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The Philippine Review of Economics

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Care work and the demographic composition of households: two Asian cases

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Who provides unpaid caregiving within the household is of economic and policy relevance. This paper examines how care activities are shared among household members, the extent to which women and men substitute for each other in care and work activities, and whether or not they realize economies of scale in care work. Mongolia and South Korea have nationally representative time-use survey data that allow an exploration of these questions. These two countries differ in their level of economic development and industrial structure, demographic profile, and household composition, providing a comparative perspective on the allocation of time to childcare, domestic work and market work within households. The maximum likelihood estimation results reveal significant evidence of substitution between men and women in childcare, but much less so in domestic work or indirect care, and economies of scale in the care of young children and in women's domestic work.

JEL classification: D13, J22, J13
Keywords: household time allocation, household composition and care work, economies of scale

1. Introduction

Understanding the dynamics of unpaid caregiving within the family is of enormous economic and policy relevance. To illustrate, when the COVID-19 pandemic closed schools, forced workers to work from home, and shuttered businesses and public services, families stepped in as the sole provider of care, comfort, and even survival worldwide. But even in more normal times, in both poorer and richer contexts, and especially where public and private social services are scarce or unaffordable to many, the family serves as the principal caregiver of young children and disabled or frail relatives. It performs the essential domestic

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tasks associated with living and work. While governments and the private sector can influence the family's roles and activities through incentive schemes such as subsidized care services, their degree of influence depends on social norms, beliefs and preferences, as well as family size, structure and wealth. For this reason, financial and non-financial incentives to alter individual and household behaviors and choices, including whether to increase labor supply, to reduce or increase family size, or to purchase care services, may not elicit the expected responses.

The economic literature usually frames the allocation of time to care and work activities as dependent primarily on individuals' preferences, wages, and constraints. This paper instead uses the household as the unit of observation. It contributes to the literature on the economics of the household by examining which family members provide care in the family, who shares in that work, which responsibilities are shared, and how household structure and its demographic composition matter in these. Time allocation decisions are made with the family's needs and wants in mind against a background of culture, gender norms, and economic institutions (Tsuya et al. [2000]; Folbre [2004], [2012]; Gimenez-Nadal et al. [2012]; Do et al. [2015]; Alesina and Giuliano [2015]).[1] In Asian countries, for example, the family income distribution is determined not only by who earns income but also by the willingness of family members to pool their resources, resulting in a more equal distribution of family earnings [Ku et al. 2018].

This paper compares the patterns of time use within the household in two countries, Mongolia and South Korea. These two countries differ in their level of economic development and industrial structure. South Korea is a high-income country, largely urban and highly industrialized, with 25 percent of its workers employed in manufacturing and 70 percent in services in 2019, and with families having at most one child.[2] In contrast, Mongolia is a middle-income country whose economy outside the Ulaanbaatar metropolitan area has traditionally depended on nomadic, pastoral agriculture, where men are responsible for long-distance herding, building, and repairing winter and spring shelters, often taking their young sons with them [Cooper and Gelezhamstin 1994].[3] Despite their large economic differences, we find similarities between these countries in the time allocation of women and men. Their labor force participation rates are strikingly similar among women, for example: 51.4 percent in Mongolia and

[1] Folbre [2004: 7] reminds us that "[d]istributional conflict influences decisions made by families and also shapes the social institutions that govern the allocation of time. Time allocation does not conform to the idealized processes of competitive markets because it involves important coordination problems that cannot be solved entirely by the independent decisions of individuals. … The social institutions that evolve to help solve these coordination problems are shaped by collective action, and often prove resistant to change even when they lead to inefficient outcomes."

[2] The total fertility rate in South Korea is 0.78 births per woman, the lowest in the world, and 2.9 in Mongolia [World Bank 2022].

[3] In pastoral areas, women are responsible for herding small stock and milking, in addition to performing domestic tasks such as product processing, cleaning, washing, and sewing [Cooper and Glezhamstin 1994]. Older boys and girls help collect wood for fuel and water [Terbish and Floro 2016].

54 percent in Korea in 2021 [World Bank 2022]. Unsurprisingly, childcare and home production activities fall most heavily on women in the household, as in many other countries (ILO [2018]; King et al. [2021])—but there is substitution between the time of women and men, particularly in childcare, although an additional male in the household would not reduce women's childcare time by as much as an additional female would reduce men's childcare time. We also find significant economies of scale in childcare. Previous studies have found similar evidence that having two children compared to one child does not double the amount of care time (Gustafsson and Kjulin [1994] on Sweden; Holmes and Tiefenthaler [1997] on the Philippines; Kalenkoski et al. [2005] on the UK). With respect to domestic work or indirect care activities such as meal preparation and housecleaning, the evidence for economies of scale is statistically significant for women's time in Korea but not for men in Korea nor for women and men in Mongolia.[4]

2. Theoretical framework

Our estimation model is based on a simple model of the household in which members produce as well as consume a nonmarket good called *care* which is a function of time and goods inputs. Because time is constrained, work is assigned among household members depending on their relative (shadow) wages, productivity, physical limitations, and preferences, and on the relationships among household members that are built on affection, interdependence, trust, and power.[5] These factors lead to a substitution between time and goods inputs in the production of direct and indirect care, and also to a distribution of time to activities among household members.[6] In meeting the care needs of the household, market goods and services may substitute for household time spent on domestic work, but purchased care services such as paid childcare, elder care, and care for members with disabilities may not be regarded as sufficient substitutes for family caregiving. The choice between paid and unpaid family care is a decision made with respect not only to prices and foregone earnings but also to social and cultural norms and personal preferences. Parents, for example, may prefer to

[4] Domestic work such as cooking meals, cleaning house or doing laundry is regarded as a good illustration of economies of scale in household production because the time required for doing these activities is not proportionate to the number of household members. Hence, cooking for four does not necessarily require twice the time of cooking for two, holding the quality of meals constant. Gustafsson and Kjulin [1994] do not find any economies of scale in non-childcare work, whereas Couprie and Ferrant [2015] do.

[5] Folbre [1986] argues that a household model needs to take into account the role of power relations, sharing, reciprocity, nurturance, and authority. Similarly, Apps [2003] points to the limitations of the New Household Economics approach, with "its estimation of aggregate household demands, in analyzing the intra-household distribution of welfare and its determinants" and not recognizing that individuals have opportunities, preferences, and constraints that affect their choices as individuals but also as members of the household.

[6] Microeconomic studies, especially those that examine labor supply behavior, have tended to ignore the significance of household production activities and how these activities compete with labor market work. In those studies, the key determinant of labor supply is market wages, and the factor that determines the relative engagement of women and men is their relative wages.

provide childcare themselves even in the presence of affordable paid care services (Hallberg and Klevmarken [2003]; Hook [2010]).

In a basic form of the household model, two independent adults share a public good Z between them, such as housing, thus benefiting from the economies of doing so and the gains from division of work according to their comparative advantage (Becker [1965]; Cherchye et al. [2020]). The utility function of each adult i depends on consuming a good *care* (C) which he or she produces using care time t_C and a public good Z,

$$C_i = C_i(t_{Ci}, Z) \quad i \in \{1, 2\}, \tag{1}$$

subject to two constraints—a time constraint T_i and a budget constraint Y_i,

$$\begin{aligned} T_i &= t_{Ci} + t_{Wi} \\ Y_i &= w_i\, t_{Wi} \geq \frac{p}{2} Z \end{aligned} \tag{2}$$

where t_w represents adult i's time on paid work and w is the market wage for time worked. Adult i's income from market work, Y, is used to purchase Z at the market price $p/2$, on the assumption that the two adults share equally in the cost of Z. The standard optimization condition in this model is that each adult will allocate time to own-care t_{Ci} up to the point at which the ratio of the marginal product of own-care time to that of paid work (the marginal rate of substitution) is equal to the ratio of the wage to the (one-half) price of the purchased input Z.

Expanding the model, if the two adults care for one another such that each adult's well-being depends also on the other person's well-being, then each adult will produce not only own-care but also care for the other adult, and the care consumed by each adult i will then be a function of own-care time, t_C, the care time *received* from adult j, τ_c^j, and the shared (public) good Z. In Becker's [1991] model of an altruistic household, the household head maximizes the well-being of all members, but that model requires a further assumption that the altruistic head of the household is able to control the distribution of resources [Pollak 1985]. For the purpose of this paper, we ignore the sources and distribution of this control. Regardless of assumptions about control within the household, one possible (and probable) outcome of the household time allocation model is that a household member, most likely a woman, takes on most care responsibilities in exchange for receiving goods or money from household members who are able to earn more in the labor market [Apps 2003]. The effect of market forces that predict this distribution of care responsibilities is either reinforced or attenuated by preferences and social norms.

