Counting Women's Work in an Aging World

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Abstract

Standard measures of economic activity leave out one extremely important component of production and consumption—the unpaid care and household services that maintain and reproduce society. Unpaid care services represent a large portion of total work in our economies and are largely performed by women. Standard measures that ignore this kind of work underestimate women's economic contributions and misstate the true nature of productivity and dependency. The invisibility of unpaid care work also hinders efforts to examine the gendered nature of economic activity and take steps to integrate men and women in all spheres of economic life more equitably. This paper reports on a methodology to understand and measure the gendered economy, combining gender-disaggregated market measures with unpaid care work estimates. As an example of how including unpaid care work enhances economic demography, support ratios based on market work are compared with those based on unpaid care work. Dependency has different patterns in the unpaid care work economy and care-sensitive policies may be a way to meet some of the economic challenges posed by population aging.

1. Overview

Unpaid care work (UCW) creates the future. As infants, the most valuable investment our parents make in us is their time to care for us (National Transfer Accounts, 2017). Unpaid care work also undergirds the market economy, for who among us could hold a job without the mundane tasks of cooking, cleaning, laundering, or caring for us when we are sick? Certainly people could outsource these tasks to a paid provider, but evidence presented here shows that unpaid care work takes up close to the same amount of time as paid work and these tasks are nowhere in danger of being entirely outsourced to the market. It is notable then, that we know much more about market labor force participation than we know about participation in UCW. International databases are available to look up comparative data on market labor, by age, sex, and other characteristics for almost every nation on the planet. Government statistical agencies and researchers in the public and private sectors make it their business to understand current patterns of market labor and forecast worker demand and supply to ensure economies can grow. Important economic analyses connecting demography and economic growth, such as the analysis of support ratios and demographic dividends, usually include only the measured, market-based aspects of production and consumption. Far less attention is paid to understanding the labor force involved in UCW which could also be a part of demographic dividends.

The first objective of this paper will be to use a methodology called the National Time Transfer Accounts to document current patterns of unpaid care work in a diverse array of countries. Patterns of UCW production, consumption, and transfers, in units of time, will be shown by age and sex, and compared to market-based measures. UCW will be divided into two types: direct care for children, adults, and elders, and indirect care provided through unpaid housework and household management and maintenance. Showing the production and consumption patterns by age and sex will address such questions as which groups are consuming the most or least UCW, and which are producing it. The time spent producing UCW will also be examined relative to time spent in market work, both to gauge how large the UCW sector is compared to market work, and to see how gendered patterns of production vary in different places.

The second objective of this paper will be to combine those estimates of current patterns of UCW by age and sex with population projections over the next fifty years to create projected care support ratios (CSR). These support ratios hold the age- and sex-specific patterns of the care economy constant but follow projected changes in national populations by age and sex. This represents a first pass at understanding the challenges and opportunities in the UCW economy in the future, whether future age structures will make it easier or harder for a population to continue to provide current levels of care based on the consumption needs of the population. These care support ratios are an UCW analog to the economic support ratios (ESR) long used in demographic dividend analysis. ESRs measure the extent to which age structure changes will make it harder or easier for a population to sustain its current pattern of consumption of market goods and services. A rising ESR indicates a demographic dividend in the market economy, a rising CSR indicates a demographic dividend in the household unpaid care work economy. Comparing the ESR and CSR across a diverse set of countries reveals how our aging future will enhance or hinder the maintenance of current levels of consumption in both spheres.

2. Data and methods

2.1. National Transfer Accounts

NTA methodology has been refined over many years and is documented on the project website (www.ntaccounts.org) and in a United Nations technical manual (United Nations, 2013). Well over 80 country research teams are involved in the NTA project and follow the methodology using available data in each country in order to understand each country's generational economy. The basic estimates produced are called age profiles, per capita age-specific measures of economic flows consistent with aggregate annual flows as measured in each country's national accounts. Age profiles are cross-sectional, rather than cohort measures. Developing an age profile in the NTA project has three main components: calculation of age-specific means, smoothing, and adjusting to national accounts aggregates.

Age means are calculated for each type of flow using an appropriate data source that indicates relative amounts of a particular economic activity by age. For private flows, household survey data is often available to indicate the amount of flow for each individual or the household as a whole. For household-level amounts, consumer weights are used to allocate most private flows to individuals. For other private flows for which consumer weights are not appropriate, numerical methods based on observed household amounts and household structure are used to apportion amounts to individuals. For many

types of public flows, survey data is not sufficient and administrative data is used. Once individual-level allocations are found, age-specific averages form the age shape. To reduce noise, the age schedule is smoothed over age using a cross-validation smoother (Friedman, 1984). Finally, the resulting smoothed age shape is adjusted up or down by the same factor at all ages so that the implied population aggregate matches that measured in national accounts. To add gender into this framework, for most flows it is straightforward to add a sex variable to the calculations and produce two separate profiles for male and female for each measured age profile and adjust so that these sex-specific age profiles are consistent with a combined profile. As there are no sex-specific national accounts available consistently across countries, we rely on our surveys and administrative data to indicate the correct proportion of flows in each age group that is for male or female.

Current methodology for NTA age profiles covers all flows measured in current accounts, but only those for consumption and labor income are used in this paper. NTA consumption includes both privately provided amounts, and publicly provided consumption of services such as education, health care, and general government services. NTA labor income includes wages and salaries as well as a share of the earnings generated by owned farms and businesses meant to represent labor's contribution to self-employment income. NTA estimates for many countries are freely available for download at the project website (ntaccounts.org).

2.2. National Time Transfer Accounts

The age- and sex-specific estimates of UCW presented here follow a methodology called the National Time Transfer Accounts (Donehower, 2019), or NTTA. NTTA follow the long-standing methodology that researchers have developed to estimate the production of UCW by using time use surveys to gauge how much time people spend in this type of production (Abraham and Mackie, 2005). This time is evaluated in the original time-based units for most of the analyses in this paper, but for comparison with monetarily-valued market flows, an imputed wage for the UCW can be used. There are several different bases upon which to value the time, appropriate to different research questions. The basis used in NTTA is a specialist market replacement wage in which the wage of market workers who do a particular type of UCW is used to value time spent in that activity. When wage data by activity is limited, the generalist replacement method can be used in which a general housekeeper or domestic worker wage is used as the imputed value. Valuation by the replacement method is closest to that recommended to produce household production satellite accounts – UCW analogs to traditional market measures of labor covered in national accounting, such as Gross Domestic Product (Landefeld et al., 2009).

The NTTA approach adds the NTA framework to this methodology, explicitly acknowledging the role of age in determining much of the variation in economic activity. As UCW is largely driven by lifecycle processes of birth, marriage, household formation, aging, and death, a focus on the age dimension is necessary to understand UCW and make good policies around it. Much work on UCW has focused on just one particular age group with a very wide age band, often those in their peak working or childbearing ages, rather than focusing on how UCW patterns change by age.

In addition to an improved focus on age, the NTTA approach allows us to see the whole system of exchange of UCW between persons, not just production. To get the other side of the exchange, we impute the consumption of UCW produced in households to individuals (methodology discussed in greater detail below). Applying this methodology to unpaid care work services reveals the same system

of transfers between persons in the UCW economy that NTA has revealed in the market economy – young and old in different countries and regions have different levels of "dependency" relative to the productive capacities of peak age workers, and those workers provide for the needs of young and old dependents in different ways and with different generational arrangements.

To summarize, traditional methods to estimate household production satellite accounts are combined with NTA methods to disaggregate by age and impute consumption and transfers. This hybrid methodology is called National Time Transfer Accounts (NTTA) and has been developed by the Counting Women's Work project. Its strengths are that it brings a greater focus on the age dimension of UCW than previous research, making it amenable to the study of UCW in aging societies, and that it includes methodology to impute UCW consumption which is harder to observe directly. The resulting estimates – age- and sex-specific average amounts of care produced, consumed, and transferred – can then be combined with population projection to reveal how the current system of UCW demand and supply will fare in the context of population age structure change.

The countries whose estimates appear in this work are all members of the NTA project, with country-based research teams. Counting Women's Work is part of NTA's efforts to understand the gendered aspect of generational systems. Some of the NTTA estimates are available to the public and downloadable through the Counting Women's Work project website (www.countingwomenswork.org). This website also gives details on the research teams in each country.

2.2.1. Time use survey (TUS) data and methods to estimate UCW production

TUS data, either in the form of a complete time diary survey, or a survey module with sufficient questions about UCW activities, are used to estimate the production of UCW. Accepted criteria for identifying UCW activities have been developed in the process of creating household production satellite accounts (Abraham & Mackie, 2005), and this work follows those criteria. We calculate average time spent in UCW activities by age and sex and smooth[1] those schedules over age to produce age profiles of the production of the two main types of care (direct care of persons and indirect care through housework and household management) separated by sex, for each country.

