DEMOGRAPHIC, HEALTH, AND ECONOMIC TRANSITIONS AND THE FUTURE DEMAND FOR CAREGIVING

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THE CARE WORK AND THE ECONOMY (CWE-GAM) PROJECT

The Care Work and the Economy (CWE-GAM) Project strives to reduce gender gaps in economic outcomes and enhance gender equality by illuminating and properly valuing the broader economic and social contributions of caregivers and integrating care in macroeconomic policymaking toolkits. We work to provide policymakers, scholars, researchers and advocacy groups with gender-aware data, empirical evidence, and analytical tools needed to promote creative, gender-sensitive macroeconomic and social policy solutions. In this era of demographic shifts and economic change, innovative policy solutions to chronic public underinvestment in care provisioning and infrastructures and the constraints that care work places on women's life and employment choices are needed more than ever. Sustainable development requires gender-sensitive policy tools that integrate emerging understandings of care work and its connection with labor supply, and economic and welfare outcomes.

Find out more about the project at www.careworkeconomy.org.

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1. INTRODUCTION

Demographic transitions are decreasing fertility rates, epidemiological improvements are lengthening lives, rapid urbanization is reshaping household structure, and technological innovations are changing the nature of jobs. Together, these macro forces are transforming how people use their time and, in particular, the amount of time they spend on paid work, leisure, and unpaid care work. Unpaid caregiving, including child and elder care, care for ill or disabled family members, and household tasks such as cooking and cleaning, is a significant household activity in all countries, yet policies related to employment promotion and poverty reduction are often made without considering the impact of such activities. The still-prevailing belief is that care work is primarily a family duty and responsibility and of little direct relevance to economic development. This neglect ignores the realities that households face: the unequal burden of care within households, the impact on girls and women who bear the brunt of that burden, and the limited capability of low-resource households to provide adequate care for their members. Unpaid care work is critical, but remains "invisible."

The COVID-19 pandemic has put a spotlight on unpaid caregiving in the home. When public and private services are shut down or incapacitated, the ability of household members to care for one another becomes our sole option for comfort and even survival. Understanding the magnitude of future care need is a first step in planning for adequate caregiving in countries and for ensuring that that need is met. Alleviating also some of the burden that falls on the household would allow traditional caregivers to have more time to engage in income-earning activities, take better care of themselves, and, for girls, to attend school longer.

Our paper aims to estimate the future global care need and burden, putting forth a simple model that takes into account the projected shifts in population growth, labor force participation, and health status, and also time-use data on care work. Our estimates pertain to caregiving within the household. In contrast, the report *Care Work and Care Jobs* by the International Labour Organization (2018) uses a very broad definition of the care sector that includes health, education, and social work workers, that is, teachers, professors, and physicians, as well as daycare workers and domestic workers.[1] That report estimates a global number of 215 million workers in all care sectors.

[1] "Care workers include a wide range of workers who differ in terms of education, skills, sector and pay: from university professors, doctors and dentists at one end of the spectrum, to childcare workers and personal care workers at the other. Care workers in care occupations deliver health, social and education services, with the support of other workers, such as managers, accountants, technicians and office workers laboring in the same hospital or school. While not classified as care workers, their work is integral to the provision of care services. For this reason, the report considers them to be part of the care economy and all occupations in the "health and social work" and "education" sectors as forming part of the care workforce." (ILO, 2018, p. 8).

In Section II, we combine UN age-specific population projections by country with country data on morbidity rates to arrive at estimates of the extensive margin of the future global need for care. The diverse patterns in fertility rates and aging and in the prevalence of types of diseases together imply different aggregate levels of need for caregiving in low-, middle- and high-income countries in the future. The extensive margin of care need relative to the potential supply of caregivers in the population is an estimate of the future care burden in a country, a burden that is borne by a mix of unpaid family caregiving and paid care services. In Section III, we apply data from household time-use surveys in three countries to the extensive margin estimates for those countries in order to illustrate the magnitude of the intensive margin of care need met by unpaid caregiving. Taking as given the care arrangements within households, the reported care time for direct (or relational) care and indirect (support) care provides a fuller picture of the care burden in different country settings. Our estimates also show how the care burden is shared between women and men. Section IV is a brief discussion of the policy implications of our results.

2. PROJECTING FUTURE CARE NEED AND POTENTIAL CAREGIVING

The care burden is co-determined by the total care need in a population and the pool of potential caregivers. It can be thought of as dependency of those requiring care on those who provide it. In this section, we estimate the extensive margin of the global care need and the implication of that need on the global care burden. To do this, we combine the UN age-specific population projections, the ILO projections of labor force participation rates, and projections of morbidity to estimate a potential aggregate need for, and potential supply of, caregiving across countries. These care demand and supply projections yield an estimate of global care dependency.

2.1 ECONOMIC DEPENDENCY: ACCOUNTING FOR DEMOGRAPHICS AND LABOR FORCE PARTICIPATION

The UN's definition of a dependency ratio provides a starting point for estimating care dependency. That ratio represents economic dependency; it is defined as the ratio of the sum of the total number of children aged 0-14 and the total number of adults aged 65 and older to the total number of adults aged 15-64 years (United Nations, 2019b). The implicit assumption behind this definition of dependency is that all children younger than 15 and all adults older than 64 are not economically productive and are therefore economically dependent on the income of all adults aged 15-64. Changes in dependency ratios are thus driven solely by changes in the population structure, that is, by changes in fertility, mortality, and migration that shift the relative sizes of these population groups

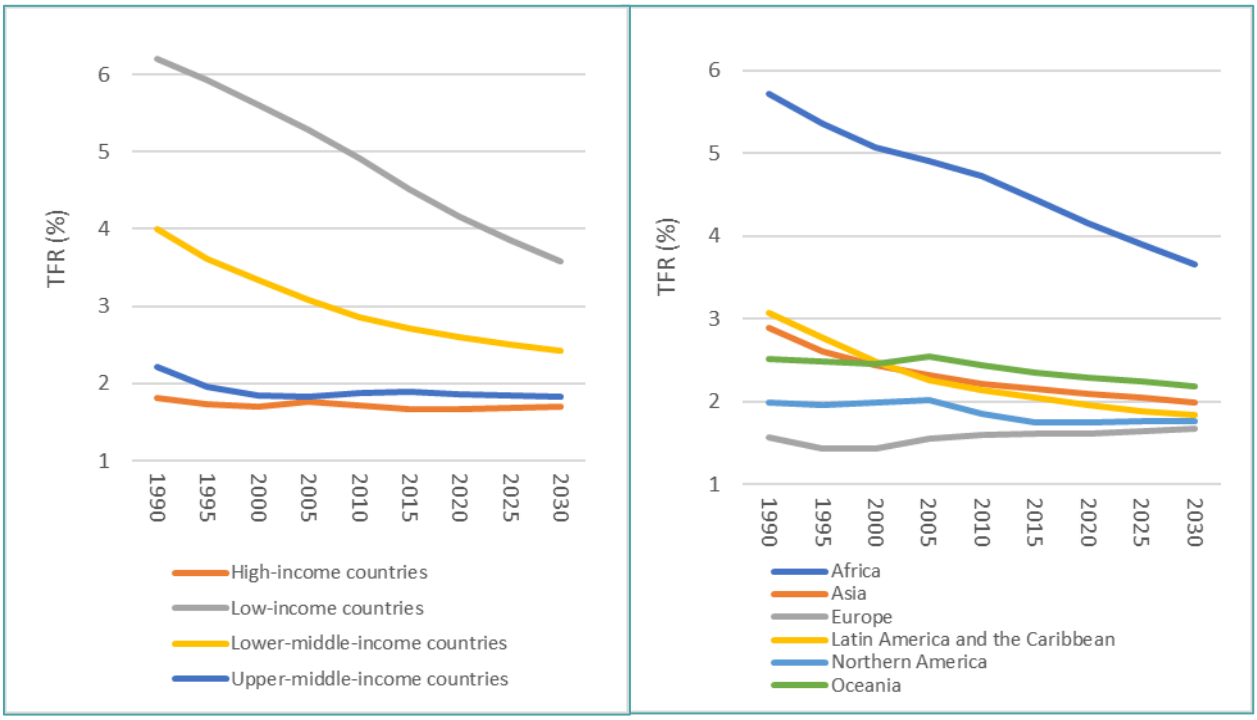
Different patterns of fertility and life expectancy cause significant variation in dependency among country income groups and world regions. The global average fertility rate has been halved since the 1960s to below 2.5 children per woman today (Figure 1). Despite this decline, the Total Fertility Rate (TFR) in the poorest countries remains very high, particularly in Africa, implying still-heavy pressure on households to care for young children. Even though some of these countries now have lower TFRs than in the past, the "youth bulge" from the past means that the absolute number of births will rise even as current couples are having fewer children. In other world regions, fertility levels have continued to fall to replacement rate (defined as 2.1 children per woman) or even lower in some countries.[2] Sustained over a long period, fertility rates below the replacement rate, in the absence of migration, means a negative population growth and a rapidly aging population.[3] The trend of longer life expectancy increases potential care dependency. According to the *World Population Prospects*, by 2050, one in six people worldwide will be over age 65, up from one in 11 in 2019, and the number of persons aged 80 years or over will triple from 143 million in 2019 to 426 million (United Nations, 2019c). [4]

[2] In 2010-15, 46 percent of the world's population lived in countries with fertility level below 2.1 births per woman. This includes all of Europe and North America, 19 countries in Asia, 15 in Latin America and the Caribbean, three in Oceania, and two in Africa (United Nations, 2017a).

[3] Between 1990 and 1995, 12 countries (all in Europe, but for Rwanda) experienced a negative rate of natural increase i.e., deaths outnumbered births. By 2030-2035, 40 countries are projected to have a negative rate of natural increase, including nine countries outside Europe (United Nations, 2013).

[4] In the United States, the percentage of the population above 65 is projected to rise from the current 12.4 percent to 20 percent by 2030 (National Institute of Aging, National Institute of Health and WHO, 2016). In the European Union, this share will rise from 16 percent today to 30 percent by 2050 (Bolin, Lindgren & Lundberg, 2008).

Figure 1: Total fertility rate, by country income group and region, 1990-2030



Data source: UN World Population Prospects, 2019 revision (United Nations, 2019a)

These patterns are expected to persist to at least 2030. Figure 2 presents the population pyramids for country income groups, based on the medium variant of the UN population projections from the 2019 revision of the *UN World Population Prospects* (United Nations, 2019a).[5] According to the projections for 2030, the largest increases in population will be in low- and middle-income countries, while the populations in high-income countries will stay fairly constant. The age structures of the populations across these country income groups differed dramatically in 2015, and those differences will intensify by 2030. High-income countries are already aging noticeably, as are middle-income countries, but lower-middle-income countries are still in the process of attaining the middle-age bulge which presages their period of a demographic dividend. Low-income countries will continue to be much more youthful than other countries, but the relative size of their older groups will also rise. For example, about 46 million people aged 60 years and over live in sub-Saharan Africa today; this population is expected to more than triple to 165 million by 2050.