Numerous studies have shown that the presence of young children profoundly changes the labor supply decisions and care responsibilities of adults in the household, and the dynamics between them (e.g., Behrman [1997]; Blundell

et al. [2005]; Connelly [1992]; Guryan et al. [2008]; Zangger et al. [2021]). Translating this finding into our model, total childcare (C_c) depends on the time inputs *received* by children from each adult i (τ_{Ci}^{c}), purchased child-specific input Z_c (e.g., anything from diapers to paid childcare) for price p_c , and the public good Z. That is, the production of childcare in a household with two adults is

$$C_c = C_c(\tau_{C1}^{c}, \tau_{C2}^{c}, Z, Z_c). \tag{3a}$$

Folding into own-care and care for adult j other activities such as domestic work, the time constraint of each adult i is now a function of own-care time, care time given to the other adult j (t_C^{j}), time for childcare (t_C^{c}), and market work time (t_W),

$$T_i = t_{Ci} + t_{Ci}^{j} + t_{Ci}^{c} + t_{Wi}, \quad i, j \in \{1,2\}, \quad i \neq j \tag{3b}$$

In this model, who cares more for the child and who shares in that responsibility depend on the relative market wages of the adults at home and their relative marginal productivities in care work. Per this condition, the adult with a lower wage compared to other adults or a higher relative marginal productivity in care work will likely provide more childcare. Moreover, the higher the price of Z_C (e.g., paid childcare) relative to wages, less of Z_C will be purchased and more time for childcare will be given by the adult whose wage is lower than either the price of Z_C or the wage of the other adult. This is the reason why a subsidy for paid childcare which lowers the price of Z_C would be a condition for women to increase their labor supply. But market wages and the price of paid services are not the only important factor affecting childcare decisions in households. In their review of a rich literature, Monna and Gauthier [2008] conclude that family traditions and society's expectations about the appropriate roles and behaviors of parents mediate (and perhaps mitigate) the effect of the market on parental care. Arslan et al. [2023], in this issue, also argue that the perceived quality of paid care services can be a critical factor in the decision of the family to use paid childcare services.

Is the burden of childcare on the household mitigated by economies of scale?[7] The empirical estimation in the next section examines how the time allocation to childcare changes with the number of children in the household. The addition of a second child in the household increases the marginal productivity of time for childcare by both adults. If a second child also lowers the average childcare time, then there is evidence of economies of scale. Previous studies have long recognized that as the number of children in the family increases, the cost per child decreases (e.g., Aalto and Varjonen [2006], Kalenkoski et al. [2005]). However, there are limits to such economies. In the Philippines, economies of scale do

[7] Economies of scale can exist even without children. As applied to time allocation instead of household expenditures, Couprie and Ferrant [2015: 9] define the concept as follows: "Economies of scale measure the extra time that two singles living apart need to have to be as well off as when living together." In this paper, we focus the analysis on economies of scale in childcare.

not extend beyond a total of three children [Holmes and Tiefenthaler 1997]. The age composition of children also likely affects the possibility of economies of scale. If there is a substantial age gap among them, childcare would involve age-appropriate care activities that may be different enough as to not lower parents' per-child care time. Any parent would know that caring for an infant is not the same as caring for a school-age child of eight or a teen in terms of attention and physical care. Rosenzweig and Zhang [2009] point to another reason why there may be no economies of scale in childcare time. They find economies of scale in a sample of twins in China with respect to purchased inputs, such as clothing and books, but not with respect to parents' per-child time assisting with homework. Unequal aspirations about the schooling of boys and girls, they find, may dilute economies of scale in parental time for homework.

If we consider time spent for caring for infants or toddlers and older children as two different care activities and if parents are able to engage in both care activities at the same time, is this evidence of economies of scope? When are simultaneous or overlapping activities evidence of economies of scope in household production? The definition of economies of scope requires that the cost of doing both activities at the same time must be less than the sum of the cost of doing each activity separately, *without loss of effectiveness*.[8] Adults frequently engage in simultaneous or overlapping activities, such as cooking a meal while listening to the radio, or watching a toddler while helping an older child with homework, but the condition about loss of quality is important and harder to measure. Ascertaining economies of scope is difficult. While the total time spent is observable and measurable, direct measures of the total (physical and mental) cost of overlapping activities and their effectiveness are generally not available (Floro and Miles [2003]; Folbre and Yoon [2007]; Suh and Folbre [2016]).

Economies of scale and economies of scope exist not only with respect to time but also with respect to purchased inputs. For example, siblings (even of different ages) can share a room; toys and books can be shared by children of similar ages; parents may be able to employ a childminder for less than double the price for the care of twins. Without data on expenditures related to time for care work, we do not examine these economies. In the next sections, we examine the presence of economies of scale and scope in time allocation, but we hesitate to conclude about economies of scope for reasons mentioned above.

[8] To illustrate what is meant by economies of scope, consider one definition in agricultural production: "when a farmer can use the same input(s) to produce two or more products, and lower the cost of producing them separately. To achieve this end the inputs have to be complementary. By developing cost complementarities between different crops or livestock species, diversified farms can become more efficient than specialised farms" [de Roest et al. 2018: 222]. In the literature on childcare, possible evidence of economies of scope is confounded by unobserved costs associated with simultaneous activities. For there to be economies of scope in childcare, the energy tax (cost) on parents of caring for two children *at the same* time must be less than the sum of the cost of caring for each child separately. In addition, there should be no loss in the quality of simultaneous caregiving.

3. Estimation model

In our model, the household is the unit of production and consumption in which decisions are made collectively or are negotiated among its members as in a bargaining model, and where such decisions hinge on the total time resources and wealth of the household and on markets and public goods that are available. We examine how childcare and domestic work are influenced by the size and demographic composition of the household. The starting point of our empirical model is given by Equation 4, which is estimated separately for women (f) and men (m). For ease of presentation, we drop the subscript for the household.

$$\ln(t_h^j) = \alpha_{hj} + \boldsymbol{\eta_{hj}}\boldsymbol{X} + \gamma_{hj}(N_j - 1) + \beta_{hj}N_C + \epsilon_{hj}, \quad j = \{f, m\} \tag{4}$$

where t_h^j is the total time spent by adults aged 15-64 of gender j in the household on activities in category h (either childcare, indirect care, or market work); N_j−1 is the total number of co-resident adults who are potential caregivers; N_c is the total number of children; and ϵ_{hj} is a stochastic error.[9] The dependent variables pertain only to time for a main or primary activity. We use a logged specification of the dependent variables which has the benefit of being able to interpret the coefficients as elasticities.[10] So as not to lose the sample households that reported zero time for any of the three activity groups, we assign them a value of one minute per day for the dependent variable (thus, a log value of zero). The coefficients of the count variables indicate the percentage change in time spent for activity h by adults aged 15-64 of gender j with respect to a unit change in any of the count variables.

$\boldsymbol{X}$ is a vector of household characteristics (the age, gender and education of the household head, measures of household wealth, and urban or rural location). These household variables are common controls used in household demand models. The education of the household head, household wealth and location can proxy for missing variables such as wages. The gender of the household head may indicate the relative power of women and men in the household, but previous studies of female headship caution against reading too much into this variable (e.g., Handa [1994]; Budlender [2003]; Klasen et al. [2015]), Brown and van de Walle [2021]). Some of the reasons for female headship (e.g., singlehood, widowhood, divorce, and separation) which imply the absence of adult males may render the female head and her household to be more vulnerable to risks of poverty. Because of absent data in time surveys on wages, previous employment, market for paid care services, and disabilities and chronic illness within the family, $\boldsymbol{X}$ does not include these variables.[11]

[9] Annex Table 2 lists the types of activities included in the time-use surveys.

[10] This is similar to studies that have examined the allocation of household expenditures within the household (e.g., Nelson [1988]; Lanjouw and Ravallion [1995]; Brown and van de Walle [2021]).

[11] For example, Pagán [2013] finds that "disability steals time:" disabled individuals devote less time to market work (especially females), and more time to domestic work such as cooking, cleaning and child care, to tertiary activities such as personal care and medical treatment. On wage measures, Mas and Pallais [2019] rightly argue that the market wage is only an approximation of the opportunity cost of employed workers but not of unemployed workers' opportunity cost which is difficult to measure since it reflects activities that happen outside the market.

In Equations 5, we show our full specifications. The estimated system of time-use equations has a common set of regressors. We add gender-specific count variables for adults in order to explore the presence of substitution and/or complementarity in work between women and men, and the presence of economies of scale and scope in childcare. The term N_j is the number of adults aged 15-64 of gender j in the household, minus one if j is of the same gender. In other words, the equation for the time use of women includes the number of adult women in the household minus one ($N_f - 1$), as well as the number of adult men, N_m, to examine whether other women or men share in the time for activity h.

$$\ln(t_h^f) = \alpha_{fh} + \boldsymbol{\eta_{fh}} \boldsymbol{X} + \gamma_{fh}(N_f - 1) + \varphi_{fh} N_m + \sum_c (\beta_{hf}^c N_c + \delta_{hf}^c N_c^2 + \theta_{hf}^c N_c N_k) + \epsilon_{hf}$$

$$\ln(t_h^m) = \alpha_{mh} + \boldsymbol{\eta_{mh}} \boldsymbol{X} + \gamma_{mh} N_f + \varphi_{mh}(N_m - 1) + \sum_c (\beta_{hm}^c N_c + \delta_{hm}^c N_c^2 + \theta_{hm}^c N_c N_k) + \epsilon_{hm} \quad (5)$$

where h pertains to the three broad activity groups of childcare, domestic work, and market work, and c refers to two child groups, namely, ages zero to four and five to 14 for South Korea and ages zero to 11 and 12 to 14 for Mongolia, as defined by their respective time-use surveys. We distinguish between young children and older children by referring to the other child group as k, where $k \neq c$; caring for them presumably requires a different type and intensity of care work. By including a quadratic term for each child count, we test a simple form of economies of scale in activity h with respect to each child age group c. We interpret a negative coefficient δ_{ij} for this term as suggesting economies of scale, that is, an additional child (of the same age group) would increase time for activity h only by $(\beta_{hj}^c + 2\delta_{hj} N_c)$.