2.2.2. Household roster data and methods to impute UCW consumption

Some time use survey instruments indicate the exact member of the household who is the target of a direct care activity, making it possible to assign the UCW produced as the consumption of a particular individual. However, many do not have this feature. In order to estimate care consumption in a consistent way across different surveys, we will instead apply one consistent set of methods for imputing care in all countries. In this way, we do not observe the consumption of UCW directly. Instead, consumption is imputed to persons in households based on the amount of UCW we observe as being produced in the time use survey and a set of assumptions about how the consumption of UCW is distributed.

For indirect care within a household, i.e. the general activities within the household (cleaning, cooking, household management and maintenance, etc.), the time produced is divided equally among all

[1] As in NTA, NTTA smoothing is done with Friedman's SuperSmoother, a cross-validation smoother (Friedman, 1984).

household members, which assumes all household members benefit equally from this work. For direct care within a household, i.e. age-targeted care activities, this model is not appropriate, and numerical methods are used. Specifically, for childcare a household-level regression model is estimated on the survey data where we regress the household amount of childcare produced on the number of household members in each child age/sex group. The regression coefficients on each age and sex group then become consumption weights used to apportion the household amount of childcare produced in each household to each child in that household. Similarly for adult or elder care, we regress the household production of adult care on the number of adults in each age/sex group. Note that for either type of care, the producer of the care is not included in the regression estimation even if he or she is in the target age group because he or she is not a potential target of the care. For UCW that benefits non-household members, the production is distributed as consumption to all persons in the target population, using the age profile of care provided within the household as proportional weights.

Once all UCW production is allocated to particular consumers, then producing the age- and sex- profiles is a matter of taking the age- and sex-specific average amounts consumed and smoothing over age to create sex-specific consumption schedules by age just as for the production schedules. For some surveys, all adults in the household provide time use data so that the survey can serve as both a production and consumption sample and overall population-level production is equal to consumption, except for small imbalances introduced by smoothing and sampling. In other surveys, not all potential care producers are sampled. In that case, population-level production estimates are weighted to be representative of the population average but the consumption is an underestimate because of the missing data from other household UCW providers. If the adults in the household who do give time use data are randomly selected, however, we can simply introduce a correction factor and inflate the consumption estimates so that they are equal in aggregate to the production estimates. All time use surveys have some age cutoff below which they do not collect time use data from household members, usually age 10 or age 15. We assume zero UCW production for those younger unsampled age groups.

Note that a full household roster, giving the age and sex of each member of the household of any time use respondent, is necessary for these methods just described. Some time use surveys collect this data, but for those that do not (Bangladesh and Thailand in the current set of countries), an alternate source of household structure data was used. Specifically, census samples available from the IPUMS International Database (Minnesota Population Center, 2018). These samples provide complete listings of household members by age and sex which can be combined with the time use data on production of UCW activities. The imputation is done by identifying as many matching variables in the time use survey and census sample as possible – age, sex, household size, relationship to household head, marital status, and education. The average amount of production of UCW activities is calculated from the time use survey in cells defined by all categories of the matching variables and then imputed onto individuals in the census sample with the same categories of the matching variables. This puts the time use estimates into a context where the full household roster is available and makes it possible to impute consumption of UCW time. An alternative method would be to “hot deck” the imputation, but that is less necessary in this case because we are focused on average production and consumption and not inference or variability.

2.2.3. Estimating UCW transfers

Making the simplifying assumption that UCW time is consumed at the same time it is produced, total production of UCW time must equal its total consumption and no net transfers out of the system are possible.[2] This is true for the population as a whole but not for any individual or group within the population. Each age/sex group will have some net transfer made or received, calculated as the difference between total UCW produced and consumed, for direct, indirect, and total UCW.

2.3. Population projection data and support ratios

Once we are grounded in the empirical facts of the current market and UCW economies, we can then imagine how those economies might shift in the future. One way to do that is with the thought experiment "what if the market or care economy stayed as it is currently in terms of the average production and consumption by age and sex, but the numbers of people in those categories changed?" This is a straightforward calculation holding the production and consumption estimates constant while using a population projection into the future to change the population age and sex structure.

The population projections come from the United Nations World Population Prospects database (United Nations DESA, 2019) and the "medium variant" projection is used. The estimated population at 2015 is the starting point and the population by age and sex is projected to 2065. These projections continue the trajectory of population aging for most countries, with continuing gradual mortality decline and longer lives, and continuing gradual fertility decline for countries with above replacement fertility levels. For countries with below-replacement fertility, however, gradual fertility increases to replacement level are modeled, albeit with a very slow rate or fertility increase.

As discussed earlier, the ratio of aggregate supply to demand, or production relative to consumption, for UCW is here called a care support ratio (CSR). The ratio of aggregate amounts of labor income to consumption in the market economy is referred to here as an economic support ratio (ESR). Of course, we know that in the care economy, production must equal consumption in the aggregate by definition, but our projected CSRs will not equal 1 because the shares of consumers versus producers of UCW will shift. What does this mean, then? The CSR, rather than a model of a possible future, is instead an indicator of whether projected supply of care will be sufficient to satisfy projected demand. If not, there may not be enough care available for those in need, given current patterns of care consumption. If the opposite arises, then time in the future may be available for uses other than providing care as we observe in the current patterns of UCW production.

[2] This is in contrast to market goods and services which can be sent across national borders or can be saved and stored for later as assets or borrowed in the form of debt, to consume now and pay back in the future.

3. Charting the gendered economy

3.1. Production

Figure 1 shows the time-valued age profiles in hours per week for eighteen countries, for the year in which a time use survey was available in that country. There are several similarities across all of the countries despite the diversity of the sample by region, income level, and cultural background:

- women produce more UCW than men,
- there is a global or local maximum in women's UCW production between the ages of 27 and 38 (Vietnam is an outlier in this pattern with a local maximum at 22), and
- many countries have a "double hump" shape for women's UCW with another local maximum at older ages.

On the other hand, there is wide diversity in other aspects, such as the gap between males and females, and the absolute level of production by men or women. In all likelihood, some of this variation is due to different time use survey instruments, different interpretations of the meaning of the questions by survey respondents in different cultural contexts, or different coding of activities described by survey respondents by coders in different contexts. Vietnam in particular is a small sample and a very new survey instrument, and the results should be considered preliminary.

Figure 2 shows the same age profiles as in Figure 1 but for direct UCW only, that is the direct care of persons, not housework or other general household activities which benefit all household members equally. Certainly the Colombia survey instrument finds a greater baseline amount of direct care production across all ages than in any other country, and the Vietnam survey has a distinctive hump-shape which may turn out to be more due to a small sample than an overall care system which is different than that in every other country, but in general the patterns are more consistent: largest amounts of care production are for women in the peak childrearing years. Men have a lower peak and in most countries it is a few years older than for women, possibly indicating that fathers are likely to help out more with the older children when mothers are busy with new infants.

Figure 3 shows the remaining portion of UCW: indirect care including general housework, household maintenance and management. It has a very different age pattern compared to that of direct care work: there is generally more of it than for direct care work and it is much more likely to be done by older persons than is direct care work. The maximum ages of the different types of UCW are shown in Table 1. In most of the 18 countries, women's peak age of direct care is in the late 20s to mid 30s, and for men it is a few years older. For indirect care, however, there is much less of a clear pattern by age and for many countries the peak level of production is at older ages.

One of the notable findings from the time patterns shown in Figures 1, 2, and 3 is just how much UCW older people produce. In the direct care figure, there is a small second peak for women in many countries around the ages of grandmotherhood. For indirect care, production actually rises with age in many countries until the oldest age groups when it does drop off in all countries.

Figure 1. Average amount of time spent in unpaid care work by age and sex, hours per week.