[5] Figure A1 presents the age-group population pyramids by geographic region instead, showing clear differences among the world regions – from the youthful populations of African countries to the increasingly aging populations of European countries. In 2030, the developing countries in other regions will be reaping the demographic dividend, their prime working age-groups increasing relative to children and the elderly.

Figure 2: Age-gender population pyramids, 2015 and 2030, by country income groups

Data source: UN World Population Prospects, 2019 revision (United Nations, 2019a)

Table 1 translates the changes in population structures in the population pyramids into dependency ratios by country income group for 2015 and 2030. Following the UN definition, these dependency ratios are defined as:

$$\frac{n_c + n_e}{n_a} \qquad \textit{(Eq 1)}$$

where n_c is the number of children, n_e is the number of elderly persons, and n_a is the number of non-elderly adults. These ratios can be decomposed into a child dependency ratio and an elderly dependency ratio. For low- and lower-middle-income countries, child dependency ratios fall despite their still-high fertility rates. In middle-income countries, reduced mortality rates and longer lives increase the elderly dependency ratios, but overall, there is a shift of the population to the working ages 15-64, promising a demographic dividend. In high-income countries which have had low fertility rates for some time, a rapidly

aging population increases the elderly dependency ratio as well as the total economic dependency ratio.[6]

Table 1: Economic dependency ratios by country income group

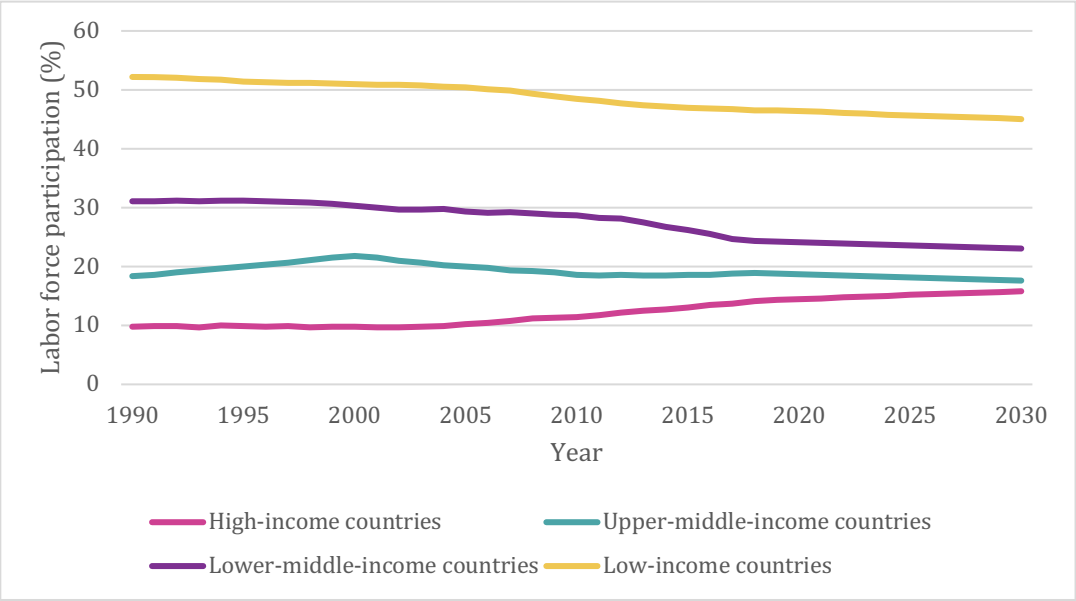
Country income group	*Dependency ratio type*	*2015*	*2030*
Low-income	Child	78.9	65.4
	Elderly	6.0	6.4
	Total	85.0	71.7
Lower-middle-income	Child	48.3	40.6
	Elderly	8.2	11.6
	Total	56.5	52.1
Upper-middle-income	Child	29.7	27.5
	Elderly	12.6	22.2
	Total	42.3	49.6
High-income	Child	25.8	24.9
	Elderly	25.3	35.3
	Total	51.0	60.2

Data source: UN World Population Prospects, 2019 revision (United Nations, 2019a)

These conventional dependency ratios do not fully capture economic dependency. Just as not all adults 15-64 are working, neither are all those under 15 nor those over 65 out of the labor force. The average labor force participation rate of adults over 65 in low-income countries has dropped from over 50 percent in 1990, but it was still over 40 percent in 2015 and is projected to be 45 percent in 2030 (Figure 3). This rate is declining also in middle-income countries, but in high-income countries, the labor force participation rates of seniors are increasing, projected to reach 15 percent in 2030 as older populations live longer, healthier lives.

[6] The predicted economic dependency ratios will also differ by geographic region (Table A1): The total ratio will decline significantly in African countries due to a lower child dependency ratio, and it will increase in Europe due to a rising elderly dependency ratio. The total dependency ratio in Asia will fall only slightly, because the decline in its child dependency ratio will be almost offset by an increase in its projected elderly dependency ratio.

Figure 3: Labor force participation rate of populations aged 65 and over, 1990-2030



Data source: ILOSTAT modelled estimates of labor force participation by age and sex, 2019 revision (ILO, 2019).

To acknowledge that the conventional assumptions about labor force participation of adults are far from real, we adjust the formula for the dependency ratio by the age-specific labor force participation rates in countries, but only for adults ages 15 and above, maintaining therefore the UN assumption that children younger than 15 do not work.[7] For the sake of simplicity, we assume that labor force participation suffices to measure economic production, recognizing that this is only a potential measure rather than an actual one, since not all who are in the labor force are actually employed.[8] With these considerations, we rewrite Eq. 1 thus,

[7] Children below 15 also work in the labor market despite national laws that prevent them from doing so (Figure A2). Child labor force participation is prevalent, with a large proportion of them working in the informal and unregulated sector. Country data on child labor force participation rates are spotty, but data from several countries illustrate our point: Afghanistan (50 percent in 2011), Bangladesh (58 percent, 2013), Colombia (13 percent, 2015), Guatemala (40 percent, 2015), Senegal (45 percent in 2015), and Sudan (25 percent, 2014). Moreover, data on average work hours indicate that children who are employed work full-time hours in several countries (World Bank, 2020).

[8] Of course, labor force participation rates are not necessarily equal to employment rates. Even in a full-employment economy, there will be adults who are not actually employed but are seeking work, and will still be part of the labor force participation numbers. The labor force participation rate, however, is likely to be more stable than the employment rate which depends on the business cycle. The business cycle can affect labor force participation too as indicated by the discouraged-worker phenomenon, but it is less sensitive to cyclical fluctuations. We note that this definition of economic dependency ignores other sources of income that people have, such as rent from property owned, which do not depend on people's time.

$$\frac{n_c + (1 - p_j)n_j}{p_j n_j} \qquad (Eq\ 1)$$

where $\boldsymbol{p}$, which takes on a value between 0 and 1, inclusive, is the labor force participation rate of adults ages 15 and over, and *j* represents all adults 15 and older. In this formulation, a 0.5 value of *p,* for example, means that either all adults in the population spend one-half of their time in the labor force or one-half of all adults spend all of their time in labor force while the other half are not in the labor force. How much time "all of their time" means could be 40 or 50 hours per week, depending on both custom and regulatory limits on work hours.[9] Unlike the UN definition, the numerator of Eq. 1' includes adults aged 65 and older who are not in the labor force and the denominator includes the share of that population that is in the labor force.[10] This modification yields lower economic dependency ratios for the elderly, but increases the dependency ratios for children and adds a representation of economic dependency for adults to the total ratio.

By recognizing explicitly that adults above 65 do participate in the labor market, the projected elderly economic dependency ratio in low-income countries in 2030 drops from 6.4 percent in Table 1 to 2.6 percent, and in high-income countries from 35.2 percent to 18.6 percent (Table 2). Accounting also for the fact that not all adults aged 15-64 are in the labor force, the estimated economic dependency ratio for this age group ranges from a low of 40.7 percent in low-income countries to a high of 75 percent in lower-middle-income countries. These ratios are large because youths aged 15-22 who are considered part of the adult population are increasingly attending secondary school or tertiary education and not working;[11] in lower-middle-income countries, this age group is a larger share of the population than in the other income groups. Adjusting for data on the labor force participation rates of adults raises the implied total economic dependency ratio across all country income groups from the conventional economic dependency ratio – by 83 percent in low-income countries, almost triple in lower-middle-income countries, about double in upper-middle-income countries, and 71 percent in high-income countries.

[9] Working hours vary greatly among countries. For example, assuming a 50-week working year, average weekly hours range from 27.1 in Germany to 49.1 in Cambodia (Feenstra, Inklaar, & Timmer, 2015).

[10] In the U.S., for example, the proportion of adults over 65 who work full time is non-trivial and this proportion has been increasing over time. In 2005, 65.7 percent of men aged 66-69 and 49.5 percent of women of the same age worked full time; the corresponding shares for men and women aged 70 and over were 51.7 percent and 39.2 percent, respectively (Gendell, 2006).

[11] Secondary and tertiary education enrollment rates expanded greatly over the past 30 years, taking an increasingly significant number of young adults out of the labor force and into colleges and universities (World Bank, 2020). In 2017, the gross enrollment rate in tertiary education was 9 percent in low-income countries, but it was 24 percent in lower-middle-income countries, 52 percent in upper-middle-income countries, and 77 percent in high-income countries. These substantial percentages would have reduced the contribution of young adults to both the income-earning and care work of their families.

Table 2: Economic dependency ratios, adjusted for labor force participation rates, by country income group

Country income groups	Type of dependency ratio	2015	2030
Low-income	Child	105.6	88.1
	Adult	37.6	38.6
	Elderly	4.3	4.7
	Total	147.5	131.4
Lower-middle-income	Child	79.6	66.9
	Adult	68.2	69.2
	Elderly	9.9	14.6
	Total	157.8	150.8
Upper-middle-income	Child	40.4	37.8
	Adult	39.2	42.8
	Elderly	14.0	25.1
	Total	93.6	105.7
High-income	Child	34.0	31.5
	Adult	36.4	33.3
	Elderly	29.0	37.5
	Total	99.4	102.3

Notes: See Eq. 1'.
Source: Authors' calculations using UN World Population Prospects, 2019 revision (United Nations, 2019a); ILOSTAT modelled estimates of labor force participation by age and sex (ILO, 2019).