We also consider a simple test for the presence of the economies of scope in childcare by adding an interaction variable of the age-specific child count variables in Equations 5, but as we discuss above, this test rests on the assumption that the care of young and older children are two distinct care activities. A negative coefficient of the interaction term θ would mean that an additional child of one age group would increase childcare time by less than that coefficient multiplied by the count of children of the other age group. Since one alternative explanation for a negative coefficient is measurement error in reporting or recording the time for secondary or simultaneous activities, we interpret our findings with a fair degree of caution. Another source of a measurement error is the possibility that the older child may be helping to care for the younger sibling, thus reducing the reported or observed adult care time for the younger child.

4. Data and descriptive statistics

We analyze time-use survey data from Korea [Statistics Korea 2014] and Mongolia [NSO Mongolia 2011] separately. These nationally representative time-use surveys cover all household members (ages ten and above for Korea, 12 and above for Mongolia) instead of only one randomly selected member of a household, allowing us to use the whole household as our unit of analysis. Descriptions of the collection dates, methods, sampling, and sample size of the time-use surveys are presented in Annex Table 1. Time-use survey data are extremely useful for documenting the types and levels of care activities, but they also have important limitations that apply to our study.[12] First, as mentioned earlier, although the two surveys we use collect time data on secondary or simultaneous activities, such data are more likely to suffer from measurement error (Charmes [2019]; Folbre and Yoon [2007]; Gauthier et al. [2004]), so they would underestimate care work at home.[13] Second, time-use surveys generally do not collect data on prices of goods, occupation, or wages of household members who are employed, physical health of household members, and so on, thus limiting our ability to predict the allocation of time across the activity groups and between women and men.

4.1. Country differences in household composition and time use

Table 1 shows striking differences in the composition of households in Mongolia and Korea. Of the full survey samples, 42.5 percent of households in Mongolia and 57.8 percent in Korea have no children aged zero to 14 years, reflecting Korea's extremely low fertility rate. Tracing the transformation of the Korean household over the past decades, Kweon [1998] notes that between 1975 and 1995/6, the share of the traditional Korean extended family (of the eldest son and his family living with his elderly parents) fell from 78 percent to 20 percent, while the share of one-generation families doubled and that of elderly-only households rose more than sevenfold. Two decades later, the share of single-person households had risen to 28.7 percent and had grown at a rate faster than in other OECD countries [Seo 2019], and nearly one-fourth of households include only adults aged 65 and older. Rapid urbanization accompanied by massive outmigration from rural areas of young people and deep changes in attitudes toward extended families and gender roles are regarded as main reasons.

[12] Time-use researchers have been developing different methods since the 1980s to address many of the challenges and difficulties of time-use data collection and measurement. A review and comparison of data collection methods can be found in Floro and King [2016] and Buvinic and King [2018].

[13] For example, Fedick et al. [2005], using Canadian data, find that for every childcare hour recorded as a primary activity, three to four more hours of childcare are performed as a secondary activity. Supervisory care in particular is likely to be considered secondary, which often leads to significant underestimates of childcare time. The time-use surveys of Mongolia and Korea collect time spent in secondary activities, but the accuracy of that time data would depend on the training of interviewers and/or clear instructions provided to respondents about using time diaries. Collecting the time for simultaneous activities seems more sensitive to such factors.

TABLE 1. Age composition of time-use surveys

	Mongolia	South Korea
Full time-use survey samples (households)	1322	11787
Households with no children aged 0-14	562 (42.5%)	6815 (57.8%)
Households with only members aged 65 and over	62 (4.7%)	2793 (23.7%)
Households with members aged 0-64 (estimation samples)	754 (57.0%)	2179 (18.5%)

Sources: Authors' calculations using the 2011 Mongolia Time-Use Survey [NSO Mongolia 2011] and 2014 South Korea Time-Use Survey [Statistics Korea 2014].
Notes: The analysis samples include households with one or more members aged 15-64 and one or more children under 15, but no members above 65.

Fertility rates have also fallen dramatically in Mongolia—from 7.1 births per woman in 1970 to 2.6 in 2011 [World Bank 2022]. Rapid urbanization in response to expanding employment opportunities in cities has been transforming its household composition. Household size has shrunk to 3.6 but it is still 50 percent larger than the average household size in Korea. The share of single-person households is half that in Korea; 62.3 percent are nuclear family households, 24.9 percent are extended families, and 2.1 percent are mixed family households [NSO Mongolia n.d.]. The share of elderly-only households is five percent, as compared with 23.7 percent in Korea.

Table 2 shows the gender-disaggregated means and standard deviations of total household time spent in the three care categories, measured in minutes per day, from the two time-use surveys.[14] Several patterns emerge from just these averages: In both countries, women perform the bulk of unpaid care work.[15] On average, the total time for childcare by women in households with at least one child aged less than 15 is 68 minutes per day in Mongolia and 168 minutes in Korea. The corresponding averages for men are far lower—15 minutes in Mongolia and 42 minutes in Korea. We note that 58 percent of households in Mongolia have at least one child younger than 15, whereas only 42 percent of households in Korea do. Interestingly too, the childcare numbers between columns 2 and 3 are not similar. For Mongolia, the average childcare time is larger in column 3, suggesting that some households with children report zero childcare time by adults aged 15 to 64. In Korea, the opposite seems to be case: many more households report positive time for childcare but have no children younger than 15 living in the same household. These findings point to the existence of inter-household care arrangements in which childcare duties are shared also with non-resident adults, such as grandparents (aged less than 65) who reside on their own.

[14] The specific activities included in the aggregate categories of childcare and domestic work are described in Annex Table 2.

[15] Older children do care for younger siblings (e.g., East [2010]; Yi et al. [2012]). They also help with domestic work and may even be employed in some contexts, but here we follow the UN definition that children under 15 are not in the labor market.

TABLE 2. Mean unpaid time for childcare, domestic work or indirect care, and market work by household members aged 15-64 (minutes per day)

		All households	Households with children aged <15 years old	Households with childcare time > 0
	Activity	**(1)**	**(2)**	**(3)**
Mongolia				
Women	Childcare	44.9 (93.13)	68.1 (108.86)	98.7 (117.38)
	Domestic work	61.5 (125.49)	59.7 (124.72)	74.2 (133.57)
	Market work	277.3 (317.14)	298.4 (314.52)	292.2 (319.11)
Men	Childcare	10.4 (37.18)	15.1 (43.32)	22.8 (52.52)
	Domestic work	51.6 (93.07)	52.1 (90.78)	59.3 (99.55)
	Market work	312.1 (339.68)	343.9 (337.23)	308.4 (324.28)
	N	1322	802	601
South Korea				
Women	Childcare	34.9 (88.10)	167.9 (131.95)	126.9 (128.54)
	Domestic work	140.2 (134.15)	198.4 (107.17)	214.5 (109.69)
	Market work	92.5 (159.39)	66.5 (118.73)	78.5 (123.22)
Men	Childcare	8.7 (30.84)	42.3 (57.62)	31.4 (52.34)
	Domestic work	26.9 (50.74)	29.8 (47.97)	30.6 (49.87)
	Market work	132.0 (168.10)	165.7 (122.63)	166.8 (131.59)
	N	11787	2254	3244

Data sources: Authors' calculations using the 2011 Mongolia Time-Use Survey [NSO Mongolia 2011] and 2014 South Korea Time-Use Survey [Statistics Korea 2014].
Notes: Standard deviations in parentheses. Childcare pertains to direct care given to children under 15. Only time for primary activities is included in these numbers.

In Mongolia, the gender gap in the time spent for domestic work is significantly smaller than the corresponding gender gap in Korea. In Korea, women's average time for domestic work is five times that of men's across all households. When focusing only on households with children (column 2) or on households that spend time on childcare (column 3), the gender gap is even wider, with women spending about seven times more time on domestic work. The presence of children

increases the time that women spend on domestic work, while men's contribution to domestic work is hardly affected by the presence of children.

Aggregate data show that women's labor force participation in Korea is far lower than that of men, 54.0 percent v. 72.7 percent in 2021, even though Korean men and women have about equal years of schooling [World Bank 2022]. Korea's gender gap in labor force participation rates is larger than Mongolia's, 51.5 percent v. 67.0 percent in 2021. Time-use data indicate that this gender disparity is evident also at the intensive margin: in Mongolia, the average market hours of employed men exceed those of women by 12.5 percent across all households and by 15.2 percent in households with children. In Korea, the gender difference in market hours is much more pronounced; men work 42.7 percent more hours in the market than women across all households and 149 percent more in households with children.