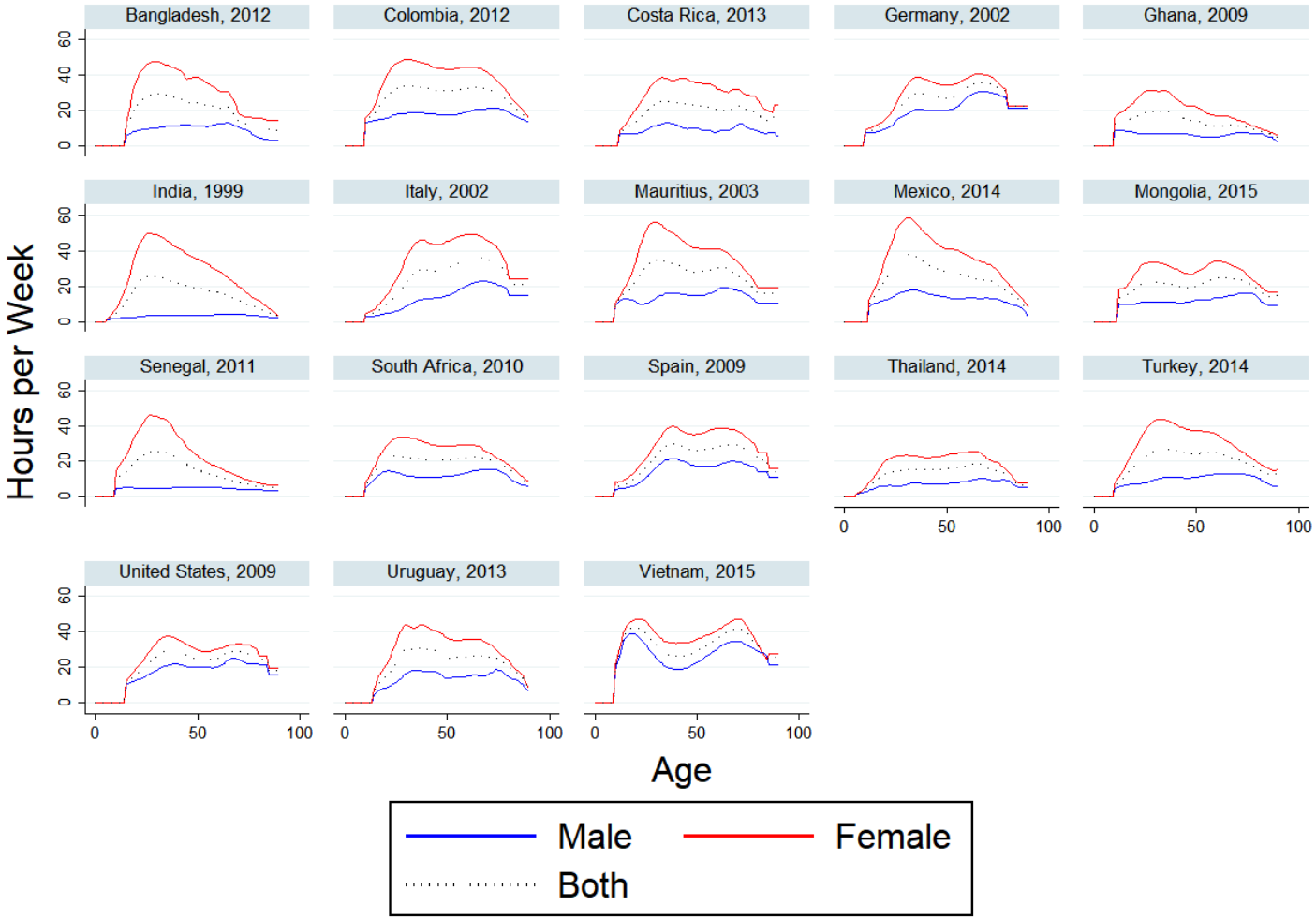


Figure 2. Average amount of time spent in direct unpaid care work by age and sex, hours per week

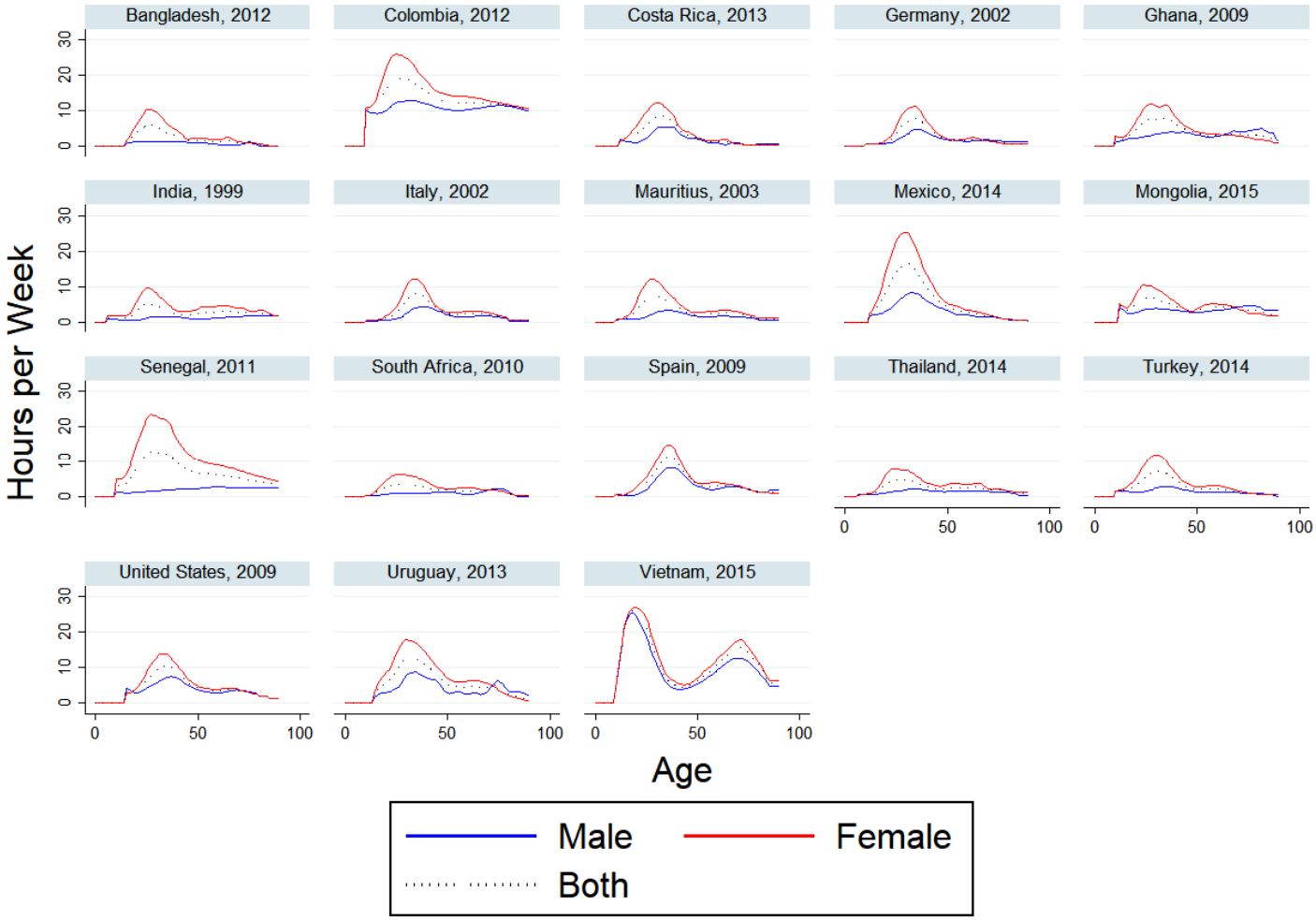
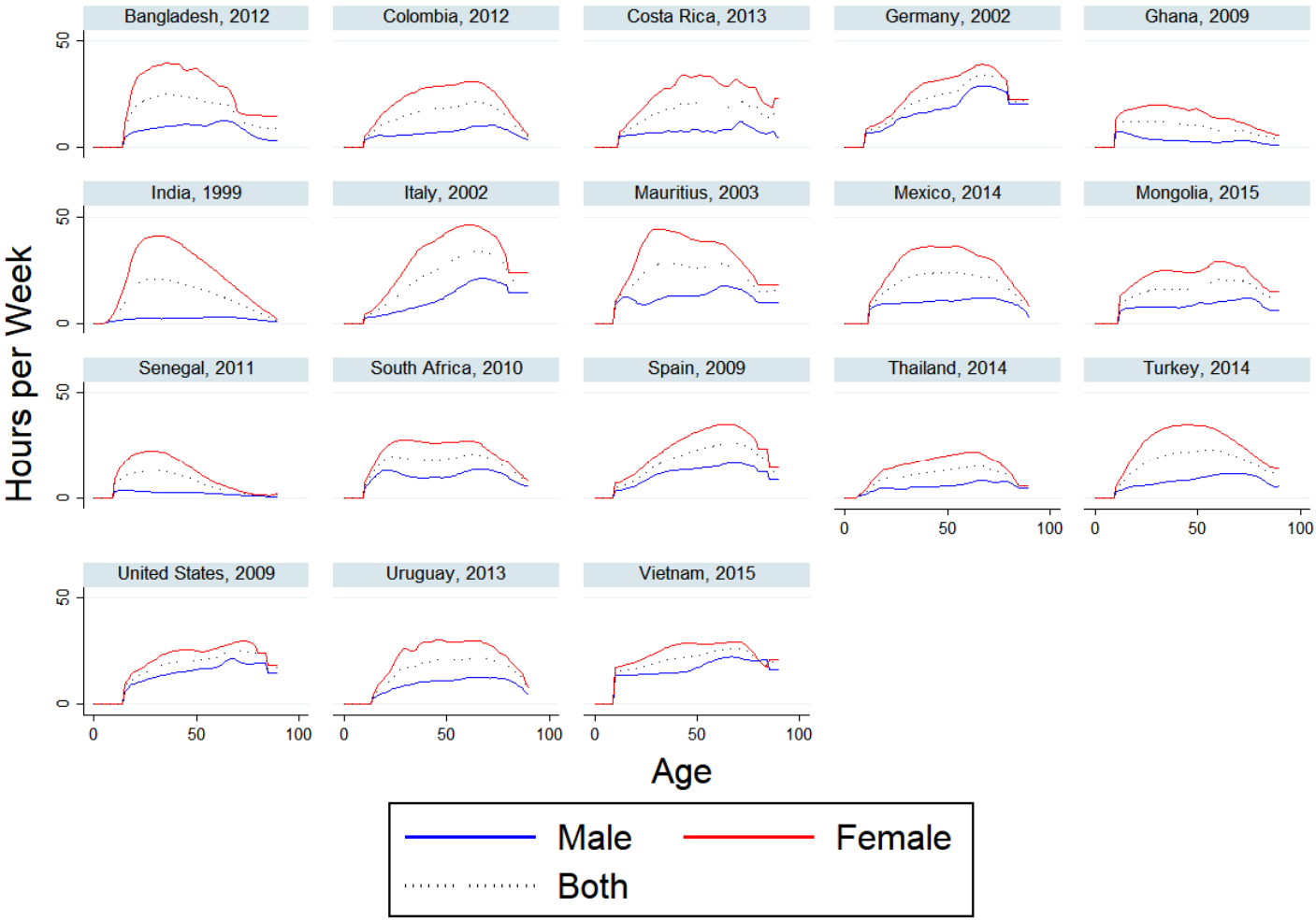