3. CARE DEPENDENCY: THE EFFECTS OF LABOR MARKET PARTICIPATION AND MORBIDITY PATTERNS

The previous sections adjusted conventional dependency ratios to better represent economic dependency. This section turns to estimating care dependency, still using the UN's definition of dependency ratio as a starting point. We introduce the concept of a *care dependency ratio* to measure future care needs relative to the potential future supply of caregiving in a country.[12] We incorporate morbidity rates into the conventional dependency ratio to account for the effect of health status on future care need, and we change the adjustment for labor force participation in the previous section to better capture those who are potential caregivers.[13] We assume that all young children (aged under 15) need full direct care from parents and other caregivers in the best of times and that the probability of morbidity adds to that care need. Elderly persons who are physically and mentally healthy do not need direct care and may be caregivers themselves when they are not working. However, illness and disability among the young and old intensifies the need for care. A number of conceptual and measurement issues complicate efforts to estimate future care needs; we return to those issues later in this section.

Population trends affect not only economic dependency but also care dependency. As fertility rates fall, particularly in those countries with below-replacement TFR, it becomes easier for parents to care for and invest more resources per child, and the lower pressure to expand public services such as schools frees resources for improving the quality of those services instead. Over the long run, however, persistently low fertility levels mean having fewer future workers to support expanding pension and social security systems for elders (UN, 2017a; Guo, 2012; Stephen, 2012).

Like population trends, labor force participation is closely related to the availability of caregiving, but market work does not necessarily limit one's availability for care work. Adults who are in the labor force also spend time for direct and indirect care activities. However, those adults who are not employed or work few hours, particularly women, are the most likely providers of care. We define potential caregivers as those adults aged 15 and older who are not working, represented as $(1 - p_j)n_j$. As noted in the previous section, it is

[12] The ILO also estimates care dependency ratios, adjusted by healthy life expectancy at 60 using two datasets: total population, disaggregated by age groups, and healthy life expectancy at age 60 (years) (ILO 2018, p. 23). The numerator refers to the people in need of care, defined as children under the age of 15 and older persons at or above the healthy life expectancy age of 60 years old, while the denominator refers to potential care providers, defined as adults between aged 15 and the healthy life expectancy minus six years of age. (ILO 2018, p. 357). Budlender (2010) defined the care dependency ratio as the sum of the population in the age groups 0-6, 7-12, 75-84, and 85+, with the relative weights of 1, 0.5, 0.5, and 1, respectively, divided by the number in the age group 15-74. The relative weights are not derived from data from time-use surveys. The numerator is defined as the number of all people needing care and the denominator is the number of potential caregivers.

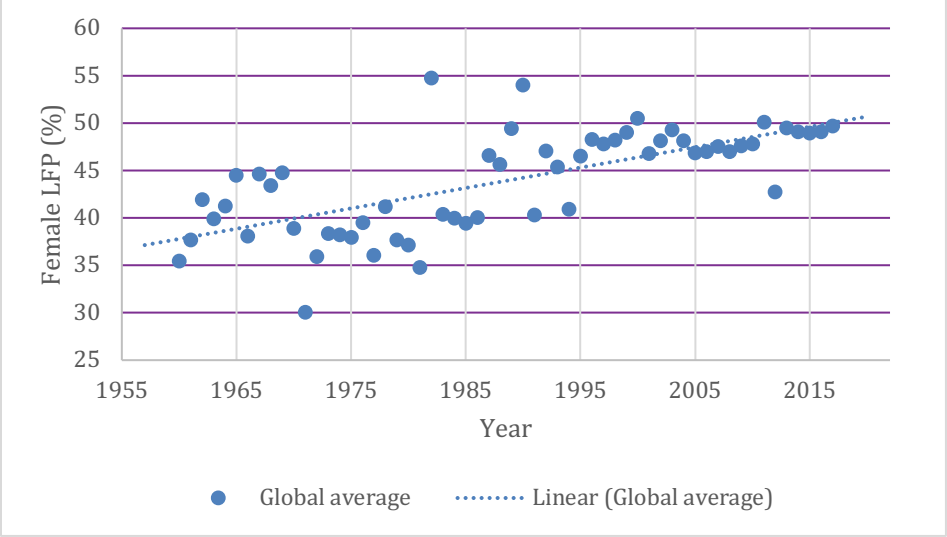
[13] Mortality is already embedded in population projections for any given country or region.

possible to specify *p* flexibly enough such that adults who are not employed full-time can still be caregivers. We continue to impose the assumption that children below the age of 15 are not potential caregivers, in part because data on their unpaid caregiving are generally unavailable.

The burden of caregiving within the household has historically fallen mainly on women and girls (ILO, 2018), so the rising trend in female labor participation intensifies the conflict between market work and family responsibilities and also between unpaid and paid care.[14] Female labor force participation (FLFP) rates have increased from a worldwide average of about 30 percent in 1960 to above 50 percent in 2017 (Figure 4) (ILO, 2019). These rates are highest in low-income countries where families cannot afford to have women not work, but they are also high in high-income countries in North America and Europe. Studies find that individuals are able to balance their employment and caregiving when their care responsibilities are not heavy, but much less so when care work involves more than ten hours per week, particularly for women (Do, 2008; Liu et al., 2010).

[14] Dodson (2013) finds support for this conflict between family care responsibilities and work using interviews and interpretive focus groups of low-income/working class mothers and employers of entry-level workers in the US. Likewise, two systematic reviews of a number of empirical studies on the US, UK, and Canada (Lilly et al., 2007; Meng, 2013) conclude that caregiving is generally associated with lower female labor force participation. It produces a moderate reduction in the number of labor market hours, but the magnitude of that effect varies from almost negligible to six fewer hours of labor market work per week for each additional hour of caregiving (Meng, 2013). In the UK, caregiving men are not likely to leave the labor force or reduce their hours at the beginning of their caregiving commitment; however, those men who have been at this work for a number of years are much less likely to be employed (Meng, 2013).

Figure 4: Annual average global women's labor force participation, 1960-2017



Data source: ILOSTAT (ILO, 2019)

Children and elderly household members assist with care provision. Across many societies, grandparents and older children, especially daughters, share the burden of child care and the care of ill and aged relatives. Studies have found that grandparental childcare significantly increases women's labor force participation (Posadas & Vidal-Fernandez, 2010; Compton & Pollak, 2014; Maurer-Fazio et al., 2011; Zamarro, 2011), suggesting that raising retirement ages might increase seniors' labor supply but at the expense of young women's labor supply. Other studies have also found that older children spend a significant amount of time on care work, including housekeeping tasks and care of young children (Larson & Verma, 1999; Yi et. al, 2012; Yanagisawa et al., 2010; Hunt et al., 2005; Dodson & Dickert, 2004; East, 2010).

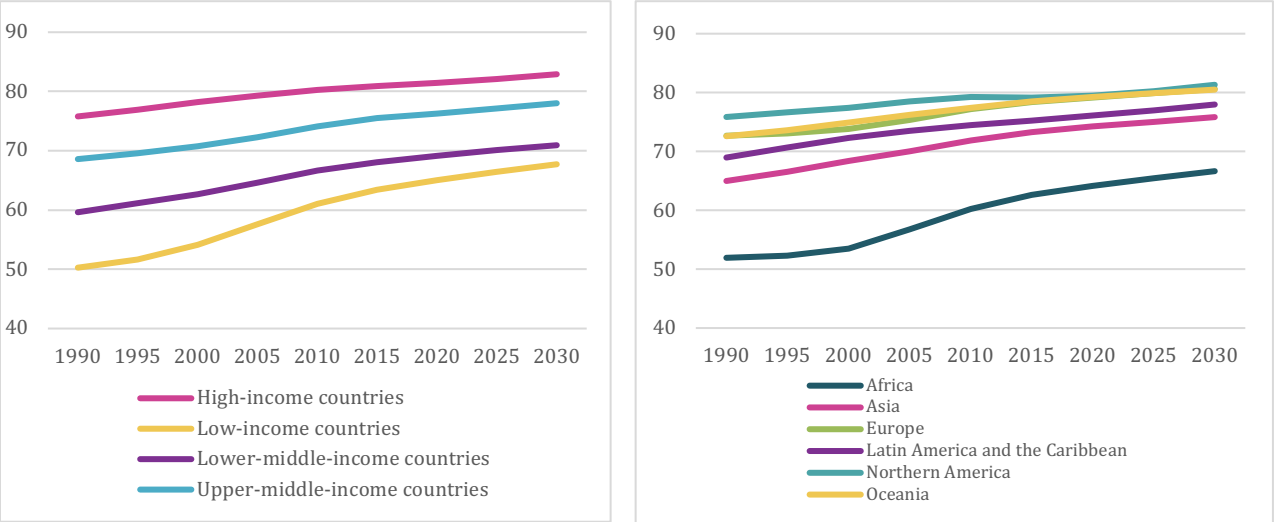
In addition to labor force participation, health status and the nature of illness and disability will determine the need and provision of care in the future. Medical advancements, investments in public health infrastructure (e.g., better water and sanitation services, safer roads, more health clinics), and higher incomes have together increased life expectancy at birth worldwide—from 48 years in 1950 to 72 years in 2016 (Roser, 2018) (Figure 5).[15] The largest increase in life expectancy has been in Africa, rising by 6.6 years between 2000-

[15] Other factors besides health can also explain the changes in mortality and morbidity trends: Rapid urbanization has changed the profile of diseases worldwide, worsening some health problems while improving others (Eckert & Kohler, 2014). Insufficient housing and informal settlements are associated with poor sanitary conditions and congestion, even as landscape changes may reduce malaria transmission (Tatem et al., 2013). Worse air quality from industrial pollution may lead to more respiratory infections (Bygsbjerg, 2012). Traffic-related accidents and industrialization may increase all forms of disability. Violence and crime may cause not only more physical harm but also mental illness (Srivastava, 2009).

[15] Dietary changes, in part due to higher incomes and changes in family life, may result in less hunger but also in a higher risk of diabetes and obesity (Eckert & Kohler, 2014).

2005 and 2010-15 and projected to rise by another 11 years by 2050 (United Nations, 2017b). But longer lives along with shifts in the nature of illness and disability will alter the levels and types of care needed.