4.2. Household characteristics of the estimation samples

Because our analysis focuses on how care work, particularly childcare, is shared within households, our estimation samples include only those households that have at least one child aged zero to 14, at least one adult aged 15 to 64, and no adult aged 65 years and above. We impose this selection rule on the two countries for the purpose of comparing households with more similar demographic composition. This rule is perhaps more restrictive in Korea than in Mongolia because of the low fertility rate in Korea and its rapidly aging population. Omitting the households with elderly members aged 65 and over reduces our sample only by a small fraction of the households with young children in the two countries—in Mongolia, by three percent, and in Korea, zero percent. In the reduced samples of households, we do not include the time of older adults because their time-use data would reflect not only differences in time allocation behavior between the two countries but also the large gap between their life expectancies at birth (Mongolia, 73, and Korea, 83) and household structure [World Bank 2022]. Excluding the elderly-only households, as Table 1 indicates, reduces the Mongolia sample by 4.7 percent and the Korea sample by 23.7 percent.

In our estimation sample for Mongolia, 31 percent of households have female heads, as compared with Korea where just 13 percent of households are headed by females (Table 3). This disparity in the prevalence of female headship in the two countries may be reflecting the differences between an economy where the principal livelihood outside the capital city is associated with a nomadic lifestyle and an economy that is largely urban and industrial. There is also a wide gap of ten years of schooling between the average education levels of the household heads in the two countries. The average years of education of the head is 4.2 years in Mongolia, as compared with over 14.4 years in Korea. This gap is due partly to differences in the gender composition of the household heads and partly to the difference in the level of educational development between the two countries.

Using data from several years of the Korea Time Use Survey, Park [2021] finds that both mothers and fathers have increased their childcare between 1999 and 2014, irrespective of their education levels. However, the increase over time has been greater among parents with a university degree, as compared with parents with less education. Similarly, Dotti Sani and Treas [2016] find that in 11 Western countries between 1965 and 2012, mothers and fathers with more education showed larger increases in childcare time than parents with lower education.

TABLE 3. Summary statistics for estimation samples

	Mongolia		South Korea	
	Mean (s.d.)	**Min, max**	**Mean (s.d.)**	**Min, max**
Number of children aged 0-4[a]	1.47 (0.91)	0, 5	0.78 (0.72)	0, 3
Number of children aged 5-14[a]	0.33 (0.54)	0, 3	0.71 (0.70)	0, 3
Number of female adults aged 15-64	1.34 (0.67)	0, 6	1.06 (0.37)	0, 4
Number of male adults aged 15-64	1.15 (0.69)	0, 5	0.97 (0.34)	0, 3
Household head is female (binary)	0.31 (0.46)	0, 1	0.13 (0.33)	0, 1
Head's age	37.92 (9.94)	12, 64	38.95 (6.39)	20, 64
Head's highest completed schooling (years)	4.23 (1.84)	1, 8	14.43 (2.47)	0, 23
Wealth index	0.70[b] (0.18)	0, 1	--	--
Size of house (sq. ft.)	--	--	80.51 (28.04)	16,347
Owns house (binary)	--	--	0.57 (0.49)	0, 1
Double earner household (binary)	--	--	0.41 (0.49)	0, 1
Urban (binary)	0.35 (0.48)	0, 1	0.46 (0.50)	0, 1
N	*754*		*2179*	

Sources: Authors' calculations using the 2011 Mongolia Time-Use Survey [NSO Mongolia 2011] and 2014 South Korea Time-Use Survey [Statistics Korea 2014].
Notes: The subsample used is households with at least one child and one member 15-64, but without elderly members.
[a] The age cut-offs for children differ for Mongolia; instead of zero to four, the youngest child group pertain to children zero to 11, and the second group is for children ages 12-14.
[b] This is a normalized index of household assets, created using principal component analysis to binary variables regarding the ownership of various assets. For Mongolia, the assets include ownership and size of agricultural land; ownership of livestock or farm animals, horses, cattle, camels, sheep, goats, pigs, and poultry; ownership of a renewable energy generator, computer, TV, washing machine, refrigerator, microwave, telephone, cell phone, car, bus or minivan, and motorcycle; and household access to internet or cable TV. The Korean Time-Use Survey does not have sufficient asset information to allow the calculation of a wealth index.

In our estimation samples, urban residence is lower in Mongolia at 35 percent, compared with 46 percent in Korea. These rates are significantly lower than the population-based urbanization rates [World Bank 2022] which were 68 percent in 2011 for Mongolia and 82 percent in 2014 for Korea. The disparity in the rates is likely due to the differences in the demographic composition of households that reside in urban areas. For example, one might expect that a higher share of single households and couple-only households resides in urban areas because of the higher cost of living in those areas; these are the households that are excluded from our estimation samples.

With respect to household wealth, detailed information on the ownership of pre-specified assets is available for Mongolia, allowing us to use principal component analysis to construct a wealth index with values between zero and one; the mean value of the index is 0.70.[16] For Korea, similar detailed information about asset ownership is not available, but we use the size of the house in which the household lives,[17] house ownership (57 percent) and the presence of more than one earner in the household (41 percent) as proxy variables for wealth.

5. Regression results

In this section, we examine whether the disparities in time use between the two countries are associated with household differences in demographic composition and socioeconomic characteristics. We assume that the decisions about the household's time on different activities are jointly determined, so we estimate a Seemingly Unrelated Regression (SUR) model using maximum likelihood to account for correlated error terms in the equations for childcare, domestic work or indirect care, and market time for women and for men. The omitted time categories are eldercare and household time spent on residual activities, including self-care, leisure, voluntary work, and, among older children, school hours.

Our focus here is on the results for the count variables but there are some noteworthy findings about the control variables. Annex Tables 3 and 4 show that, across the specifications, female headship is associated with a more traditional allocation of time: significantly more time for childcare and domestic work by women in the household, significantly less time for childcare and domestic work among men, but significantly more market time by women than men. This finding seems contrary to a naïve expectation that having a female head may result in a more gender-equal allocation of time. For Mongolia, it is likely explained by the fact that rural males spend considerable time away from home due to their livelihood of livestock raising.

[16] Details on which assets are included in the construction of each index are given in the notes for Tables 3 and 4.

[17] According to Statistics Korea [2011], the home ownership rate in Korea was 56 percent of households, a far lower rate than in other countries with comparable average income.

With respect to the education of the household head, in Mongolia both women and men in households with more education spend more time in market work and less time in childcare. In contrast, in Korea, in households where the head has more education, both women and men spend significantly more time in childcare and domestic work, and women spend significantly less time in market work. Previous studies have similarly noted that, holding other household characteristics constant, more education is associated with more time for childcare by both women and men compared with households with less education, possibly because greater value is placed on investments in children (Guryan et al. [2008]; Dotti Sani and Treas [2016]; Park [2021]).

Table 4 presents the coefficient estimates for the full specification. Panel A presents the estimates for the childcare equations, Panel B for domestic work or indirect care, and Panel C for market work.[18] Since the dependent variables are in log values, the coefficients of the child count variables show the percent increase in the time allocated by males or females in response to an additional child, and the coefficients of the adult count variables indicate the marginal contribution of an additional adult. In Panel A, considering both the linear coefficients of the child count variables and the coefficients of the quadratic terms (that is, $\beta_{hj}^{c} + 2\delta_{hj} N_c$), an increase from one child to two children aged zero to four years old, holding other variables constant, would increase women's total time spent on childcare by 76.6 percent in Mongolia and by only 6.3 percent in Korea. Less than a hundred percent increase indicates economies of scale in time for childcare, so the economies of scale are substantial in Korea. The corresponding numbers for men are 32.3 percent and 0.9 percent, respectively, also showing significant economies of scale. The estimates for older children are not significant except in Korea: having two children aged five to 14 instead of one would increase women's total childcare time by 7.2 percent.

TABLE 4. SUR results: Coefficients of full regression specifications, using the estimation samples

	Mongolia		South Korea	
	Females	**Males**	**Females**	**Males**
A. Total household time spent on childcare by gender (in logs)				
Children 0-4 (0-11)	1.730***	0.803***	1.891***	1.417***
	(0.314)	(0.234)	(0.266)	(0.376)
Children 5-14 (12-14)	-0.161	-0.0472	1.004***	-0.174
	(0.423)	(0.316)	(0.261)	(0.369)
Female adults 15-64	0.260**	-0.150*	1.287***	-0.286**
	(0.118)	(0.0882)	(0.080)	(0.114)
Male adults 15-64	-0.199*	0.0734	-0.167	0.641***
	(0.115)	(0.0857)	(0.101)	(0.144)
Children 0-4 (0-11) squared	-0.241***	-0.120**	-0.457***	-0.352***
	(0.0698)	(0.0521)	(0.085)	(0.120)
Children 5-14 (12-14) squared	0.0747	0.0486	-0.233***	0.054
	(0.234)	(0.175)	(0.082)	(0.116)

[18] The full results of all specifications (with the control variables included) are provided in the Annex Tables 3 and 4.