Figure 3. Average amount of time spent in indirect unpaid care work by age and sex, hours per week.



It is important to remember that these are cross-sectional estimates and so this rising pattern may be a cohort effect rather than a lifecycle pattern. In other words, younger people today may have different preferences for the products of unpaid care work compared to older persons. For example, younger cohorts may be happy with a passably clean house while older cohorts may prefer a spotless one. Productivity gradients may also be in effect: it likely takes longer to clean and fold a load of laundry at age 80 than it does at age 40.

To contrast with the patterns of unpaid care work, Figure 4 shows the age profiles of market work for males and females. The age shapes of the curves are regularly hump-shaped across all countries, and in every country at almost every age men perform more market work than women. One other important point to note about this market work figure compared to the UCW Figure 1 is how much time we spend on UCW. This is summarized in Table 2 which gives the per capita average (across all age/sex groups) of time spent in market work or UCW. The ratio of these two averages is in the final column of Table 2, which shows that time spent in UCW ranges from 0.54 to 1.64 times that spent in market work. That demonstrates how important this sector of the economy is and highlights the need to understand its dynamics.

Table 1. Age of greatest average UCW time, by type of care

	Direct		Indirect	
	Male	Female	Male	Female
Bangladesh, 2012	75	26	64	35
Colombia, 2012	33	25	73	62
Costa Rica, 2013	33	31	71	43
Germany, 2002	36	34	67	67
Ghana, 2009	81	27	10	30
India, 1999	90	25	63	31
Italy, 2002	38	34	67	61
Mauritius, 2003	36	28	63	31
Mexico, 2014	33	30	66	54
Mongolia, 2015	78	24	75	60
Senegal, 2011	60	27	16	28
South Africa, 2010	74	26	66	30
Spain, 2009	37	36	68	64
Thailand, 2014	33	24	68	62
Turkey, 2014	35	30	65	45
United States, 2009	37	33	67	73
Uruguay, 2013	34	30	64	47
Vietnam, 2015	18	20	67	69

Table 2. Per capita hours per week by type of work

	UCW	Market	Ratio
Bangladesh, 2012	16.4	16.8	0.98
Colombia, 2012	24.2	16.6	1.46
Costa Rica, 2013	16.2	19.3	0.84
Germany, 2002	23.2	16.3	1.42
Ghana, 2009	11.4	21.2	0.54
India, 1999	14.0	25.3	0.56
Italy, 2002	22.9	17.8	1.29
Mauritius, 2003	22.6	20.0	1.13
Mexico, 2014	21.4	22.8	0.94
Mongolia, 2015	15.3	16.9	0.90
Senegal, 2011	12.6	14.9	0.85
South Africa, 2010	15.6	15.8	0.99
Spain, 2009	21.1	12.9	1.64
Thailand, 2014	12.6	28.8	0.44
Turkey, 2014	17.6	14.7	1.20
United States, 2009	19.3	17.6	1.10
Uruguay, 2013	19.0	19.5	0.97
Vietnam, 2015	27.7	18.0	1.54

Figure 4. Average amount of time spent in market work by age and sex, hours per week.