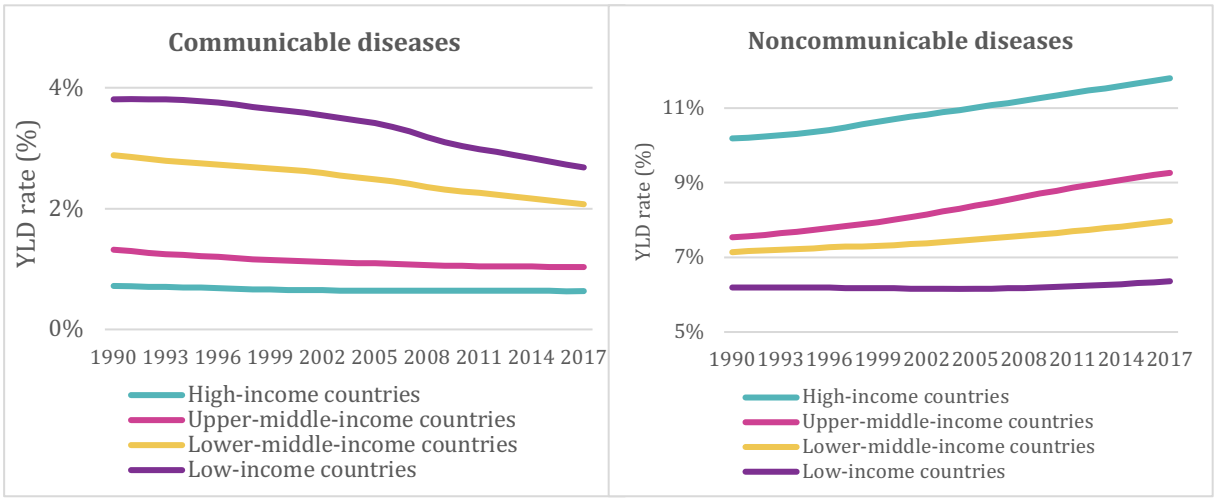
Figure 5: Average life expectancy at birth, by country income group and region, 1990-2030



Source: UN World Population Prospects, 2019 revision (United Nations, 2019a)

According to a multi-country study, an epidemiological transition is evident all country income groups (Global Burden of Disease Study, 2017). The prevalence rates of communicable (infectious and parasitic) diseases are still highest in low-income countries, but the rates across country income groups have been converging to the level in high-income countries (Figure 6). Communicable diseases disproportionately affect young children, and the decline in their prevalence has markedly reduced child mortality and morbidity rates, but older people also account for a growing share of the infectious disease burden in low-income countries.

Figure 6: Years lost due to communicable and noncommunicable diseases



Notes: YLD is the number of years that a person lives with disability.
Data source: IHME Global Burden of Disease Study, 2017 revision (Global Burden of Disease Collaborative Network, 2018).

The opposite pattern holds for noncommunicable (chronic and degenerative) diseases (NCDs), such as cardiovascular diseases and cancer (Global Burden of Disease Study, 2017): the YLDs due to NCDs increase as fast as, or faster than, population growth in each country income group and, relative to population size, their impact is largest in high-income countries. In high-income countries, the burden will fall disproportionately more on elderly people and on women since they live longer than men, on average. In middle-income countries, the burden will be distributed more equally among the elderly and middle-aged adults, including those who are still productively employed. In low-income countries, because of much shorter life spans, the burden of NCDs will fall also at younger ages. By 2030, NCDs are projected to account for more than three-fourths of the disease burden in middle-income countries and more than half in low-income countries.

The rising prevalence of NCDs means that many more elderly people are unable to perform essential tasks of daily life without the assistance of others, but older adults now need care at a later age than was previously the case. With longer lives, the demand for caregiving within families will become more multigenerational, with young adults caring for their children, parents, and grandparents simultaneously. Men living longer than in the past may also mean greater demand for spousal care or sibling care as the population of older adults without a partner or children increases (Verdery et al., 2019).

There are differences across countries, however. Disability due to disease occurs at a younger age in low-income countries than in developed countries (WHO, 2015). In sub-Saharan Africa, the care needs of those over 60 are far higher than those of people of similar ages in more developed settings due to different patterns of morbidity and inadequate

health services. For example, in Ghana, more than 50 percent of those between 65 and 75 years require some assistance with daily activities, and among those 75 years and older, greater than 65 percent (Aboderin & Beard, 2015). In striking contrast, in Switzerland, the corresponding percentages are less than 5 percent and 20 percent.[16]

We combine the population projections by country with the estimates of life years lost due to illness and disability (YLDs) from the 2017 revision of the *IHME Global Burden of Disease Study*. The YLDs are stratified by the source of illness and disability, that is, whether communicable or non-communicable disease.[17] Combining also the adjustments for labor force participation and morbidity rates, we specify the *care dependency ratio as:*

$$\frac{(1+r_c)n_c + r_j n_j}{(1-r_j)(1-p_j)n_j}$$

(Eq 2)

where r_c is the YLD rate for children below 15, and r_j is the YLD rate for adults j aged 15 and above, including elderly persons. Eq. 2 assumes that illness (and/or disability) among young children effectively expands the care needs of the existing number of children by r_c. It also assumes that illness or disability is not necessarily a full-time condition, and so r pertains to a proportion of time lived in disease or disability. The morbidity rates as defined by the IHME project, moreover, reflects the gravity of the illness or disability and not just the proportion of time sick. Finally, we assume that those who are expected to contribute economically to their households by virtue of their age may not be able to do so because

[16] The number of disabled older persons is expected to increase worldwide in the coming decades (Gobbens & van Assen, 2014). The prevalence figures are expected to range from 30 percent for persons aged 75 and older to 40 percent for those persons aged 85 and older. "Disability is commonly defined as experiencing difficulty in carrying out activities that are essential to independent living—difficulties in performing activities of daily living (ADL) and/or instrumental activities of daily living (IADL). ADL functions are essential for an individual's self-care (e.g., dressing and feeding yourself), whereas IADL functions are more concerned with self-reliant functioning in a given environment (e.g., making the beds and shopping)."

[17] The projected YLD rates per 100,000 population are obtained from a straight-line fit to yearly IHME data on each country group in 2010-2016. The rates are grouped by gender and five-year age bins, and the YLD rate is projected for each group. To translate these rates into population numbers for each country income group, we multiply them by the UN population projections for corresponding age and gender groups in each year. Data, methods, and cause categories are described in a technical paper available on the IHME website (Global Burden of Disease, 2016; Disease and Injury Incidence and Prevalence Collaborators, 2017). A disability weight is a weight factor that reflects the severity of the disease on a scale from zero (perfect health) to one (equivalent to death). YLDs are calculated by multiplying the number of cases by duration and weight of disability for the underlying condition. Egalitarian principles are explicitly built into the DALY and YLD metrics, and the global burden of disease studies apply these to all regions of the world. The studies use the same 'ideal' life expectancy for all population subgroups and exclude all non-health characteristics (such as race, socioeconomic status, or occupation) apart from age and sex from consideration in calculating lost years of healthy life. Most importantly, they use the same 'disability weight' for everyone living a year in a specified health state. There are several alternatives to using YLDs and DALYs to measure the burden of disease, including QALYs; these alternatives differ by their focus and by their use of age weighting and discounting. Gold et al. (1996) give a comprehensive review of the differences between DALYs and QALYs.

of disease and disability, and, for the sake simplicity, that children below age 15 are not caregivers, contrary to the experience of many households; the latter assumption can be relaxed if children's time-use data are available. Thus, the *care dependency ratio* assumes that the total burden of providing care to young children, elderly persons, and non-healthy adults is borne by those adults who are not ill and not disabled, (1-r_j) of them, and not working, $(1 - p_j)$ of them. Once again, both r_j and p_j are specified flexibly so that ill or disabled adults and those who work part-time can still provide care.[18]

Once adjusted for morbidity, care dependency is significantly higher in Table 3 than in Table 2. In 2015, the total care dependency ratio in low-income countries is 2.4 times the total economic dependency ratio; in 2030, this falls to 2.2. In high-income countries where morbidity rates are lower, the total care dependency ratio is only 1.1 times the total economic dependency ratio; in 2030, there is hardly any difference between the two ratios. Focusing on the care dependency estimates in Table 3, the care burden declines between 2015 and 2030 but do so unequally across the country groups because of differences in their demographic and epidemiological changes. For example, the total care burden will fall in all country income groups, with this decline being largest in the upper-middle-income countries (18.9 percent) and smallest in the high-income countries (6.5 percent). Aging will increase the elderly care dependency in the three higher income groups. Moreover, recent epidemics, such as COVID-19, Ebola and SARS will likely increase future care dependency ratios beyond what we have been able to project, and the size of their effects will depend not only on the prevalence and duration of those epidemics but also on the severity of their impact on survivors. For example, those who survived the Ebola virus disease present ongoing muscular and joint pain, tiredness, decreased appetite, or vision and hearing problems (Center for Disease Control, 2018), thus needing continuing care, perhaps from both public or paid health services and from family members

Table 3: Care dependency ratios, By country income group

Country income group	Type of care dependency ratio	2015	2030
Low-income	Child	307.6	245.7
	Adult	40.7	38.9
	Elderly	5.8	5.6
	Total	354.1	290.3

[18] We know that even adults who are ill or working in the labor market contribute to caregiving, though perhaps less than do adults who are not employed, so omitting them from the denominator overestimates the care burden. For this reason, conceptually r and p should not be defined as (0,1) variables. Note that the morbidity rate *r* is already calibrated for the gravity of the illness or disability as well as for the proportion of time spent ill or disabled, such that even those adults who are ill or disabled (i.e., who are not able to walk or are hearing impaired) can be caregivers. One statistical caution is that illness and disability are reasons why some adults are not in the labor force, so observed labor force participation rates compound the effects of illness and work-seeking behavior, perhaps exaggerating the adjustments made if the rates cannot be disentangled.

Lower-middle-income	Child	123.4	97.0
	Adult	25.6	24.2
	Elderly	5.3	6.9
	Total	154.3	128.0
Upper-middle-income	Child	91.8	68.8
	Adult	31.4	25.9
	Elderly	9.4	13.6
	Total	132.6	108.3
High-income	Child	65.7	57.2
	Adult	29.7	27.6
	Elderly	15.7	19.6
	Total	111.1	104.4

Source: Authors' calculations using UN World Population Prospects, 2019 revision (United Nations, 2019a); ILOSTAT modelled estimates of labor force participation by age and sex (2019); and IHME Years lost to disability (YLDs), 2017 revision (Global Burden of Disease Collaborative Network, 2018)

A number of conceptual and measurement issues are worth noting when estimating future care needs. As previously mentioned, labor force participation rates and the assumption that children younger than 15 are not care providers tend to underestimate potential care supply. Labor force participation rates do not distinguish between full-time and part-time work and the definition of this work intensity differs, both by custom and regulation, across countries. Furthermore, the informality and place of work influence whether employed individuals are able to combine market work with unpaid caregiving. Finally, a proportion of those who are employed are actually employed as paid care providers; the size and nature of this paid care sector vary across countries. Further exploration of available data is needed to adjust the estimates of the extensive and intensive margin of the care burden for the use of paid services.[19] For all these reasons, the projections in Table 3 should be interpreted as upper-bound estimates of the extensive margin of the care burden.