TABLE 4. SUR results: Coefficients of full regression specifications (continued)

	Mongolia		South Korea	
	Females	**Males**	**Females**	**Males**
Children 0-4 (0-11) x Children 5-14 (12-14)	-0.0145 (0.170)	-0.161 (0.127)	-0.564*** (0.141)	-0.189 (0.199)
Adjusted R^2	0.199	0.201	0.255	0.216
B. Total household time spent on indirect care by gender (in logs)				
Children 0-4 (0-11)	0.0540 (0.141)	0.00721 (0.260)	0.560** (0.245)	-0.574 (0.397)
Children 5-14 (12-14)	-0.199 (0.190)	-0.0875 (0.351)	0.697*** (0.240)	-0.713* (0.389)
Female adults 15-64	-0.0863 (0.0530)	-0.209** (0.0979)	1.397*** (0.074)	-0.204* (0.120)
Male adults 15-64	0.0157 (0.0514)	-0.0809 (0.0950)	-0.088 (0.093)	0.963*** (0.151)
Children 0-4 (0-11) squared	0.0113 (0.0313)	0.00654 (0.0578)	-0.133* (0.078)	0.170 (0.127)
Children 5-14 (12-14) squared	0.0987 (0.105)	-0.179 (0.194)	-0.186** (0.076)	0.179 (0.123)
Children 0-4 (0-11) x Children 5-14 (12-14)	-0.122 (0.0760)	0.0970 (0.141)	-0.287** (0.129)	0.385* (0.210)
Adjusted R^2	0.854	0.444	0.173	0.0850
C. Total household time spent on market work by gender (in logs)				
Children 0-4 (0-11)	-0.250 (0.414)	0.114 (0.299)	-0.720** (0.354)	0.268 (0.371)
Children 5-14 (12-14)	-0.228 (0.558)	0.236 (0.403)	-0.279 (0.347)	0.512 (0.364)
Female adults 15-64	0.819*** (0.156)	-0.0260 (0.113)	1.116*** (0.107)	-0.281** (0.112)
Male adults 15-64	0.0169 (0.151)	0.323*** (0.109)	-0.366*** (0.135)	1.944*** (0.142)
Children 0-4 (0-11) squared	-0.0193 (0.0920)	-0.0274 (0.0665)	0.203* (0.113)	-0.029 (0.119)
Children 5-14 (12-14) squared	-0.234 (0.308)	0.0219 (0.223)	0.030 (0.110)	-0.128 (0.115)
Children 0-4 (0-11) x Children 5-14 (12-14)	0.242 (0.224)	-0.272* (0.162)	0.217 (0.187)	-0.205 (0.196)
Adjusted R^2	0.142	0.603	0.547	0.270
N	754	754	1984	1984

Data sources: Authors' calculations using the 2011 Mongolia Time-Use Survey and the 2014 South Korea Time-Use Survey.

Notes: Standard errors in parentheses. Asterisks represent statistical significance: * p<0.10, ** p<0.05, ***<0.01. Estimates are calculated using a seemingly unrelated regression (SUR) specification. The outcome variables are logged total household time spent on the specified activity by either men or women as indicated. The subsample used from each survey is those households with at least one child and one member 15-64, but without elderly members. Control variables include an indicator for whether or not the household head is female; the head's age and age squared; the head's highest years of education completed; and an indicator for whether or not the household resides in an urban area. Additional controls by country are: Mongolia: wealth index (see notes for Table 2); South Korea: size of house (sq. ft.) and indicator for whether or not the household owns their house (proxies for wealth); indicator for whether or not the household is a dual-earner household. To estimate the effect of the child counts, use the individual coefficients of the linear, quadratic and interaction terms, as explained in Equation 5.

The rows for the number of female adults and male adults indicate the degree of substitution between them. Focusing first on childcare time, in the regressions for total female time, an additional female adult in the household would increase the total time for childcare by women in the household by 26 percent in Mongolia and by 128.7 percent in Korea. One possible explanation for the large percentage increase in women's time for childcare in Korea is that an additional woman (in an otherwise nuclear family household) might be a grandmother (younger than 65, so as to be included in our estimation sample) or another female relative who has joined the household for the primary purpose of providing childcare. Analyzing panel data in Korea, Park [2022] finds that the rate of grandparent care for grandchildren has been increasing, and that the amount of this time commitment for this activity is large in Korea. The presence of an additional male adult would not increase total childcare time by men in Mongolia, but it would increase it by 64 percent in Korea.

Turning to the cross-gender coefficients, a negative coefficient for the male adult count in the regression for women's childcare time (or for the female adult count in the regression for men's childcare time) indicates substitution between adult men and women in childcare. We find statistically significant negative cross-gender coefficients: holding constant the child count variables, an additional adult male in the household would decrease women's total time spent on childcare by 20 percent in Mongolia and by 17 percent in Korea (though the latter is not statistically significant). In the case of total male time on childcare, the coefficients for an additional female adult are also negative, implying substitution (by 15 percent in Mongolia and 29 percent in Korea). The results suggest asymmetry in the substitutability between men's and women's time in childcare: an additional male in the household would not reduce women's childcare time by as much as an additional female would reduce men's childcare time.

Panel B pertains to domestic work or indirect care time. The presence of young and older children in Korea is significantly associated with the total time spent on domestic work, particularly by women. Having two children aged zero to four instead of one child would increase total domestic work of women by 2.8 percent. Considering now also the coefficient θ of the interaction term of the child variables indicates the presence of economies of scope, an interpretation discussed in Section 2. These coefficients are significant for women's childcare and domestic work and also for men's domestic work in Korea. To illustrate, assume that a family has an older child and a young child comes along. The total time for childcare by women in the household would increase by 41.3 percent instead 97.7 percent. The total time for domestic work by women would rise only by 0.7 percent instead of 71.3 percent, suggesting that older children are more independent or may even be helping with domestic work. For Mongolia, only one of the coefficients is statistically significant; the age range of the child count variables may not be differentiating enough between young children who are going to be more dependent on adults and older children who would be more independent.

The results for the cross-gender counts suggest less substitution between women's and men's domestic work than in the case of childcare in Korea. An additional female adult in the household would increase the total time of women on domestic work by nearly 140 percent and would decrease men's time by 20 percent. An additional male would nearly double men's total time contribution to domestic work but would not decrease women's time. The results suggest that while men and women may share in childcare, domestic work which includes tasks such as meal preparation and housecleaning is regarded as "women's work," to be done by women when they are present.

In Panel C, considering again the coefficients of the child count variables, that is, β, δ and θ, the results indicate that having two young children aged zero to four instead of just one would decrease the total market hours of women in Korea by 31.4 percent, but an additional child in the older age group does not have a significant coefficient. The number of children does not appear to affect men's market work in Korea. Women's or men's market work in Mongolia is also not significantly associated with the number of older children, possibly because older children (age group 12-14 years) are likely to be in school and so are not a hindrance to labor supply. The negative relationship between female labor supply and the presence of young children is well documented by other studies (e.g., Connelly [1992]; Lilly et al. [2007]; Morrissey [2017]).

The coefficients of the count variables for adults of the same gender are large and statistically significant in both countries, signifying that an additional adult who may be co-residing to supplement childcare time may allow a parent to increase the total time for market work. The coefficients are larger for women than for men in Mongolia (82 percent v. 32 percent) and larger for men than for women in Korea (194 percent v. 112 percent), providing support to previous findings that co-residence with other adults can raise market participation for both women and men [Tsuya et al. 2000]. Evidence of cross-gender substitution in market work is limited to Korea: An additional female would reduce the total market hours of men by 28 percent, while an additional male would reduce the total market hours of women by 37 percent. The disparity in results for the two countries is revealing of the country-specific gender allocation of time within the household.

6. Concluding remarks: care and family policy

This study has focused on the relationship between the size and demographic composition of the household and time spent for childcare, domestic work or indirect care, and market work by adult family members. The two countries we study differ greatly with respect to their household characteristics and economy. In 2022, the average family size was 3.6 in Mongolia and 2.4 in Korea [World Bank 2022]. Mongolia is a lower-middle-income country whose economy is still largely based on livestock-raising and a relatively nomadic lifestyle, while Korea is a mostly urban, industrial, high-income country where the average education

level is about thrice that in Mongolia. The gender patterns in time allocation are broadly similar in these two countries, but there are also clear differences between them based on our analysis of time-use survey data.

Using a household perspective and controlling for household characteristics, our findings show that women do most of the childcare in the family, sharing that work with co-resident women and, to a lesser degree, with men. Women and men substitute for each other in childcare, but more so in Korea than in Mongolia, and not to an equal degree. There is an asymmetry in this substitution: an additional male in the household would not reduce women's childcare time by as much as an additional female would reduce men's childcare time. Our results reveal significant economies of scale in the care of young children by women, and possibly also economies of scope. Domestic work or indirect care, unlike childcare, is primarily the domain of women and is barely shared by men, whatever the size and composition of the household. Recent research on Korea, however, shows that gender patterns in childcare have been shifting over time with changes in the demographic composition and structure of households (Peng [2018]; Park [2022]).