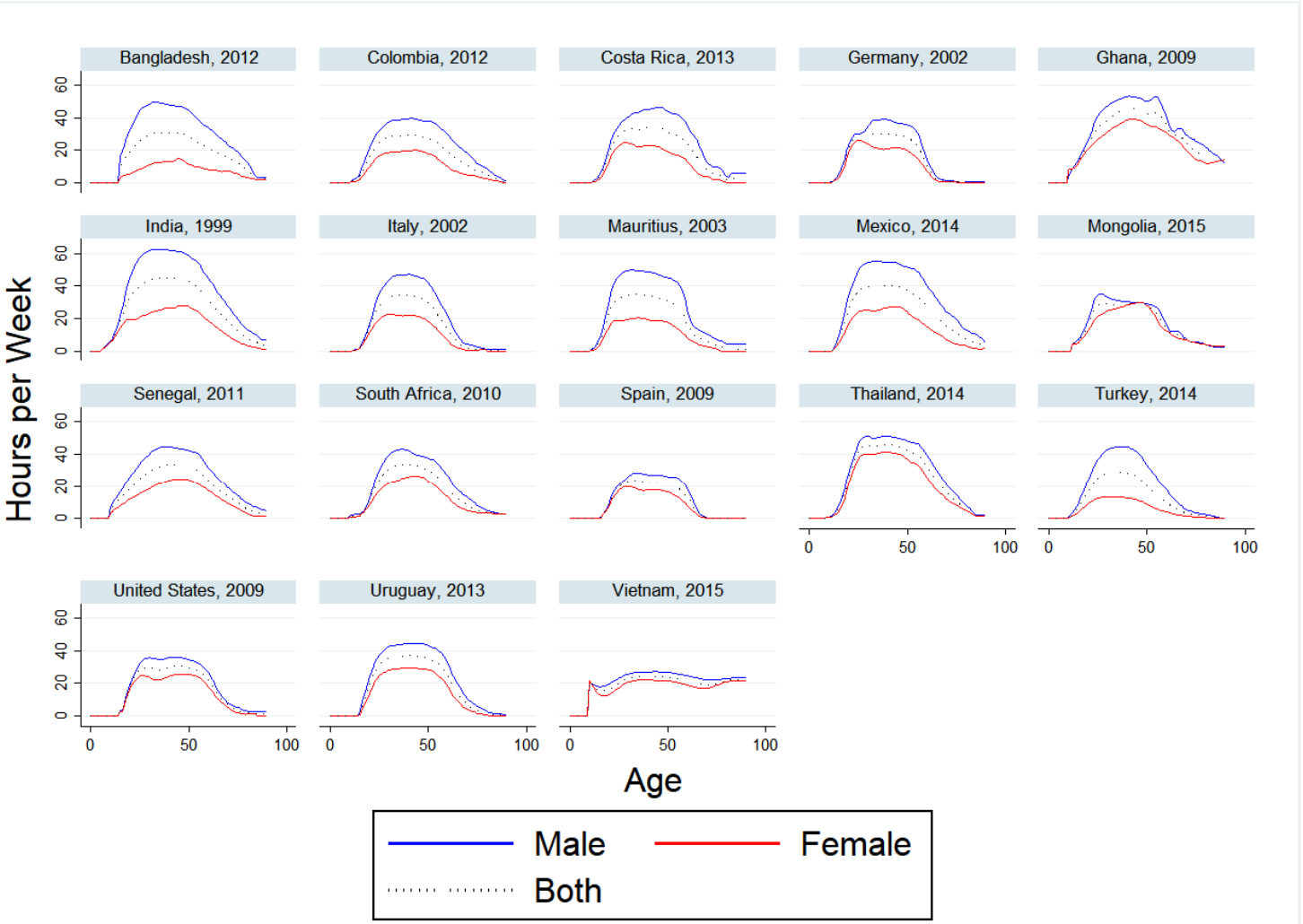
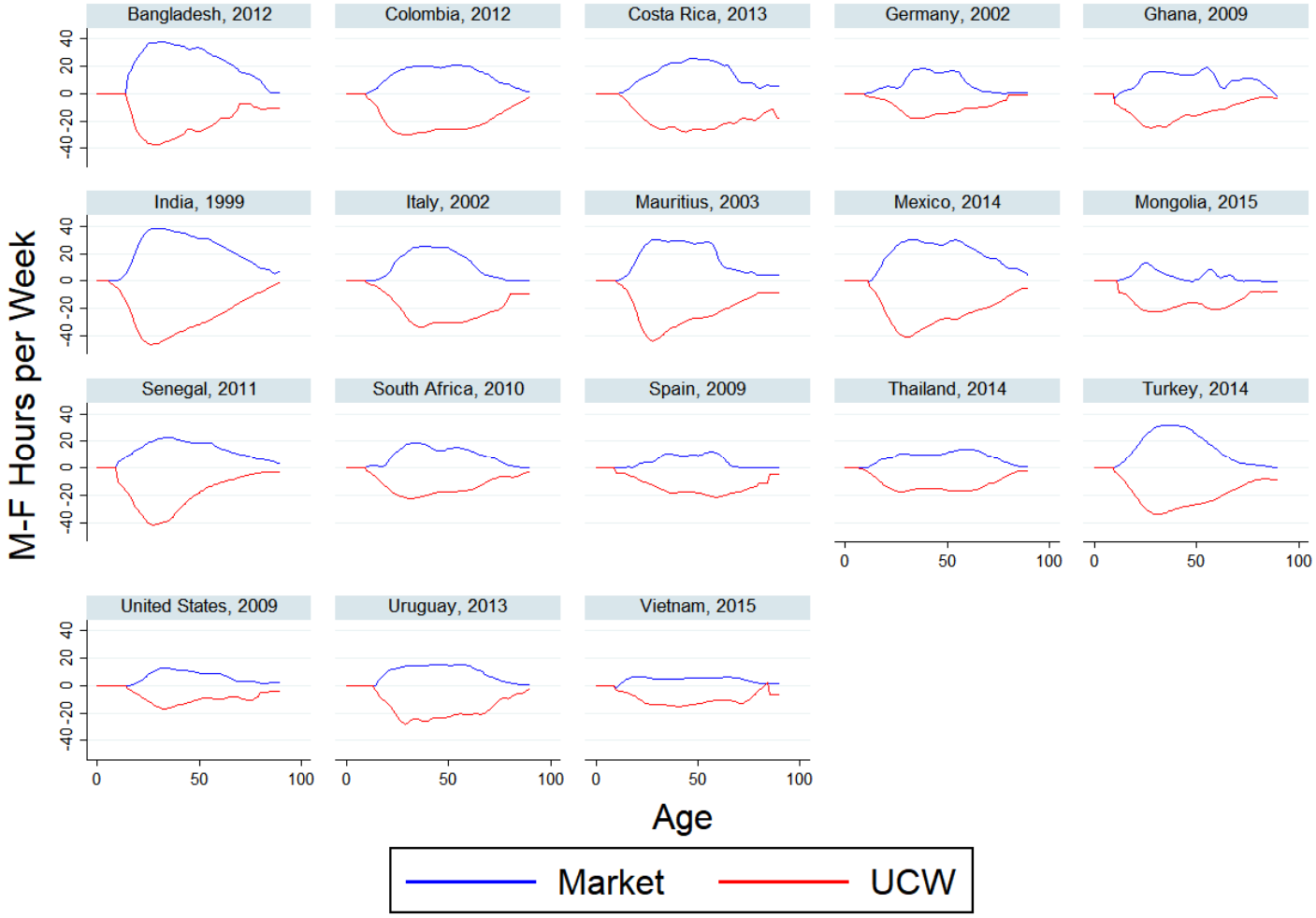
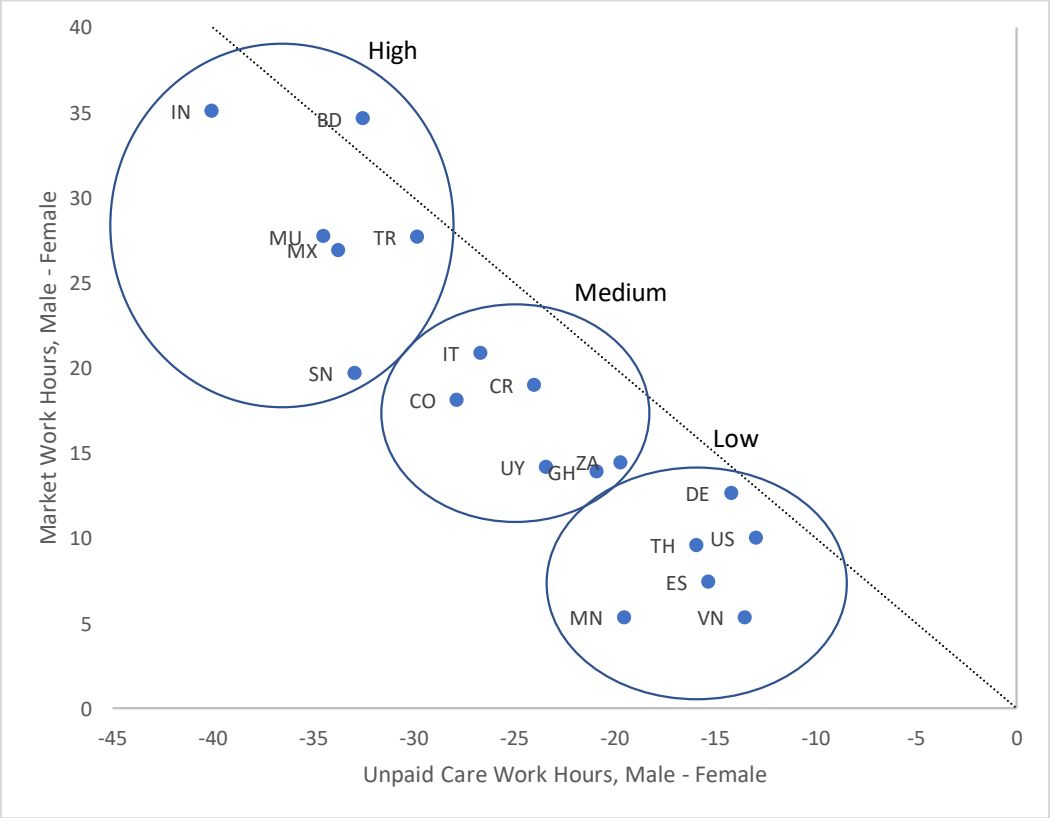


Figure 5. Difference in average time spent by type of work, age, and sex, hours per week, male - female.



To examine the gender dynamics between market and UCW more closely, Figure 5 shows the difference between male and female for average time spent in both market work and UCW by age. Differences are plotted for the male minus female amount, so a line above zero means males do more, below zero means females do more. We see in this chart that in every country at every age, men do more market work, women more unpaid care work. One of the unexpected patterns seen in Figure 5, though, is the seeming symmetry around the zero line. This is related to what is often referred to as the "iso-work" phenomenon, wherein large gender differences in participation between the market and household spheres add up to strong patterns of equality in total work (Burda, et al. 2007). If we compared total work, women in most countries are doing slightly more total work, but this is not a universal pattern across countries or by all ages.

Figure 6. Age-specific gender difference (male - female) in time spent by type of work and country, equal weighted average over ages 20-50.



Note: Three equal groups formed based on the sum of absolute values of gender gaps in market and unpaid care work represent degree of gender segregation in production between market work and UCW. Groups are high (IN – India, BD – Bangladesh, MX – Mexico, MU – Mauritius, TR – Turkey, SN – Senegal), medium (IT – Italy, CR – Costa Rica, CO – Colombia, UY – Uruguay, GH – Ghana, ZA - South Africa), and low (DE – Germany, MN – Mongolia, ES – Spain, TH – Thailand, US – United States, VN – Vietnam)

To explore this gender differentiation further, Figure 6 shows a scatter plot of the gender difference in market work versus UCW. The calculation includes ages 20-50 and is an equal weighted average of age profile values, so that population age structures which vary from country to country will not affect the comparison. The differences are expressed as male minus female, so that the difference for UCW is negative on average while for market work it is positive. If the iso-work phenomenon were in effect, all of the points would line up on the dotted diagonal line at which adult men's excess market work time would exactly equal adult women's excess UCW time. If there were little gender differentiation in economic activity between the market and household/UCW spheres, then the points would line up at the origin where there would be no difference in men's and women's work time in either sector. What we see is that there is a great variation in the degree of gender differentiation from country to country,

from Vietnam which is closest to the origin, to India which is the farthest away. We also do not see the iso-work phenomenon here, using this summary measure that averages across adult age groups. Instead almost all points are below the diagonal line, with the exception of Bangladesh, indicating that in this sample, adult women's greater amount of UCW is of higher magnitude than men's greater amount of market work. Three circles are drawn to divide the sample into three groups of highest, medium, and lowest levels of gender specialization between market and UCW spheres. The groups do not seem to correlate strongly with distance to the diagonal, revealing no strong correlation between specialization and disadvantage in terms of total work.