4. ESTIMATING THE INTENSIVE MARGIN OF CARE NEED

Eq. 2 defines the extensive margin of care need relative to the potential supply of care. In this section, we estimate the intensive margin of care, which depends on the varying level of care needed by individuals of different ages and health status. We use time-use data to

[19] Home care rather than paid center-based care is relatively more common in lower-income countries than in high-income countries. According to an ILO report (2018), paid domestic workers accounted for 3.6 percent of all paid employees worldwide in 2018, but there is wide variation across countries. In Africa, these workers accounted for 4.9 percent; in Latin America and the Caribbean, 11.9 percent; in Asia, excluding China, 4.7 percent; and in advanced countries, 0.9 percent.

estimate a measure of the intensive margin for unpaid care provided within the household, although factoring time spent into Eq. 3 is still only a partial elaboration of care needed and given. We illustrate the methodology using time-use survey data from Ghana, Mongolia, and South Korea.[20] We recognize the limitations of time-use data in accurately measuring the amount of time spent on caregiving, but hope that future improvements in time-use surveys will yet produce the best resource for estimating the intensive margin of the care burden. These three countries have very different family structures and average household sizes, so they allow us to examine how care patterns differ and how they are similar in different country settings.

4.1 FROM CARE DEPENDENCY TO THE INTENSITY OF THE CARE BURDEN

Previous work by Durán Heras (2012), Budlender (2010) and others estimate the care burden in households by creating unpaid care scales derived from "expert opinion" about the care needs of people of different age groups and the required time of care for them.[21] These scales do not provide the level of unpaid care but instead indicate the relative time spent on different household members. Our proposed estimation of the intensive margin of care need is based on data from time-use surveys which allow us also to compare the time spent caring for a young child relative to an elderly person as well as to measure the contributions of different household members to this care.

Time-use survey data are typically available by type of care activity (e.g., care of a young child aged 0-4, care of elderly persons, housekeeping) reported by the survey respondent, but not by a specific care receiver.[22] Using the total time spent on a direct care activity by

[20] Time-use data have been collected in about 90 countries using generally harmonized surveys (Buvinic & King, 2018; Charmes, 2019), but the surveys are designed primarily to measure activities rather than responsibilities. The difference in these two concepts is key to understanding the burden of care. For example, most surveys capture direct care but not time on supervisory or "on-call" responsibilities for children and frail elderly persons which can be far greater than active direct care (Folbre, et al., 2005; Ironmonger, 2004). Moreover, both active and supervisory direct care are often conducted in conjunction with indirect activities, resulting in underestimates of time spent on total unpaid care work (Folbre & Yoon, 2007; Floro & Miles, 2003). "Indirect" care (or "support" care) which encompasses a host of activities that provide for the basic well-being of household members, including cooking, shopping, cleaning, and laundry, is often unreported by unpaid caregivers, leading to underestimates of the total time spent on unpaid care work.

[21] Some scales take into consideration the composition and health of the dependent age group, while others don't. For example, the Freetown scale developed by Rogero-Garcia (2012, as cited by Durán Heras (2012), applies a weight based on the percentage of life with poor health and the availability or absence of public services. In the case of the Santiago de Chile scale, Durán Heras used a subjective assessment of the demand for care by twenty-one ECLAC experts in social affairs and statistics (2012, p. 435). Each expert-participant prepared his/her own scale to weight care demand, using the central age group (15-64 years) as the reference group, and these scales were averaged to produce the Santiago I scale. The resulting care weights are then applied to the population in the corresponding age groups. See Endnote 12 for Budlender's (2010) scale.

[22] Data collection design and methodology of time-use surveys differ across countries. Statistical agencies make various decisions regarding the activities performed (granularity of activities and simultaneity), when to ask (seasonality consideration), whom to talk to, and how to treat those activities (richness of coding of

caregiver *k* and the number of each type of care receiver, we can compute the average direct care time per recipient given by individuals in group *k* as $w_{c,k}$ and $w_{j,k}$, where the subscripts *c* and *j* pertain, respectively, to the care of young children and of adults who need care, be they elderly or not. Similarly, we can calculate the per-recipient average indirect care time by using data on tasks that are not directed towards a particular person, such as cooking, cleaning, and other housework. We make the simplifying assumption that every individual benefits equally from such care work at a per-capita level *h* provided by caregiver *k*. This implicitly assumes that there are no economies of scale in indirect care, as we do for direct care, and that those individuals who provide indirect care also benefit from such care work. Such a per-receiver direct or indirect care time or "care weight" is defined as,

$$w_{m,k} = \frac{\sum t_{m,k}}{n_m} \qquad \textit{(Eq 4)}$$

where *t* is the time for (direct or indirect) care reported by caregiver group *k*; n_m refers to the number of individuals in the recipient group *m* (children or elderly for direct care, and all household members for indirect care).

Applying these care weights to the numerator in Eq. 2 yields a measure of the time intensity of care dependency in the population, or the *care intensity dependency ratio* in the population. Differentiating between direct (*d*) and indirect (*h*) care, the direct care weights are $\boldsymbol{d_{c,k}}$ and $\boldsymbol{d_{j,k}}$ for caregiver *k*, and the indirect care weights are $\boldsymbol{h_k}$. Aggregating across the population segments *c*, *j* and *k*, Eq. 4 represents the intensive margin of the care intensity dependency ratio in the population,

$$\frac{d_{c,k}n_c + d_{j,k}n_j}{(1-r_{j,k})(1-p_{j,k})n_{j,k}} + \frac{h_k(n_c+n_j)}{(1-r_{j,k})(1-p_{j,k})n_{j,k}}$$

$$= \frac{(d_{c,k}+h_k)n_c + (d_{j,k}+h_k)n_j}{(1-r_{j,k})(1-p_{j,k})n_{j,k}} \qquad \textit{(Eq 5)}$$

where $\boldsymbol{d_{c,k} = w_{c,k}(1+r_c)}$ and $\boldsymbol{d_{j,k} = w_{j,k}r_j}$.

Thus far, the care weights *d* and *h* which represent total direct and indirect care do not distinguish between paid and unpaid caregiving. Each of these care weights should have a paid care component, but household-based time-use surveys from which we derive care weights collect data only on the unpaid care of household members. This data limitation implies that these care weights, as well as the intensive margin of total care needs, are underestimates to the extent that households supplement unpaid caregiving with paid care

responses). A summary of which activities are included in the direct and indirect care variables for each country can be found in Table A3.

services (e.g., using paid workers to clean house or prepare meals, or to mind a young child). This underestimation will be larger in the countries where households are more likely to use paid care services and where the market for paid care services is more developed.[23]

The weights derived from time-use data for Ghana, Mongolia, and South Korea are presented in Table 4. The first two rows for each country refer to the average direct care time received by a child and by an elderly person in the households that report the respective activity. These time data are sums of time reported for all members of the household.[24] As noted above, this direct care time could be an underestimate of the total direct care time received by a child or an elderly person if paid care is used to supplement unpaid care time. The third row is the average indirect care time spent in activities such as cooking, cleaning, laundry, computed as the total unpaid indirect care time divided by household size. This too would be an underestimate if the household supplements unpaid indirect care time with paid services from, say, domestic workers. Overall, the total (direct and indirect) unpaid care time per recipient per day is just a little over an hour in Ghana, closer to two hours in Mongolia, and more than four hours in South Korea.

Table 4: Average unpaid care time per recipient in Ghana, Mongolia, and South Korea, By gender of caregiver and type of care

Country	Care per recipient (minutes/day)	Female	Male	Total	Female share (%)
Ghana	Direct child care	21.3	3.0	24.3	87.5
	Direct elderly care	4.1	1.8	5.9	70.0
	Total indirect care	28.9	4.6	33.6	86.2
	Total care time	54.3	9.4	63.7	85.2
Mongolia	Direct child	38.6	8.8	47.4	81.5
	Direct elderly	3.2	0.5	3.7	86.1
	Total indirect	28.5	23.2	51.7	55.2
	Total care time	70.4	32.5	102.9	68.4
South Korea	Direct child	117.8	30.3	148.2	79.5
	Direct elderly	5.9	2.9	8.7	67.0
	Total indirect	77.9	15.9	93.7	83.1
	Total care time	201.6	49.1	250.6	80.4

[23] Time-use surveys do not collect time from paid or unpaid non-resident caregivers, though some of the time-use surveys collect data on time exchanges between households, thus, recording time given by a household member to care for members in another household but not time received from another household. At the country level, however, if a time-use survey is nationally representative, then data from that survey should be able to capture the aggregate levels of time given and time received.

[24] Not all time-use surveys collect data on all household members (Buvinic & King, 2018). We chose these three countries partly because their time-use surveys do. For our estimates, the averages for child and elderly care are estimated only for the households that reported nonzero time for direct child or elderly care. At the country level, this estimation approach allows us to include interhousehold exchanges of direct care time. Hence, households that do not have either a child or an elderly member but reported nonzero time for such care category contribute are captured in our national averages. The implicit assumption is that such reported care time is unpaid and thus not reported as paid work.

Notes: These averages are the care time in minutes/day provided by an adult caregiver per care recipient. Total time needed is calculated according to eqn. 5 and represents the numerator of that equation; that is, the total estimated care demand in each category, based on time use data, population projections, and estimates of morbidity and labor force participation.
Data sources: Authors' calculations using 2009 Ghana Time-Use Survey, 2011 Mongolia Time-Use Survey, 2014 South Korea Time-Use Survey; UN World Population Prospects, 2019 revision (United Nations, 2019a); ILOSTAT modelled estimates of labor force participation by age and sex (2019); and IHME Years lost to disability (YLDs), 2017 revision (Global Burden of Disease Collaborative Network, 2018).

Breaking down the total care need into its components, the relative magnitudes of child and elderly care time and indirect or support care are quite different in the three countries. In Ghana, on average, each child aged 0-14 receives 21 minutes of direct care per day from all female caregivers, each elderly member aged 65 and over receives 4 minutes per day, and each household member of any age receives 36 minutes of indirect care per day. Children and elderly receive very little direct care from men (a total of just five minutes per day, on average, from all male caregivers), and men undertake very little indirect care. In contrast, reflecting the different typical household composition in South Korea and perhaps also the different expectations about the time parents should invest in each child, there a child receives 118 minutes per day of direct care from all female members of the household and 30 minutes per day from all males.[25]An elderly person receives an average of 6 minutes per day of direct care from females and about 3 minutes from males. We note that these direct care for elderly persons do not include meal preparation or housecleaning that also help the elderly; these activities are included as indirect care. Women in the household provide 78 minutes per day in indirect care activities for each household member while men spend 16 minutes per member per day in those activities.

In Mongolia the time spent on direct child care by women and men falls between the averages in Ghana and South Korea—39 minutes per day per child by women and 9 minutes by men. Mongolian women spend about the same amount of time on indirect care per recipient as do Ghanaian women, but Mongolian men's indirect care time greatly exceeds that of men in the other two countries. Quite striking is that Mongolian men provide almost as much time for indirect care activities as women do. One explanation given for this is its socialist legacy which emphasizes co-responsibility for household work, from winter risk management to childrearing, and a collective work ethic, especially in the steppes (Ericksen, 2014).