All in all, the results show the benefits of a household perspective on time allocation. Depending on traditions and norms, individuals within a household can call upon time and financial resources beyond their own. Women who must juggle hours of market work, domestic work and childcare can rely on co-resident adults to ensure that young children receive a certain level of total care or that necessary domestic work is met. In both Mongolia and Korea, caregiving, domestic work, and market work could be shared with one co-resident adult such as a spouse or a co-resident grandparent, lightening the total burden for each adult and allowing some reallocation of time. Research indicates that caregivers generally are able to balance their market work and caregiving if their care responsibilities are manageable. In Korea, Do et al. [2015] find that women who provide more than ten hours of care per week are 15.2 percentage points less likely to participate in the labor force than other women.[19]

Governments have used a variety of policies and programs that use both demand and supply forces to mitigate the cost of family caregiving and to expand the market participation of adults. For example, work leave policies allow employed parents time to care for their infants and young children without having to terminate their employment. At least 185 countries now mandate paid maternity leave, with different duration and entitlements [Del Rey et al. 2021]. In Europe, these leave policies provide universal, long, and paid entitlements; in much of the developing world, the entitlements are selective, short, and generally unpaid. An increasing number of countries have also adopted paternity leave policies [Sevilla 2020], although many provide for very limited duration. Paternity leave policies

[19] Two systematic reviews of empirical studies on the US, UK, and Canada conclude that caregiving is generally associated with a negative effect on female labor force supply that varies from almost negligible to six fewer hours of labor market work per week for each additional hour of caregiving (Lilly [2007]; Meng [2013]).

are meant to encourage the sharing of care work in the family (Farré and Gonzalez [2019]; Tamm [2019]; Corekcioglu et al. [2020]). An alternative to a gender-specific leave policy is parental leave that allows parents to assume childcare responsibilities on a more egalitarian basis. In countries that have adopted this more flexible policy, women have made career choices that are possible because couples are able to share care work (Boll et al. [2014]; Broadway et al. [2020]).

In developing countries where the formal economy is small, only a small percentage of working parents can benefit from leave policies, so it is imperative to explore other policies. Governments have provided childcare benefits directly to parents through investments in childcare services, childcare allowances, personal income tax deductions or credits, tax deductions for childcare fees in 41 percent of countries; to childcare centers through corporate income tax deductions or credits, financial and nonmonetary support in 35 percent; and to employers through corporate or income tax deductions or credits, nontax benefits or subsidies in 24 percent [World Bank 2019]. Reviews of past studies show that public programs and subsidies for childcare have increased female labor force participation (Del Boca [2015]; Morrissey [2017]). These policies, however, can sometimes crowd out informal care arrangements that local communities may be better able to, and more cheaply, provide.[20]

Who ultimately finances the cost of leave entitlements and childcare subsidies can be the critical factor determining their impact. If the cost of these programs falls mostly and ultimately on the family, and on women in particular, they will not reduce gender inequality in the recruitment of women, wages, and time for caregiving in the home [Olivetti and Petrongolo 2017]. The risk is that those costs will be, at least partially, passed on to beneficiaries in terms of discriminatory hiring, glass ceilings in occupations, and lower wages, mostly at the disadvantage of married women of childbearing age (e.g., Baker et al. [2008]; Baker and Milligan [2008]; Schönberg and Ludsteck [2014]; Olivetti and Petrongolo [2017]).[21]

Our empirical analysis does not examine other aspects of family caregiving, such as caring for elderly adults who are frail because age is not a reliable measure of the need for caregiving. The global trend of population aging is expected to raise the future burden of eldercare so this issue has to figure in future research on family caregiving. Already, an increasing number of men and women are assuming caregiving for elderly relatives in place of paid caregivers because of cost reasons and concerns about the quality of available care services.[22]

[20] In Chile and Ecuador, for example, local childcare centers adjust their schedules to fit the needs of working parents, and they accept younger children [Mateo Díaz and Rodriguez-Chamussy 2016]. For different policy scenarios about female labor supply, see also Cicowiez and Lofgren [2023] and Tribin et al. [2023] in this issue.
[21] Mandated employer provision of childcare services has been shown to reduce women's starting wages by ten to 20 percent in Chile [Prada et al. 2015] and possibly also to lower the recruitment of women.
[22] According to the *World Population Prospects*, one in six people worldwide will be over age 65 by 2050, up from one in 11 in 2019, and the number of persons aged 80 years and older will triple to 426 million [United Nations 2019].

To conclude, a household perspective on care decisions and labor supply reveals how a family meets and allocates its care responsibilities among members. And while traditional beliefs and social norms, as well as the market for paid care services, are also factors in those decisions, these contextual factors are themselves evolving in response to broader demographic and economic transformations. Understanding the family dynamics of time allocation in the face of such changes helps to predict the impact of a variety of family and social assistance programs and employment policies, such as flexible work arrangements, family leave entitlements, publicly funded childcare, and subsidies to care suppliers.

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Annex

ANNEX TABLE 1. Description of Time-use Surveys

	Mongolia	South Korea
Survey period	March – December 2011	July, September, December 2014
Collected by…	National Statistical Office of Mongolia	Statistics Korea
Sample selection procedure	Stage 1: Probability sampling proportional to size of 400 primary sampling units (lowest administrative units) Stage 2: 10 households from each PSU selected using systematic sampling	Households drawn randomly from Korea census
Time use collection method	Recall method for last week	Recall method for last two consecutive days, 24-hour time diary in 10-minute intervals
Total number of households surveyed	3,998	12,000
Household members surveyed	All members 12+	All members 10+
Nationally representative?	Yes	Yes

Notes: Information taken from statistical agency websites, time use survey documentation, and data reports.

ANNEX TABLE 2. Specific activities included in time categories in Mongolia and South Korea

	Child Care	Domestic Work or Indirect Care
Mongolia	Caring for pre-school age and school-age chil-dren/physical care	Preparing meals/snacks and cleaning up after food preparation/meals/ snacks
	Reading, playing and talking to children	Hand-washing; loading/unloading washing machine
	Assisting with school work	Indoor and outdoor cleaning
	Meeting with teachers and attending parent-teacher meetings	Shopping for/purchasing of goods and related activi-ties
	Other activities related to childcare	Improvement, maintenance and repair of dwellings personal and household goods including computers
		Vehicle maintenance and minor repairs
		Collecting water, preparing fuel and heat for dwelling
		Other activities related to household management

ANNEX TABLE 2. Specific activities included in time categories in Mongolia and South Korea (continued)

	Child Care	Domestic Work or Indirect Care
South Korea	Physical care of children aged 0-9 Educational activities with children aged 0-9 Reading and playing with children aged 0-9 Providing medical care for children aged 0-9 Other care for children aged 0-9 Physical care of children aged 10-17 Helping with homework and study for children aged 10-17 Providing medical care for children aged 10-17 Other care for children aged 10-17 Travel related to childcare	Cooking and washing dishes Laundry and clothing repair Home cleaning and taking out trash Home repairs and maintenance Shopping Organizing and managing the household Other household chores Travel related to indirect care

Sources: NSO Mongolia [2011] and Statistics Korea [2014].

ANNEX TABLE 3. SUR estimates of household time allocation (in logs) using four specifications: Mongolia estimation samples

A. Basic specification	Childcare		Domestic work or Indirect care		Market work	
	Female	Male	Female	Male	Female	Male
Children 0-11	0.829***	0.290***	0.0542	0.0613	-0.252**	-0.112
	(0.0877)	(0.0649)	(0.0389)	(0.0719)	(0.116)	(0.0830)
Children 12-14	-0.243*	-0.265**	-0.212***	-0.197*	-0.299	-0.123
	(0.144)	(0.107)	(0.0640)	(0.118)	(0.191)	(0.136)
Female-headed household	0.687***	-1.282***	4.734***	-3.104***	0.425*	-4.781***
	(0.167)	(0.124)	(0.0741)	(0.137)	(0.221)	(0.158)
Head age	0.0186	-0.0178	0.0274	-0.0204	0.297***	0.193***
	(0.0455)	(0.0337)	(0.0202)	(0.0373)	(0.0602)	(0.0430)
Head's age squared	-0.0000976	0.000259	-0.000232	0.000429	-0.00340***	-0.00226***
	(0.000569)	(0.000421)	(0.000252)	(0.000466)	(0.000753)	(0.000538)
Highest grade completed	-0.0650	-0.101***	0.00460	-0.0554	0.273***	0.108**
	(0.0505)	(0.0373)	(0.0224)	(0.0413)	(0.0668)	(0.0477)
Wealth index	3.031***	2.784***	-0.131	0.929*	-4.101***	-2.343***
	(0.586)	(0.434)	(0.260)	(0.480)	(0.776)	(0.554)
Urban	-0.0446	-0.242*	-0.142*	-0.401**	-0.312	0.163
	(0.191)	(0.141)	(0.0846)	(0.156)	(0.253)	(0.181)
Constant	-1.219	-0.165	-0.588	2.936***	0.0190	2.864***
	(0.950)	(0.703)	(0.421)	(0.778)	(1.257)	(0.898)
R^2	0.174	0.191	0.853	0.439	0.109	0.597

ANNEX TABLE 3. SUR estimates of household time allocation (continued)