The methodology for NTTA does include a protocol to value UCW time by an imputed wage, which enables comparison of the gendered economic effect of wages. Figure 7 demonstrates this picture by charting the monetary profiles for both NTA labor income and NTTA production, standardized by the average market labor income of males aged 30-49. The units reflect a year of peak male earnings. (The sex-specific labor income profile necessary for the standardization is not available for Bangladesh, Mongolia, or Thailand.) As in previous figures, estimates for males are shown in blue, for females in red. Market labor income is shown as solid lines while wage-valued UCW time is shown as dashed lines. Standardizing on male earnings instead of both sexes combined means that the comparative measures are not impacted by relative male/female wages. If standardization were done on both sexes combined, some of the male/female gender gaps would be erased.

Figure 7 clearly reflects the generally low level of market wages for UCW, because the dashed UCW profiles are generally lower than the market labor income profiles. When we use these low wages to value UCW, our estimates reflect the legacy of gender discrimination in the workplace, with historically female occupations earning low wages. Notable exceptions to this are Italy and Germany, where high minimum wages ameliorate this legacy somewhat. While average earnings are generally lower for women in market labor income, as well, this includes many types of differences, all rolled into the labor income gap: differential labor force participation, gendered occupational segregation, different propensities to work part time, and then differential wages for an hour of similar work. While some would argue that only this last represents "real" gender discrimination in the workplace, each type of difference reflects the constraints on women from cultural practices around what types of occupations women should have, and also the fact that women in market work often must constrain their job search and job choices to work that can be combined with their societal role as the main UCW provider.

3.2. Consumption

Figure 8 shows the imputed age profiles of consumption, both for unpaid care (valued in time units) and in market goods and services (valued in standardized units of male labor income age 30-49). The two different types of consumption are graphed against different vertical axes so the difference in the age shapes will be more apparent.

Only single sex profiles are shown. The imputation by separate sex turn out to be very close, which could either be that there is not sufficient evidence in the data for sex differentiation of care provision, or that the type of sex differentiation that does exist is not picked up by the methods we use. Those methods rely on differentiation across households of different age/sex distributions, but for persons in a household of same age, the imputation method we use would not be able to detect different levels for a same age male and female. For this reason, only the combined single sex age profile is shown. The

consumption patterns seen still reflect a gendered economy, however, because of the gendered nature of who is providing for most of this consumption: men provide most of the market goods and services, women provide most of the UCW.

Figure 7. NTA market-based labor income compared and NTTA imputed wage-valued UCW production, by sex, standardized to average male NTA labor income age 30-49.

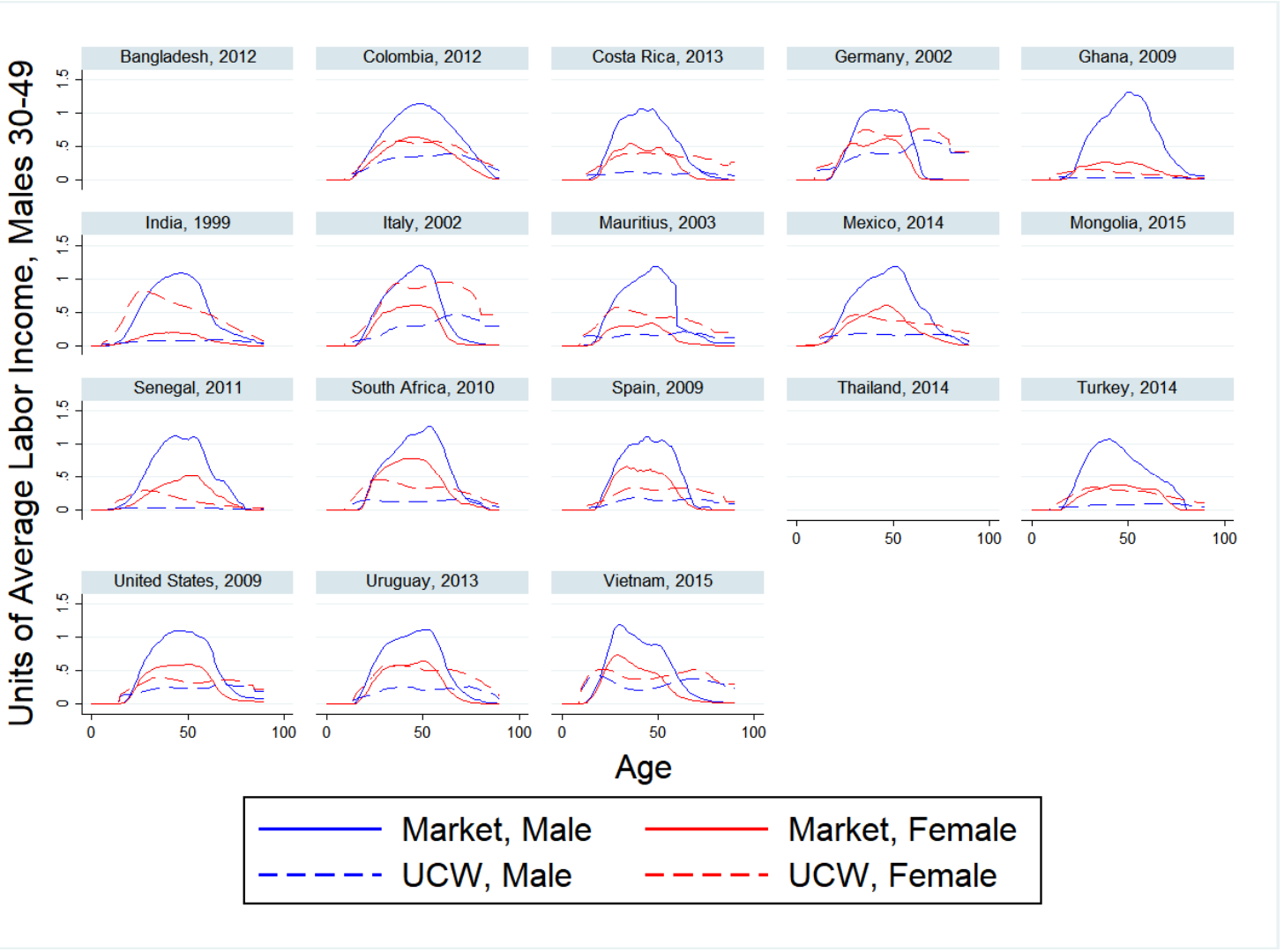
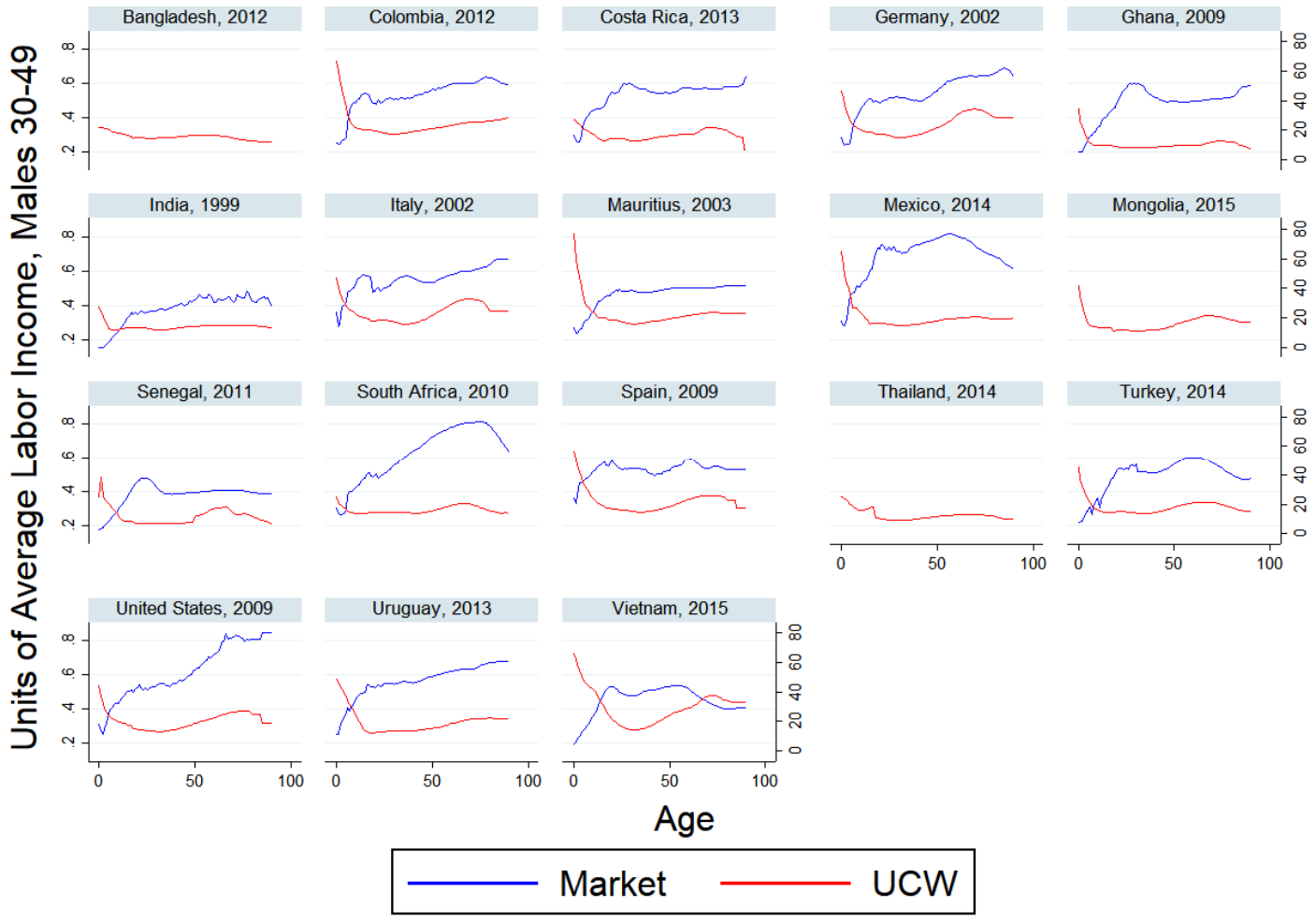