The last column of Table 4 summarizes the gender allocation of unpaid care time. Across all three countries, the bulk of care work per recipient is borne by women in the household. Of total care time, women contribute 85 percent in Ghana and 80 percent in South Korea, with Mongolia being an outlier as women's share there is 68 percent. In all three countries, women contribute at least 80 percent to child care, but the country patterns are different

[25] To confirm that the country differences are due not only to economies of scale but also to differences in care preferences that may in turn be affected by and arrangements, we compare the direct care time averages across the countries holding constant the number of children in the household; Figure A3 supports the striking per-child direct care time differences among the three countries.

for elder care and indirect care. Women's share accounts for 70 and 67 percent of elder care and 86 and 83 percent of total indirect care time in Ghana and South Korea, respectively. In Mongolia, women's share of 86 percent of elder care, but only 55 percent of indirect care. The gender pattern of women bearing the heavier load of unpaid care work is similar to that noted in previous studies (ILO, 2018).

The reasons for these marked country-specific differences in caregiving are closely linked to household structure and care norms (Table A2) as well as to the level of economic development.[26] On household structure, Korean households tend to be nuclear families with very few children; the total births per woman in 2019 was 0.92. In contrast, Mongolian and Ghanaian households tend to be multi-generational households, with grandparents being expected to help with care responsibilities, and typically have more children—2.89 and 3.87 total births per woman, respectively. The level of economic development in the three countries influences too the amount of time and resources that families typically invest in each child because of prevailing views about the level of human capital that is associated with having a good job.[27] However, we note that in Ghana and Mongolia, the reported child care could be underestimated if a larger portion of child care is undertaken as a secondary activity or as supervisory care compared to South Korea and thus not captured by time-use surveys.

The principal means of livelihood in the three countries are also very different. South Korea is highly industrialized, with 25 percent of workers being employed in manufacturing and 70 percent in services in 2019, and it has the largest formal sector. By comparison, Mongolia and Ghana are significantly more agricultural, but these two economies are also different from one another. The Mongolian economy has traditionally depended on nomadic, pastoral agriculture, while Ghana's agriculture relies on crop farming (e.g., corn, rice, millet, sorghum). The nomadic lifestyle of the rural population in Mongolia and its dependence on livestock raising where men are primarily responsible for long-distance herding, building, and repairing winter and spring shelters, often taking their young sons with them (Cooper & Gelezhamstin, 1994),[28] may explain men's high participation in care work, along with Mongolia's socialist past which we have already mentioned.

[26] The per-capita GDP levels of the three countries vary widely—US$ 4,212 in Ghana, 12,245 in Mongolia, and 36,776 in South Korea in 2011 constant purchasing power parity (PPP) dollars (World Bank Development Indicators, 2020).
[27] In South Korea, the expected completed years of schooling is 16.4, as compared with 14.2 and 11.5 in Mongolia and Ghana, respectively (UNDP, 2020).
[28] In pastoral areas such as steppes, women are responsible for herding small stock and milking, in addition to performing domestic tasks such as product processing, cleaning, washing, and sewing (Cooper & Glezhamstin, 1994). Older boys and girls help collect wood for fuel and water (Terbish & Floro, 2016). This gender division is common in steppes, given the number of workers within the household.

4.2 THE INTENSIVE MARGIN OF CARE FOR GHANA, MONGOLIA AND SOUTH KOREA

Table 5 presents our estimates of the intensive margin of future care need in each country in thousands of hours per day for each type of recipient, and translates this need into full-time equivalent workers per week, where full-time work is defined alternatively as 40 or 48 of work hours per week. We consider full-time and part-time market work in our estimation in part to acknowledge that part-time workers are more likely to be unpaid caregivers in the home than full-time workers and in part to limit the maximum time that we assume individuals to spend on both market and care work and thus recognize that caregivers have a right to time for self-care.[29]

[29] The unadjusted LFPR does not reflect the proportion of workers who work full-time and that who work part-time. Table A4 shows the differences in the LFPR of women and men in the three countries, as well as how those rates change when adjusted for hours of work. Using alternative definitions of full-time work to adjust the LFPR, we see shifts in the relative ranking of the countries by these rates. Based on the unadjusted LFPR, Mongolia has the lowest rates for women and men in either age group among the three countries. Among men, Korean men have the highest LFPR; among women, Ghanaian women do. Adjusting for full-time equivalent work, the countries' relative positions change for both women and men, but only for those aged 15-64. Adjusting for 40-hour per week full-time work, Mongolia now has a higher LFPR for both men and women than Ghana. This is because of the higher average work hours in Mongolia (51 hours per week). The adjusted LFPRs in Korea are hardly different from the unadjusted rates for women though they are much higher for men. Ghana's adjusted LFPRs are much lower than the unadjusted rates, especially for women.

Table 5: Unpaid care need in the total population by age groups in Ghana, Mongolia, and South Korea

Country	Recipient age group	In 000s hours/day		Assuming 40-hour work week				Assuming 48-hour work week			
				000s full-time equivalent workers/day		As % of labor force 15+		000s full-time equivalent workers/day		As % of labor force 15+	
		2015	2030	2015	2030	2015	2030	2015	2030	2015	2030
Ghana	Child	10547	12754	1318.4	1594.2	11.3	9.7	1098.6	1328.5	9.4	8.1
	Elderly	491	922	61.4	115.2	0.5	0.7	51.2	96.0	0.4	0.6
	Adult	9159	13029	1144.9	1628.7	9.8	9.9	954.1	1357.2	8.1	8.3
	Total	20198	26704	2524.7	3338.1	21.6	20.4	2103.9	2781.7	18.0	17.0
Mongolia	Child	1458	1744	182.3	218.1	14.2	15.4	151.9	181.7	11.8	12.8
	Elderly	102	224	12.7	27.9	1.0	2.0	10.6	23.3	0.8	1.6
	Adult	1738	2088	217.2	261.0	16.9	18.4	181.0	217.5	14.1	15.3
	Total	3298	4056	412.2	507.0	32.0	35.7	343.5	422.5	26.7	29.8
South Korea	Child	28900	22090	3612.5	2761.3	13.2	10.0	3010.4	2301.1	11.0	8.3
	Elderly	10447	20172	1305.9	2521.5	4.8	9.1	1088.2	2101.3	4.0	7.6
	Adult	58239	51770	7279.7	6471.2	26.5	23.4	6066.4	5392.7	22.1	19.5
	Total	97585	94033	12198.1	11754.1	44.5	42.5	10165.1	9795.1	37.1	35.4

Notes: Estimates of full-time equivalent workers per day assume 40 hours of workhours per week. "Child" is the sum of direct care and indirect care provided to children ages 0-14 per child; "elderly" is the sum of direct care and indirect care provided to adults ages 65 and above per recipient; "adult" is the indirect care provided to adults ages 15-64 (adults do not receive direct care by assumption); "total" is the sum of the preceding three figures. These estimates of the unpaid care burden reflect the current use of paid care services; the projections for 2030 assumes that the use of paid care services remains constant between 2015 and 2030. See Eq. 5.

To underscore the large magnitude of unpaid care need, we express our estimates in terms of the number of paid care workers who would be needed if unpaid caregivers were replaced with paid care workers, and also in terms of their full-time equivalent share of the labor force (Table 5). This thought experiment illustrates what proportion of the future work force would have to perform full-time care work in order to meet the country's future unpaid care need. Using 40 hours to define full-time work, in Ghana the total care need would be equal to 20.4 percent of the labor force in 2030. The corresponding shares in Mongolia and South Korea would be 35.7 and 42.5 percent, respectively. Using 48 hours as full-time equivalent work, these percentages would, of course, be smaller but they would be large nonetheless, illustrating the heavy pressure of future care needs in these economies. By using the same time-use data for the 2015 and 2030 estimates, we implicitly hold care norms and care arrangements constant. The changing care needs for children and elderly in Table 5 are thus due mostly to lower fertility rates (in Ghana and South Korea) and the relative aging of the population (especially in South Korea). In absolute terms, child care needs would rise in both Ghana and Mongolia but fall in South Korea; however, due to unequal changes in the labor force in the three countries, the share of the labor force

needed to replace unpaid care would fall in Ghana and South Korea but rise in Mongolia. The need for elder care would approximately double in the three countries, and whether one assumes a 40- or 48-hour equivalent work, meeting this care need would require employing a larger proportion of their labor force.

Two notes about estimating the intensive margin of care need are worth mentioning here. *First*, although we prefer to use time-use data from surveys that collect data from all members of the household in order to form a complete picture of care time within the household, this is not a requirement for estimating an aggregate measure of care dependency as long as the data for the population segments *c*, *j*, and *k* are nationally representative. *Second*, due to data limitations, our estimates of future care need are based on the implicit assumption that the current arrangements for child care, elder care, and care support activities in the household stay the same, including the use of paid care and unpaid care. Care arrangements, however, have been shifting as a result of several forces that we can already observe. Economic development processes and the manner in which these interact with social norms and practices can change gender roles. For example, an increased demand for secondary and post-secondary education would make older children less available to help with unpaid care work, especially if they have to move out of the home at least during the academic year. Greater urbanization that is accompanied by higher residential prices could increase the prevalence of nuclear households, breaking kinship networks and making co-residence with older relatives less affordable and thus reducing unpaid care for those relatives. A rise in the labor force participation of women would make child and elder care and even indirect care activities harder to meet through unpaid care, increasing the demand for paid child and elder care and indirect care services. The magnitude of future care needs also implies that the tension between the competing time demands of care and market work will increase. Analyzing multi-year data from time-use surveys can reveal the shifts in these care arrangements and provide policymakers a way to anticipate the need for paid care services.

5. SUMMARY AND POLICY IMPLICATIONS

Our projections of the future extensive and intensive margins of care need and the care burden demonstrate the importance of care work in every country income group. With appropriate caveats, they illustrate the impact of demographic trends, epidemiological changes, and labor market shifts on the number of people who will need care and who can provide care, but the picture of the level and intensity of future care needs is incomplete without considering time-use data on care work. We have illustrated the concept of the intensive margin for three countries, Ghana, Mongolia, and South Korea. While there are now about 90 countries that undertake time-use surveys, most of those surveys do not provide a full picture of the care need in the household because they query only selective household members and most miss secondary activities and supervisory care. As the number of more complete time-use surveys increases, these methods can be replicated for

a range of other countries. More comparable data across countries, such as on the supply and use of paid care services for child care and elder care, are also needed in order to obtain better estimates of the care burden on households.