B. Substitution specification	Childcare		Domestic work or Indirect care		Market work	
	Female	Male	Female	Male	Female	Male
Children 0-11	0.825***	0.291***	0.0537	0.0563	-0.242**	-0.102
	(0.0874)	(0.0648)	(0.0389)	(0.0717)	(0.114)	(0.0826)
Children 12-14	-0.224	-0.277***	-0.217***	-0.210*	-0.245	-0.129
	(0.144)	(0.107)	(0.0640)	(0.118)	(0.188)	(0.136)
Female adults 15-64	0.248**	-0.157*	-0.0853	-0.210**	0.817***	-0.0285
	(0.119)	(0.0885)	(0.0530)	(0.0978)	(0.156)	(0.113)
Male adults 15-64	-0.185	0.0790	0.0133	-0.0795	0.0215	0.322***
	(0.116)	(0.0859)	(0.0515)	(0.0950)	(0.151)	(0.109)
Female-headed household	0.563***	-1.220***	4.755***	-3.102***	0.291	-4.635***
	(0.175)	(0.130)	(0.0778)	(0.144)	(0.229)	(0.165)
Head age	0.0179	-0.0182	0.0264	-0.0256	0.310***	0.200***
	(0.0454)	(0.0337)	(0.0202)	(0.0372)	(0.0593)	(0.0429)
Head's age squared	-0.000120	0.000293	-0.000198	0.000570	-0.00380***	-0.00241***
	(0.000572)	(0.000424)	(0.000254)	(0.000469)	(0.000747)	(0.000541)
Highest grade completed	-0.0632	-0.102***	0.00416	-0.0561	0.277***	0.107**
	(0.0502)	(0.0372)	(0.0223)	(0.0412)	(0.0656)	(0.0475)
Wealth index	3.054***	2.768***	-0.140	0.904*	-4.010***	-2.340***
	(0.584)	(0.433)	(0.259)	(0.479)	(0.762)	(0.551)
Urban	-0.0623	-0.225	-0.128	-0.352**	-0.462*	0.121
	(0.192)	(0.142)	(0.0854)	(0.157)	(0.251)	(0.181)
Constant	-1.258	-0.0860	-0.503	3.306***	-1.011	2.438***
	(0.971)	(0.720)	(0.432)	(0.797)	(1.268)	(0.918)
R^2	0.182	0.195	0.853	0.443	0.140	0.602
C. Economies of scale specifiction	**Childcare**		**Domestic work or Indirect care**		**Market work**	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**
Children 0-11	1.714***	0.631***	-0.0764	0.111	0.00788	-0.176
	(0.257)	(0.192)	(0.115)	(0.213)	(0.339)	(0.245)
Children 12-14	-0.177	-0.231	-0.338**	0.0229	0.0474	-0.0729
	(0.377)	(0.282)	(0.169)	(0.312)	(0.497)	(0.360)
Female adults 15-64	0.260**	-0.152*	-0.0878*	-0.208**	0.822***	-0.0292
	(0.118)	(0.0883)	(0.0530)	(0.0979)	(0.156)	(0.113)
Male adults 15-64	-0.199*	0.0735	0.0157	-0.0810	0.0168	0.323***
	(0.115)	(0.0858)	(0.0515)	(0.0951)	(0.151)	(0.110)
Children 0-11 squared	-0.239***	-0.0909*	0.0330	-0.0107	-0.0624	0.0210
	(0.0629)	(0.0470)	(0.0282)	(0.0521)	(0.0830)	(0.0601)

ANNEX TABLE 3. SUR estimates of household time allocation (continued)

C. Economies of scale specifiction	Childcare		Domestic work or Indirect care		Market work	
	Female	Male	Female	Male	Female	Male
Children 12-14 squared	0.0710	0.00746	0.0675	-0.154	-0.172	-0.0475
	(0.230)	(0.172)	(0.103)	(0.190)	(0.303)	(0.220)
Female-headed household	0.576***	-1.214***	4.751***	-3.097***	0.300	-4.635***
	(0.173)	(0.130)	(0.0778)	(0.144)	(0.229)	(0.166)
Head age	0.0221	-0.0168	0.0265	-0.0268	0.310***	0.200***
	(0.0450)	(0.0336)	(0.0202)	(0.0373)	(0.0593)	(0.0430)
Head's age squared	-0.000145	0.000285	-0.000202	0.000584	-0.00379***	-0.00240***
	(0.000567)	(0.000423)	(0.000254)	(0.000469)	(0.000748)	(0.000541)
Highest grade completed	-0.0696	-0.105***	0.00584	-0.0580	0.273***	0.107**
	(0.0498)	(0.0372)	(0.0224)	(0.0413)	(0.0657)	(0.0476)
Wealth index	3.038***	2.763***	-0.141	0.910*	-4.006***	-2.337***
	(0.578)	(0.432)	(0.259)	(0.478)	(0.762)	(0.551)
Urban	-0.0521	-0.221	-0.131	-0.347**	-0.454*	0.121
	(0.190)	(0.142)	(0.0853)	(0.157)	(0.251)	(0.181)
Constant	-1.982**	-0.363	-0.398	3.265***	-1.210	2.499***
	(0.981)	(0.733)	(0.440)	(0.812)	(1.294)	(0.936)
R^2	0.199	0.199	0.854	0.443	0.141	0.602
D. Economies of scope specifiction	**Childcare**		**Domestic work or Indirect care**		**Market work**	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**
Children 0-11	1.730***	0.803***	0.0540	0.00721	-0.250	0.114
	(0.314)	(0.234)	(0.141)	(0.260)	(0.414)	(0.299)
Children 12-14	-0.161	-0.0472	-0.199	-0.0875	-0.228	0.236
	(0.423)	(0.316)	(0.190)	(0.351)	(0.558)	(0.403)
Female adults 15-64	0.260**	-0.150*	-0.0863	-0.209**	0.819***	-0.0260
	(0.118)	(0.0882)	(0.0530)	(0.0979)	(0.156)	(0.113)
Male adults 15-64	-0.199*	0.0734	0.0157	-0.0809	0.0169	0.323***
	(0.115)	(0.0857)	(0.0514)	(0.0950)	(0.151)	(0.109)
Children 0-11 squared	-0.241***	-0.120**	0.0113	0.00654	-0.0193	-0.0274
	(0.0698)	(0.0521)	(0.0313)	(0.0578)	(0.0920)	(0.0665)
Children 12-14 squared	0.0747	0.0486	0.0987	-0.179	-0.234	0.0219
	(0.234)	(0.175)	(0.105)	(0.194)	(0.308)	(0.223)
Children 0-11 x Children 12-14	-0.0145	-0.161	-0.122	0.0970	0.242	-0.272*
	(0.170)	(0.127)	(0.0760)	(0.141)	(0.224)	(0.162)
Female-headed household	0.575***	-1.219***	4.747***	-3.094***	0.307	-4.644***
	(0.174)	(0.130)	(0.0777)	(0.144)	(0.229)	(0.165)
Head age	0.0219	-0.0184	0.0253	-0.0259	0.312***	0.197***
	(0.0450)	(0.0336)	(0.0202)	(0.0373)	(0.0593)	(0.0429)

ANNEX TABLE 3. SUR estimates of household time allocation (continued)

D. Economies of scope specifiction	Childcare		Domestic work or Indirect care		Market work	
	Female	Male	Female	Male	Female	Male
Head's age squared	-0.000143	0.000308	-0.000185	0.000570	-0.00382***	-0.00236***
	(0.000567)	(0.000423)	(0.000254)	(0.000470)	(0.000748)	(0.000541)
Highest grade completed	-0.0695	-0.105***	0.00604	-0.0582	0.273***	0.107**
	(0.0498)	(0.0372)	(0.0223)	(0.0413)	(0.0657)	(0.0475)
Wealth index	3.038***	2.768***	-0.137	0.907*	-4.014***	-2.329***
	(0.578)	(0.431)	(0.259)	(0.478)	(0.761)	(0.550)
Urban	-0.0530	-0.231	-0.139	-0.342**	-0.440*	0.105
	(0.190)	(0.142)	(0.0853)	(0.158)	(0.251)	(0.181)
Constant	-1.997**	-0.528	-0.524	3.365***	-0.961	2.220**
	(0.996)	(0.744)	(0.446)	(0.825)	(1.313)	(0.949)
N	754	754	754	754	754	754
R^2	0.199	0.201	0.854	0.444	0.142	0.603

ANNEX TABLE 4. SUR estimates of household time allocation (in logs) using four specifications: South Korea estimation samples

A. Basic specification	Childcare		Indirect care		Market work	
	Female	Male	Female	Male	Female	Male
Children 0-4	0.559***	0.576***	0.077	0.029	-0.159**	0.037
	0.056	0.075	0.052	0.079	0.072	0.077
Children 5-14	0.052	-0.264***	0.089*	-0.076	-0.050	0.110
	0.057	0.076	0.053	0.080	0.073	0.078
Female-headed household	0.187**	-1.724***	0.154*	-1.214***	1.035***	-2.648***
	0.091	0.121	0.085	0.128	0.116	0.124
Head age	-0.089**	-0.122**	-0.039	-0.061	-0.128**	-0.129**
	0.039	0.052	0.036	0.055	0.050	0.053
Head's age squared	0.001*	0.001**	0.001	0.001	0.002***	0.001**
	0.000	0.001	0.000	0.001	0.001	0.001
Highest grade completed	0.018	0.036**	0.011	0.055***	-0.069***	-0.023
	0.013	0.018	0.012	0.018	0.017	0.018
Size of house (sq. ft.)	0.002	0.002	0.003***	-0.000	-0.001	-0.001
	0.001	0.001	0.001	0.002	0.001	0.002
Owns house	0.031	-0.038	0.042	-0.005	-0.122	0.096
	0.062	0.083	0.058	0.087	0.079	0.085
Urban	0.144**	-0.110	0.050	0.010	-0.164**	-0.079
	0.059	0.079	0.056	0.084	0.076	0.081

