allocate more than the required time to childcare. Note that these dual-income households only account for around 2% of the study sample based on our definition of minimum required time on childcare.

The relationship between income and VOTR   The high-income husbands, on average, have greater VOTRs than their low-income counterparts over the study periods. Compared to the VOTRs of the low-income wives, the time values of the high-income wives are larger in tb but smaller in tc.

Comparisons between our estimations and existing research   Consistent with previous studies on the value of time [8,9], we find that the husbands' VOTR in tc, for example, is around 58-60% of their wage rates. Compared to the meta-analysis of value of time in Japan [8], our estimations for the husbands' VOTR in tc is smaller. These differences could be because we only consider the value of time as a resource while existing research investigates the value of travel time saving.

(2) Effects of Transportation and Childcare Policies on Household Welfare

Using our findings of VOTRs and VOCTSs (with at least 10% significance), we simulate the welfare gain of a households per year to understand the effects of three transport and childcare policies in 3-(2)- .

Improving transport service by reducing a one-minute of travel time   This scenario aims to decrease people's travel burden by improving transportation. On average, a household can gain 19,145 yen/year in tb via a one-minute of reduction in the wives' travel burden over weekdays.

Work from home   For a household with a husband who telecommutes once per week, the welfare gain is 61,652 yen/year in tc.

Utilizing children-chauffeur service   Suppose that a dual-income family that could only spend the minimum required childcare time occasionally cannot pick up/drop off their children at nursery or the afterschool program because of the schedule conflict. The family then utilizes the chauffeuring service provided by the city once per week. This enables our sample households, on average, obtain 11,402 yen/year of welfare gain in tc.

The research results are archived in Munich Personal RePEc Archive [10] and have been sent to a peer-reviewed journal under review.

(3) Summary and Future Prospects

This research investigates the societal gender differences in terms of time values by life stage and the effects of transport and childcare policies on welfare for households comprising a married couple and at least one child in Japan. Compare to the husbands, our results show that wives still bear the primary childcare responsibilities and experience greater time burden when their first child is of pre-school age. Although urban strategies that facilitate travel time reduction and support childcare-chauffeur service can enhance household welfare, the simulation suggests that, in the short term, the work-from-home option seems to be more effective in improving household welfare through alleviating the time and spatial constraints.

This research contributes to the existing literature in the following ways. We extend the prominent time value model of DeSerpa (1971) [1] to directly compare the within-household gender differences in time use burdens for married couples with young children. Compared to the existing research on household and gender time use at one single time point, our model deliberately considers time allocations and the associated gendered time values by life stage based on intertemporal household decisions, which allow us to understand the trade-offs between activities across different time points.

This study, however, assumes that time value remains the same regardless of home location, which fails to consider the fact that married couples could jointly decide home location given their workplaces and that the distances from home to work change their time values. Our new project will extend the current framework by accounting for the gendered and locational time values in order to seek efficient solutions for reducing people's time burden, increasing welfare and gender equality, and enhance work-life balance.

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Measuring the Gender Differences in Value of Time by Household Life Stage: An Intertemporal Analysis based on Japan Household Panel Survey
Allied Social Sciences Associations-The Society for the Advancement of Behavioral Economics Session
2024

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2022

Ashley Wun-Tzu Lo and Tatsuhito Kono
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The 62TH Western Regional Science Association Annual Meeting, Big Island, H, U.S.

2023

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