Figure 8. Average consumption of market goods and services and UCW time, in units of average labor income for males 30-49 for market-based consumption, and hours per week for UCW consumption.



Notes: Market based consumption is scaled to average male labor income ages 30-49 and charted relative to the vertical axis on the left-hand side of the chart. UCW consumption is in hours per week and charted relative to the right-hand side of the chart. Bangladesh, Mongolia, and Thailand do not have market labor income currently available by sex, so the standardization to male labor income is not possible.

What stands out most clearly in this picture is that the youngest children are the greatest consumers of unpaid care work and the least consumers of market goods and services. Looking at the other end of the age range, UCW consumption does rise somewhat by age group at the oldest ages in many of these countries, but nowhere do we see the amount of UCW consumed by elders come anywhere close to

that consumed by infants and young children. In consumption of market goods and services, however, oldest persons are the greatest consumers in many of the countries observed.

UCW consumption for infants may be much higher because they are more likely to have multiple persons caring for them at the same time, but the imputation method used here would add those overlapping hours together. Some may consider this a double counting of care provision, but the child would still benefit in many ways from having multiple caregivers at a time, from having more attention, more interaction, and being able to hear more different types of speech than if there was one caregiver alone.

It is surprising, how little eldercare consumption we see in these estimates. This may be due to the fact that many elders remain healthy and so are not in need of much direct care. It may also be due to problems in time use survey instruments' ability to detect eldercare as thoroughly as it detects care of young children. Many eldercare activities could be coded as leisure time, such as talking on the phone with an elderly relative while also monitoring their wellbeing and assisting with household management tasks. It could also be harder to detect those very intensive eldercare episodes caused by health emergencies. If an elder is suddenly rushed to the hospital and then comes home and requires 24-hour care for a time, that is a very unlikely time for the household to be participating in a time use survey. Or if adult children leave their own residence for an extended period of eldercare at the elder's home, they will likely have no chance of that time being captured in a time use survey. For these reasons, the lack of sharp increases in care consumed at oldest ages certainly calls for more study and replication on other datasets, especially those studies modeled on the Health and Retirement Study that focus on care needs of older persons more specifically than a general population time use survey.

3.3. Net transfers

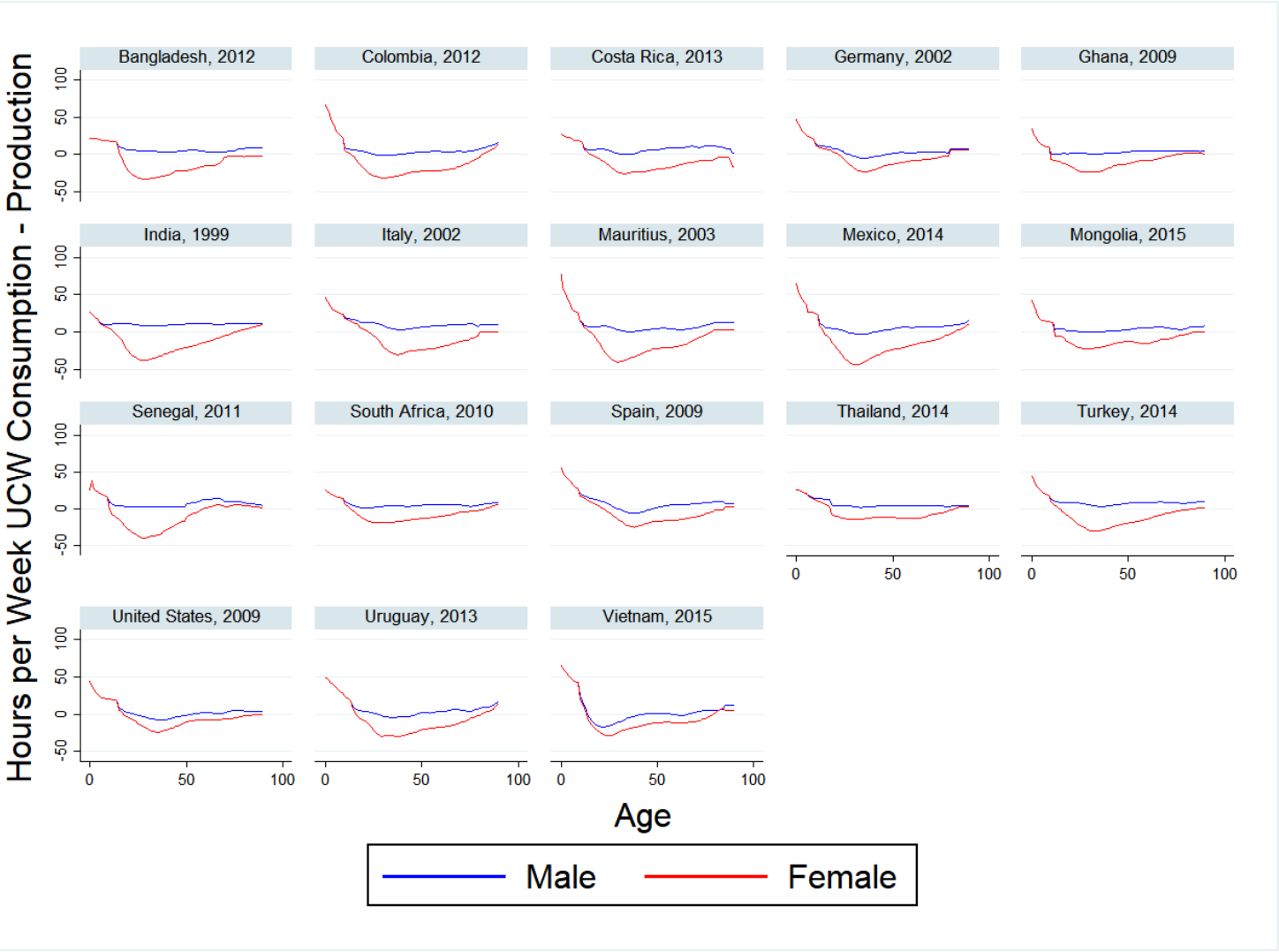
The difference between UCW consumption and production is net transfers. If we observe an age/sex group with consumption higher than production, then they must be getting a transfer to make that possible. In the market economy, the picture is more complicated because it is possible to store today's production as an asset and consume it at another time, or to borrow against assets or future production and consume tomorrow's production today. For time transfers, however, that is not possible. This is obvious for direct care as that involves interactions in the moment but conceptually less clear for indirect care. For example, I might clean the laundry today but my family will wear the clean clothes over the coming week. However, even for a situation like this, the time transfer is generally consumed in the near-term, so we will make the simplifying assumption that all time transfers are consumed at the moment of production.

Figure 9 shows the age and sex dimensions of such net transfers in our sample of eighteen countries. What is abundantly clear from this figure is that men hardly make any net transfers in any country or in any age group. The gendered nature of household production looks to be a very strong feature of economic and social organization across all of these countries, despite the huge variation in other social and economic characteristics such as income level, region, religious make-up, and fertility. Contrast Senegal and Italy, for example. Senegal is the highest fertility, youngest population in the sample and Italy is close to being the lowest fertility and oldest population (2010-2015 TFRs: Senegal 5.0, Italy 1.4, from UNWPP 2017 Revision). Despite the huge difference in population age structure and family size, their net time transfers by sex look startlingly similar. Not all of the pictures look the same however.