ANNEX TABLE 4. SUR estimates of household time allocation (continued)

A. Basic specification	Childcare		Indirect care		Market work	
	Female	Male	Female	Male	Female	Male
Double-earner household	-0.425***	0.007	-0.237***	0.274***	3.384***	0.181**
	0.061	0.081	0.057	0.086	0.078	0.083
Constant	6.036***	4.513***	5.201***	2.269**	3.574***	7.772***
	0.820	1.096	0.768	1.156	1.051	1.122
R^2	0.146	0.199	0.0204	0.0634	0.519	0.197
B. Substitution specification	**Childcare**		**Indirect care**		**Market work**	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**
Children 0-4	0.555***	0.584***	0.074	0.042	-0.165**	0.062
	0.053	0.074	0.048	0.078	0.070	0.073
Children 5-14	0.070	-0.265***	0.110**	-0.073	-0.036	0.118
	0.053	0.075	0.049	0.079	0.071	0.074
Female adults 15-64	1.290***	-0.292**	1.402***	-0.209*	1.117***	-0.276**
	0.081	0.114	0.074	0.120	0.107	0.112
Male adults 15-64	-0.168	0.627***	-0.081	0.957***	-0.362***	1.951***
	0.102	0.144	0.094	0.151	0.135	0.142
Female-headed household	-0.141	-1.260***	-0.137	-0.547***	0.607***	-1.313***
	0.109	0.154	0.100	0.162	0.145	0.152
Head age	-0.023	-0.115**	0.037	-0.037	-0.078	-0.071
	0.037	0.052	0.034	0.055	0.049	0.051
Head's age squared	-0.000	0.001**	-0.001	0.001	0.001**	0.001
	0.000	0.001	0.000	0.001	0.001	0.001
Highest grade completed	0.024**	0.035**	0.017	0.055***	-0.064***	-0.022
	0.012	0.017	0.011	0.018	0.016	0.017
Size of house (sq. ft.)	0.000	0.002	0.001	-0.000	-0.003*	-0.002
	0.001	0.001	0.001	0.002	0.001	0.001
Owns house	0.016	-0.050	0.023	-0.027	-0.129*	0.048
	0.058	0.082	0.053	0.086	0.077	0.081
Urban	0.094*	-0.088	-0.003	0.035	-0.211***	-0.033
	0.056	0.079	0.051	0.083	0.074	0.078
Double-earner household	-0.522***	-0.001	-0.347***	0.243***	3.311***	0.105
	0.058	0.082	0.053	0.086	0.077	0.080
Constant	3.854***	4.004***	2.657***	1.039	2.054*	4.974***
	0.807	1.138	0.738	1.196	1.068	1.118
R^2	0.244	0.209	0.170	0.0834	0.546	0.269

ANNEX TABLE 4. SUR estimates of household time allocation (continued)

C. Economies of scale specifiction	Childcare		Indirect care		Market work	
	Female	Male	Female	Male	Female	Male
Children 0-4	0.943***	1.100***	0.079	0.072	-0.355**	-0.075
	0.123	0.173	0.113	0.183	0.163	0.171
Children 5-14	0.085	-0.481***	0.231**	-0.087	0.075	0.179
	0.126	0.177	0.115	0.187	0.167	0.175
Female adults 15-64	1.294***	-0.284**	1.401***	-0.209*	1.113***	-0.278**
	0.081	0.114	0.074	0.120	0.107	0.112
Male adults 15-64	-0.159	0.643***	-0.084	0.958***	-0.369***	1.947***
	0.102	0.144	0.094	0.152	0.135	0.142
Children 0-4 squared	-0.185***	-0.261***	0.005	-0.016	0.098	0.069
	0.052	0.073	0.047	0.077	0.068	0.072
Children 5-14 squared	0.016	0.137*	-0.059	0.009	-0.066	-0.038
	0.054	0.076	0.050	0.081	0.072	0.075
Female-headed household	-0.133	-1.244***	-0.140	-0.546***	0.600***	-1.317***
	0.109	0.154	0.100	0.162	0.145	0.152
Head age	-0.006	-0.079	0.030	-0.034	-0.094*	-0.081
	0.038	0.053	0.035	0.056	0.050	0.052
Head's age squared	-0.000	0.001	-0.000	0.001	0.001**	0.001
	0.000	0.001	0.000	0.001	0.001	0.001
Highest grade completed	0.024*	0.033*	0.018	0.055***	-0.064***	-0.021
	0.012	0.017	0.011	0.018	0.016	0.017
Size of house (sq. ft.)	0.000	0.002	0.001	-0.000	-0.003*	-0.002
	0.001	0.001	0.001	0.002	0.001	0.001
Owns house	0.017	-0.043	0.020	-0.027	-0.132*	0.046
	0.058	0.082	0.053	0.087	0.077	0.081
Urban	0.092*	-0.092	-0.002	0.035	-0.210***	-0.032
	0.056	0.079	0.051	0.083	0.074	0.078
Double-earner household	-0.518***	0.011	-0.350***	0.244***	3.306***	0.102
	0.058	0.082	0.053	0.086	0.077	0.080
Constant	3.347***	3.069***	2.784***	0.981	2.433**	5.226***
	0.820	1.156	0.753	1.220	1.089	1.141
Wealth index	3.038***	2.763***	-0.141	0.910*	-4.006***	-2.337***
	(0.578)	(0.432)	(0.259)	(0.478)	(0.762)	(0.551)
Urban	-0.0521	-0.221	-0.131	-0.347**	-0.454*	0.121
	(0.190)	(0.142)	(0.0853)	(0.157)	(0.251)	(0.181)
Constant	-1.982**	-0.363	-0.398	3.265***	-1.210	2.499***
	(0.981)	(0.733)	(0.440)	(0.812)	(1.294)	(0.936)
R^2	0.199	0.199	0.854	0.443	0.141	0.602

ANNEX TABLE 4. SUR estimates of household time allocation (continued)

D. Economies of scope specifiction	Childcare		Indirect care		Market work	
	Female	Male	Female	Male	Female	Male
Children 0-4	1.891***	1.417***	0.560**	-0.574	-0.720**	0.268
	0.266	0.376	0.245	0.397	0.354	0.371
Children 5-14	1.004***	-0.174	0.697***	-0.713*	-0.279	0.512
	0.261	0.369	0.240	0.389	0.347	0.364
Female adults 15-64	1.287***	-0.286**	1.397***	-0.204*	1.116***	-0.281**
	0.080	0.114	0.074	0.120	0.107	0.112
Male adults 15-64	-0.167	0.641***	-0.088	0.963***	-0.366***	1.944***
	0.101	0.144	0.093	0.151	0.135	0.142
Children 0-4 squared	-0.457***	-0.352***	-0.133*	0.170	0.203*	-0.029
	0.085	0.120	0.078	0.127	0.113	0.119
Children 5-14 squared	-0.233***	0.054	-0.186**	0.179	0.030	-0.128
	0.082	0.116	0.076	0.123	0.110	0.115
Children 0-4 x Children 5-14	-0.564***	-0.189	-0.287**	0.385*	0.217	-0.205
	0.141	0.199	0.129	0.210	0.187	0.196
Female-headed household	-0.138	-1.245***	-0.142	-0.543***	0.602***	-1.319***
	0.109	0.154	0.100	0.162	0.145	0.152
Head age	-0.006	-0.079	0.030	-0.034	-0.094*	-0.081
	0.038	0.053	0.035	0.056	0.050	0.052
Head's age squared	-0.000	0.001	-0.000	0.001	0.001**	0.001
	0.000	0.001	0.000	0.001	0.001	0.001
Highest grade completed	0.021*	0.033*	0.016	0.057***	-0.063***	-0.022
	0.012	0.017	0.011	0.018	0.016	0.017
Size of house (sq. ft.)	0.000	0.002	0.001	-0.000	-0.003*	-0.002
	0.001	0.001	0.001	0.002	0.001	0.001
Owns house	0.014	-0.044	0.018	-0.024	-0.131*	0.045
	0.058	0.082	0.053	0.086	0.077	0.081
Urban	0.088	-0.093	-0.004	0.037	-0.208***	-0.033
	0.056	0.079	0.051	0.083	0.074	0.078
Double-earner household	-0.516***	0.011	-0.349***	0.242***	3.305***	0.103
	0.058	0.081	0.053	0.086	0.077	0.080
Constant	2.697***	2.852**	2.454***	1.424	2.683**	4.990***
	0.833	1.179	0.767	1.243	1.109	1.163
N	1984	1984	1984	1984	1984	1984
R^2	0.255	0.216	0.173	0.0850	0.547	0.270