Our estimates clearly illustrate the influence of social norms on the division of labor, the gender allocation of roles and responsibilities, and time use on the potential demand for and supply of caregiving in these countries. They further show that the care burden borne by unpaid household members is quite large relative to the size of the paid labor force, and emphasize that care policies should be a key part of development policy for many countries. Estimating the magnitude of the future care burden is useful for assessing the importance of care burden issues and for motivating the policy discourse on those issues. Thus far, care burden issues have been accorded relatively low political priority because of the belief that caregiving is primarily the responsibility of the family and has little impact on economic development and growth. In reality, care work contributes to the development and maintenance of human capabilities which provide important positive spillovers for living standards, quality of life, and sustainable economic development (Folbre, 2012). Indeed, measures to address the changing demand for caregiving should be embedded in a broader, gender-aware, strategic plan involving care, macroeconomic considerations, social protection, and labor policies. More options for caregiving in the form of public and market services and financial support can expand the capabilities and choices of women and men to meet their families' multiple care needs.

Economic policies regarding care should aim to reduce the care burden, particularly on women, with investments designed to enhance the productivity of unpaid work and to encourage the sharing of care work. Governments around the world have already begun implementing policies with these goals. To illustrate, in Japan and Korea, the expansion of Long-Term Care Insurance (LTCI) allows families to purchase private care services through government-employer sponsored individual savings plans. Singapore gives tax support for adult child-elderly parent co-residence, and tax and immigration policy support for foreign domestic care workers (Peng & Yeandle 2017). In several Latin American countries, early child development and care policies cover children 3–7 years of age, in some cases with almost universal and free coverage (Esquivel & Kaufmann, 2017; Neuman, Josephson, & Chua, 2015). In Norway, progressive taxation and benefit transfers aim to encourage a more egalitarian division of labor in the home and to promote women's participation in the labor market while pulling men toward household work (Kitterød & Lappegård 2012).

Employers have an important role in supporting the care needs of employees and their families. The costs of not undertaking this role are clear. For employees, the lack of access to high quality and affordable care for children and the aged force many women to leave their jobs, take more time off, or choose lower-paying positions in exchange for flexibility in work hours. For employers, the care burden of employees at home could mean higher turnover and absenteeism rates, lower employee productivity, and greater difficulty in recruiting skilled workers (International Finance Corporation, 2017). Providing subsidized or free worksite care centers can benefit both employers and employees.

Other public policies such as investments in basic infrastructure that result in more affordable and easier-to-access safe water supply and sanitation services and in better roads and transport systems can release the time of household members for other productive activities. In Uganda, for example, better water supply is both a poverty reduction measure and a critical support to women and girls who spend significant time fetching water (Karimli et al., 2017). Lastly, migration policies that recognize that migrant workers can expand the supply of paid care workers can have an enormous impact on the well-being of both caregivers and care recipients. Several OECD countries have used temporary foreign workers to help fill gaps in their labor markets, especially during seasonal peaks and critical economic recovery periods (King-Dejardin, 2018).

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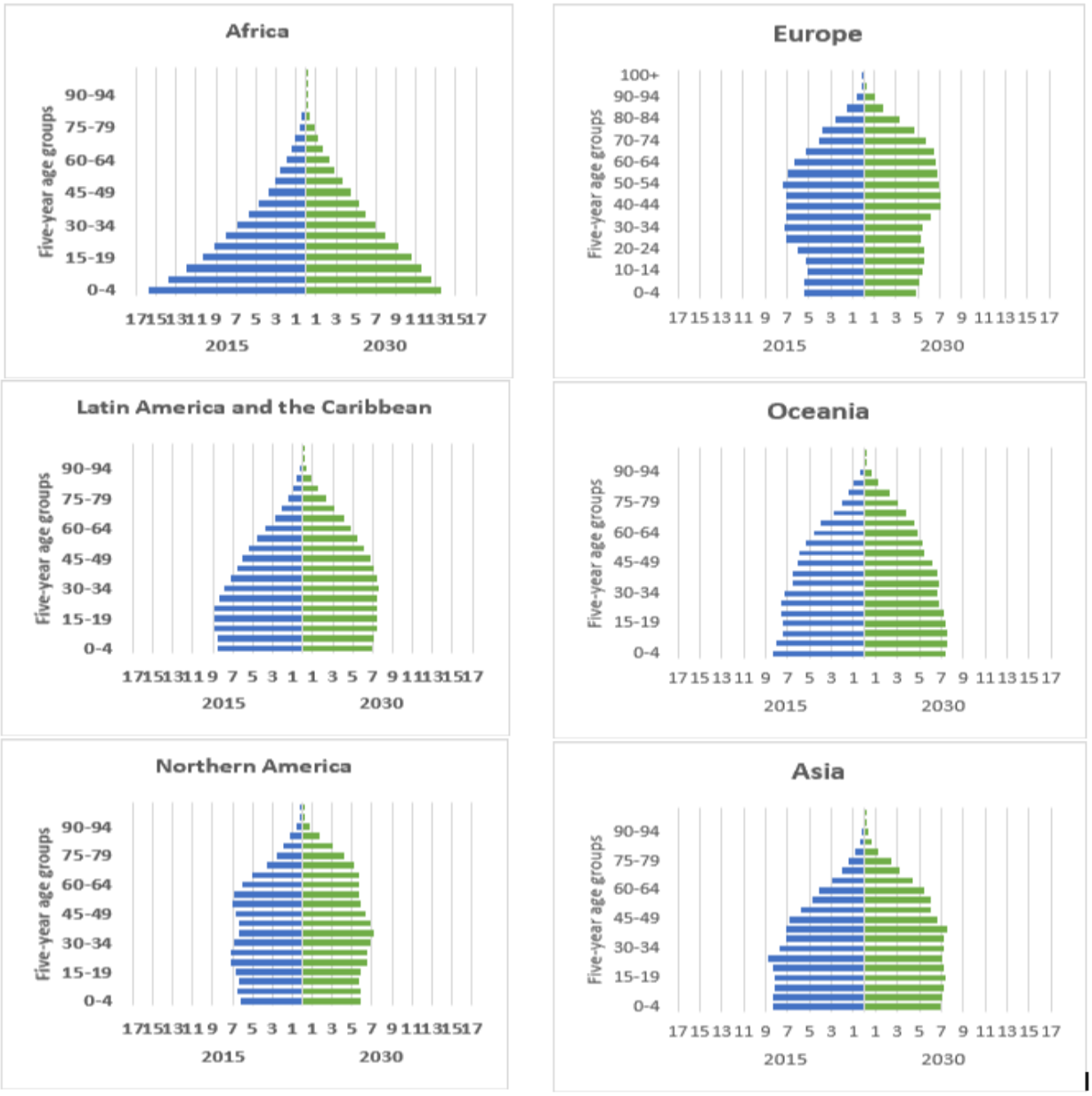
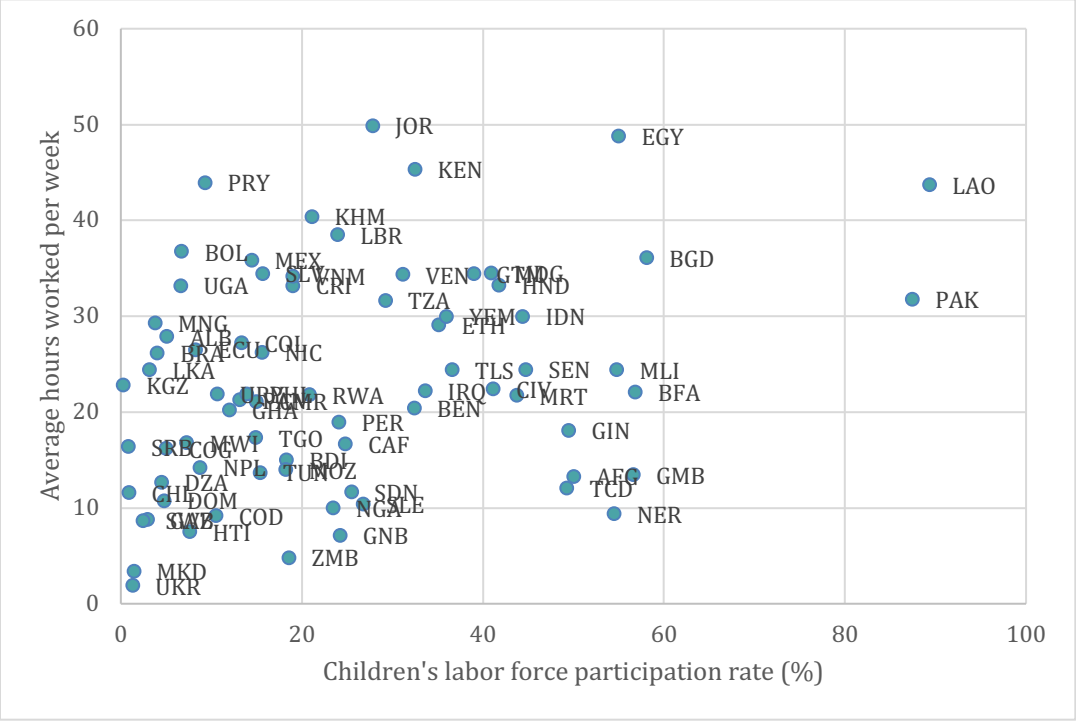
APPENDIX, FIGURES AND TABLES

Figure A1: Age-gender population pyramids, 2015-2030, by geographical regions



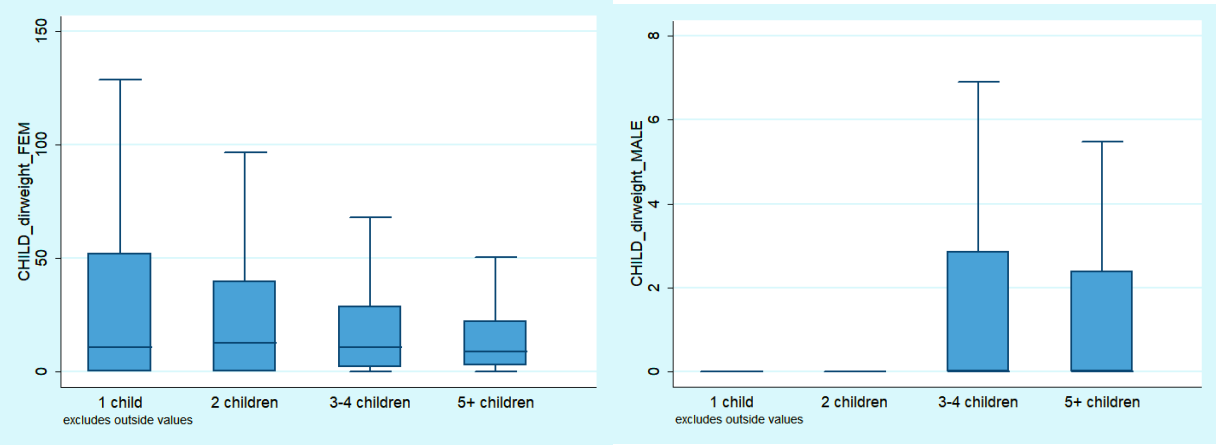
Data source: UN World Population Prospects, 2019 revision (United Nations 2019a). Middle Eastern and North African countries are included in Asia or Africa.

Figure A2: Labor force participation rates and average weekly hours worked, children aged 7-14, latest year of data

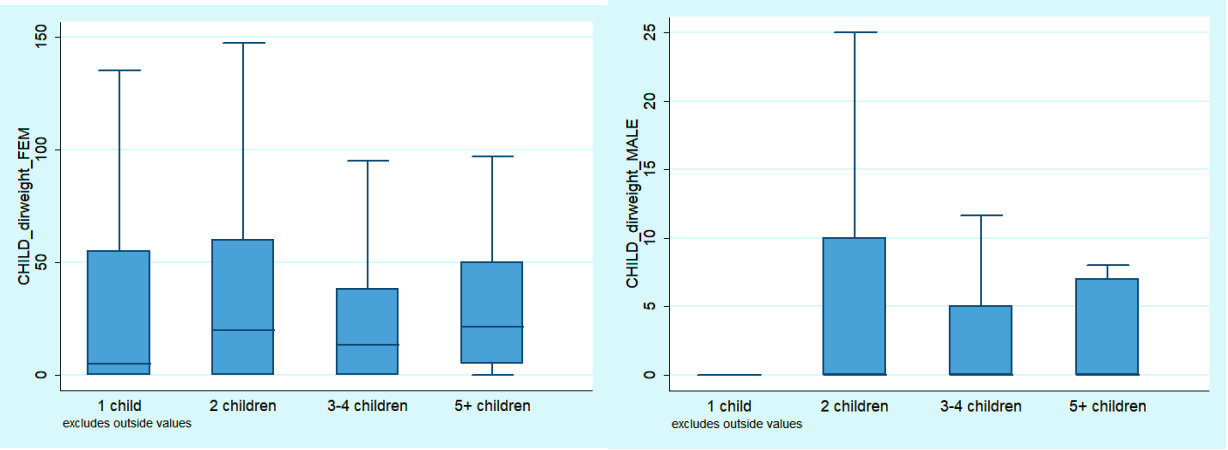


Data source: World Development Indicators, last year available for each country; extracted February 2020

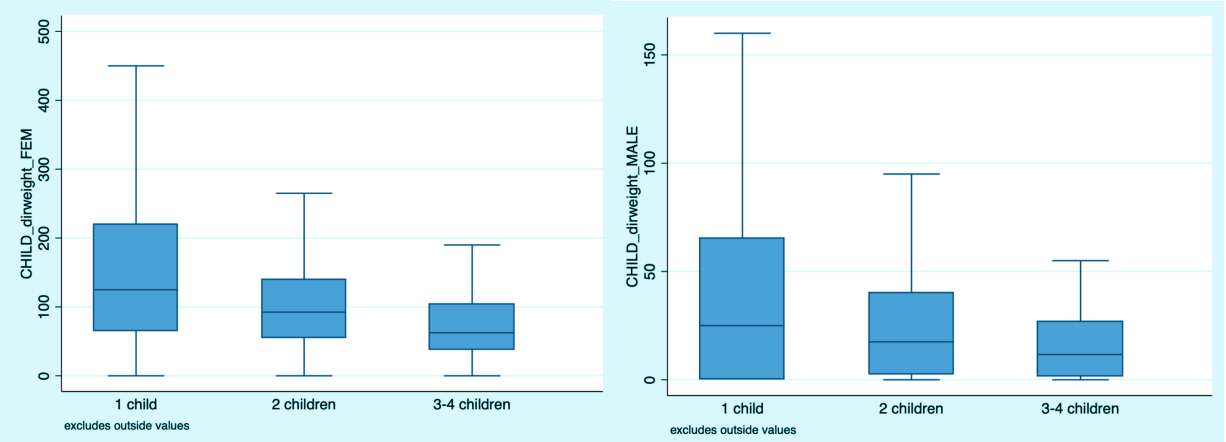
Figure A3. Mean and median values of unpaid child care time, by number of children



(a) Unpaid child care time by number of children in the household, Ghana



(b) Unpaid child care time by number of children in the household, Mongolia



(c) Unpaid child care time by number of children in the household, South Korea

Data sources: Authors' calculations using 2009 Ghana Time-Use Survey, 2011 Mongolia Time-Use Survey, 2014 South Korea Time-Use Survey, the 2019 revision of the UN Population Prospects; ILOSTAT modelled estimates of labor force participation by age and sex (2019); and IHME Years lost to disability (YLDs), 2017 revision.

Table A1: Economic dependency ratios by world region (%)

	Type of dependency ratio	2015	2030
Africa	Child	74.1	64.0
	Elderly	6.1	6.8
	Total	80.2	70.8
Latin America & the Caribbean	Child	38.5	31.8
	Elderly	11.6	17.9
	Total	50.1	49.7
Northern America	Child	28.5	27.7
	Elderly	22.3	33.0
	Total	50.8	60.6
Europe	Child	23.7	24.1
	Elderly	26.4	37.0
	Total	50.1	61.1
Oceania	Child	36.8	35.6
	Elderly	18.1	24.3
	Total	54.9	59.9
Asia	Child	36.2	31.4
	Elderly	11.0	17.6
	Total	47.2	49.0

Source: UN World Population Prospects, 2019 revision (United Nations 2019a).

Table A2: Specific activities included in time-use survey care categories, Ghana, Mongolia, and South Korea

	Child Care	Elder Care	Indirect Care
Ghana	Physical care of young children	Physical care for adults	Food management
	Teaching, training, and helping children	Emotional care and support for adults	Cleaning and upkeep of dwelling and surroundings
	Accompanying children to places	Accompanying adults to places	Do-it-yourself decoration, maintenance and small repairs
	Minding children (passive care)		Care of textiles and footwear
			Household management
			Shopping for/purchasing of goods and related activities Shopping for/availing of services and related activities Travel related to provision of unpaid domestic services Unpaid domestic services not explicitly covered by the above
Mongolia	Caring for pre-school age and school-age children/physical care	Caring for dependents adults/physical care	Preparing meals/snacks and cleaning up after food preparation/meals/snacks
	Reading, playing and talking to children	Caring for the ill, disabled, and bedridden	Hand-washing; loading/unloading washing machine
	Assisting with school work	Other activities related to caring for dependent adults	Indoor and outdoor cleaning
	Meeting with teachers and attending parent-teacher meetings		Shopping for/purchasing of goods and related activities
	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
South Korea	Physical care of children aged 0-9	Medical care for non-household parents	Cooking and washing dishes
	Educational activities with children aged 0-9	Other caring activities for non-household parents	Laundry and clothing repair
	Reading and playing with children aged 0-9	Medical care for non-household family members	Home cleaning and taking out trash

	Providing medical care for children aged 0-9	Other caring activities for non-household family members	Home repairs and maintenance
	Other care for children aged 0-9	Travel related to elder care	Shopping
	Physical care of children aged 10-17		Organizing and managing the household
	Helping with homework and study for children aged 10-17		Other household chores
	Providing medical care for children aged 10-17		Travel related to indirect care
	Other care for children aged 10-17		
	Travel related to child care		

Data sources: 2009 Ghana Time-Use Survey, 2011 Mongolia Time-Use Survey, and 2014 South Korea Time-Use Survey.

Table A3: Household composition by age group, Ghana, Mongolia, and South Korea

	Percent distribution by number of household					
Ghana (N=4,179)	**0**	**1-2**	**3-4**	**5-6**	**7+**	**>0**
All ages		35.0	30.7	22.1	12.2	100
0-4	62.3	35.6	2.0	0.1	0.0	37.7
5-14	48.3	38.2	11.9	1.3	0.1	51.7
15-64	6.6	68.8	20.6	3.4	0.5	93.4
65-74	88.2	11.8	0.0	0.0	0.0	11.8
75+	92.6	7.4	0.0	0.0	0.0	7.4
Mongolia (N=1,322)	**0**	**1-2**	**3-4**	**5-6**	**7+**	**>0**
All ages	0	28.1	47.4	21.2	3.4	100
0-11	45.6	46.8	7.3	0.3	0.0	54.4
12-14	81.6	18.3	0.1	0.0	0.0	18.4
15-64	4.7	59.5	32.2	3.3	0.4	95.3
65-74	90.6	9.4	0.0	0.0	0.0	9.4
75+	95.2	4.8	0.0	0.0	0.0	4.8
South Korea (N=11,756)	**0**	**1**	**2**	**3+**		**>0**
All ages		62.5	35.4	2.1	0.0	100
0-4	88.4	8.6	2.9	0.1		11.6
5-14	88.9	8.5	2.4	0.1		11.1
15-64	23.7	17.9	37.0	21.4		76.3
65-74	86.4	8.9	4.7	0.0		13.6
75+	90.1	7.6	2.3	0.0		9.9

Notes: The average household sizes in the three countries based on their national time-use surveys are: 3.76 in Ghana, 3.53 in Mongolia, and 2.23 in South Korea.
Data sources: Authors' calculations using 2009 Ghana Time-Use Survey, 2011 Mongolia Time-Use Survey, and 2014 South Korea Time-Use Survey.

Table A4: Labor force participation rates (LFPR) and average hours worked in Ghana, Mongolia, and South Korea

Country	Gender	Unadjusted for full-time or part-time work				Adjusted for 40-hour work week*				Adjusted for 48-hour work week*				Average hours per week
		LFPR 15-64		LFPR 65+		LFPR 15-64		LFPR 65+		LFPR 15-64		LFPR 65+		
		2015	2030	2015	2030	2015	2030	2015	2030	2015	2030	2015	2030	2015
Ghana	Female	65.0	63.1	37.5	34.1	50.5	49.1	29.2	26.5	42.1	40.9	24.3	22.1	31.1
	Male	73.6	72.2	47.0	42.4	64.8	63.6	41.4	37.3	54.0	53.0	34.5	31.1	35.2
Mongolia	Female	56.8	52.6	7.2	6.6	63.9	59.2	8.1	7.4	53.3	49.3	6.8	6.2	45.0
	Male	69.9	63.2	10.9	8.0	89.2	80.6	13.9	10.2	74.3	67.2	11.6	8.5	51.0
South Korea	Female	57.9	60.9	23.4	25.5	57.7	60.8	23.4	25.5	48.1	50.7	19.5	21.2	39.9
	Male	77.8	80.1	42.2	42.9	88.9	91.5	48.2	49.0	74.1	76.3	40.2	40.8	45.7

*Notes: *Labor force participation rates adjusted for a 40- or 48-hour workweek are the full-time equivalent labor force participation rates assuming a 40 or 48 workweek. The rightmost column shows that average workhours per week vary significantly across the three countries. These adjustments aim to capture differences among the countries in shares of full-time and part-time workers.*
Data source: ILOSTAT modelled estimates of labor force participation by age and sex (ILO, 2019) and of average actual hours worked by sex (ILO, 2019)