Moving to compare Spain, the lowest TFR country in the sample at 1.3 children per woman in 2010-2015 (from UNWPP 2017 Revision), we see still the overall feature of women making more net transfers than men, but men do make net transfers in the age groups of peak childrearing work. Transfers are also less in magnitude overall and the degree of gender difference is less as well.

This suggests that the gendered economy is a stable feature of economic organization throughout the world, but the degree of gender differentiation can vary greatly. It also suggests that any economic policy related to the labor force or household or family dynamics must be gender-aware. Men and women lead different economic lives, on average, and policy that does not take that into account is likely to miss its targets.

Figure 9. Average net transfers of unpaid care work time by sex, hours per week.



3.4. Dependency in market versus UCW spheres

Ideally we would have the net transfers of market goods and services by sex as a picture to complement the UCW transfers shown in Figure 9, but that work is ongoing to fully disaggregate market-based NTA accounts by gender. It is more complex than for UCW because it also involves transfers mediated by the state, in other words public taxes and transfers. We can be fairly certain, however, based on their much larger labor income that men are making most of the net transfers of market goods and services to children and women. What we can observe is the combined sex differences in dependency in terms of market goods and services compared to UCW.

Figure 10 shows estimates of the lifecycle deficit in the two different spheres of market goods and services versus UCW. The concept of the lifecycle deficit is directly related to dependency – positive values are resources which must be obtained through transfers in the case of UCW or transfers and asset-based reallocations in the case of market goods and services. Figure 10 shows clearly the different nature of dependency in these two spheres of economic activity. Elders are the source of the largest per capita lifecycle deficits in the market economy, but in the UCW economy in many countries, they are actually producing surplus into very old age groups. Children have large deficits in both spheres, but the UCW deficit is greatest at birth and declines steadily with age, whereas the market deficits for old people rise until they begin to enter the labor force.

4. The gendered economy in an aging future

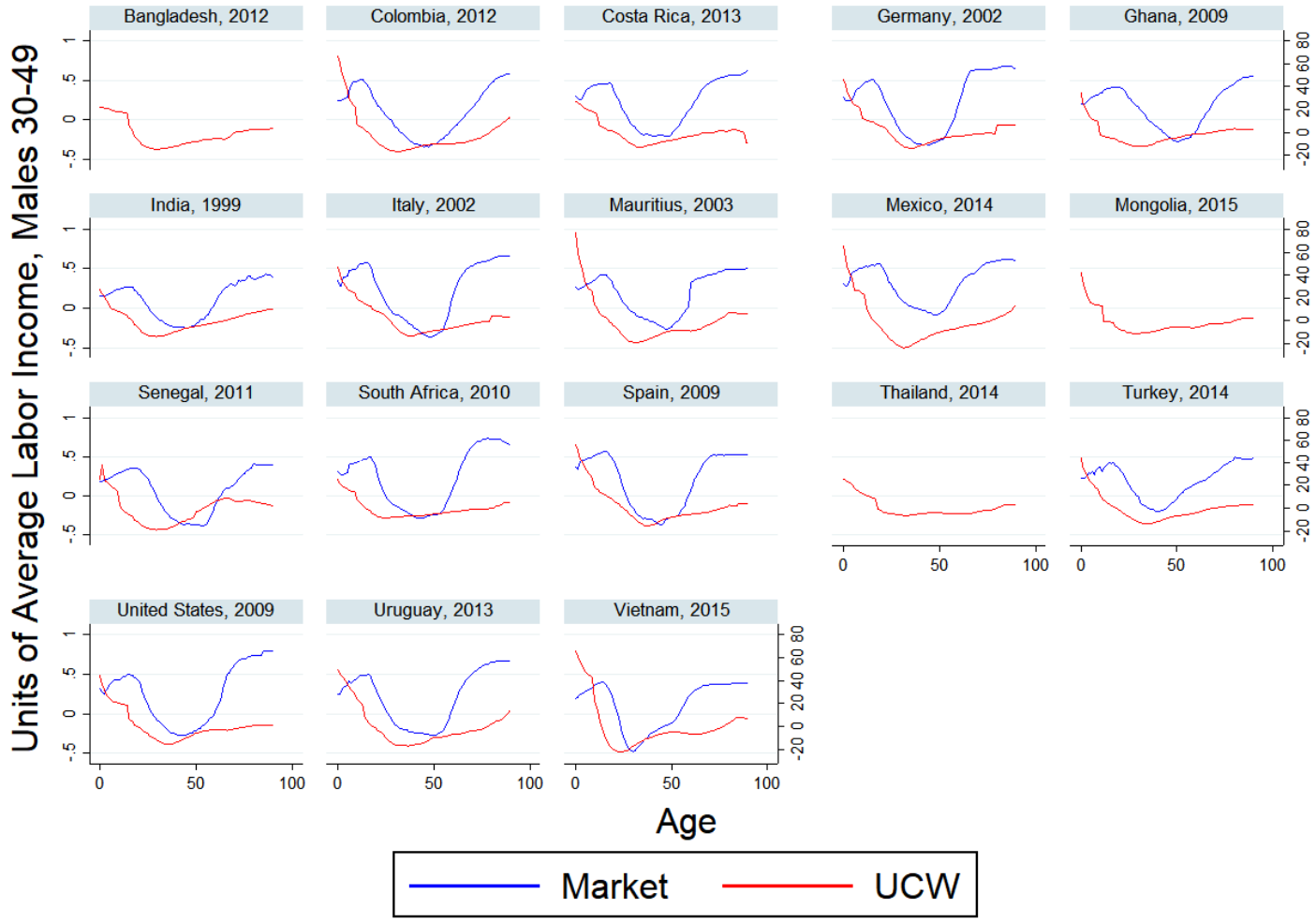
4.1. Gender, dependency, demographic dividends, and support ratios

Early work connecting demographic change to economic outcomes was based on dependency ratios – the population ratios of dependent young and old age groups to working age groups. The age groups were defined somewhat arbitrarily and applied across all areas in an analysis equally, regardless of how different age patterns of education, home leaving, family formation, and retirement might be from place to place. If the dependency ratio was falling, a population was said to be experiencing the demographic dividend.

Lee and Mason and collaborators developed a better way to measure dependency using real data (Lee and Mason, 2011; United Nations, 2013). This method produces estimates of the age dimension of economic activity called National Transfer Accounts (NTA), described previously. An age group's level of dependency in NTA estimates is its consumption minus labor income, a value called the lifecycle deficit shown as the blue lines in Figure 10. In demographic dividend analysis using NTA age profiles, the balance between consumption and production is often measured as the support ratio, although here I will refer to it as the economic support ratio (ESR) to distinguish it from the care support ratio (CSR) that will be discussed later. A one percentage point rise in the ESR enables a percentage point rise in consumption at every age, all things being equal, without any increase in age-specific labor income necessary. A rising ESR indicates a demographic dividend, a falling ESR a demographic tax. Mason et al. (2017) showed in ESR estimates the degree to which different nations would be impacted both by their changing population age structures, but also by the generational economies that had developed and set the levels of production relative to consumption for different age groups. For most countries, the long-term outlook is that population aging represents a significant challenge to countries' ability to support

the market-based consumption of future populations with their labor. However, compensating factors such as the ability to invest more in human and physical capital have the potential to ameliorate the situation somewhat.

Figure 10. Lifecycle deficit (consumption less production) for market economy versus UCW, in units of average labor income for males 30-49 for market-based consumption, and hours per week for UCW consumption.



Notes: Market based consumption is scaled to average male labor income ages 30-49 and charted relative to the vertical axis on the left-hand side of the chart. UCW consumption is in hours per week and charted relative to the right-hand side of the chart. Bangladesh, Mongolia, and Thailand do not have market labor income currently available by sex, so the standardization to male labor income is not possible.

If we think of unpaid care work as representing another sphere of economic activity, the population-weighted ratio of UCW production to consumption gives a care support ratio (CSR) that is similar to the ESR and a rising or falling CSR will represent a demographic dividend or tax in the unpaid care economy from population age structure change. A rising CSR means that population change will make current levels of UCW consumption easier to sustain in the future. A falling CSR, the opposite. As mentioned previously, the CSR is not meant to reflect reality as the ratio will deviate from one in the projections, but in the real world we know the care economy will have to adjust so that aggregate production is always equal to aggregate consumption.

The ratios are calculated based on different units, the ESR based on monetary age-profiles and the CSR based on time-based age profiles. Because these are ratios the units disappear, and in general the monetary-valued UCW profiles have very similar shapes to the time-valued profiles because of relatively constant imputed wages over age. It is important to keep in mind, however, that a change in ESR will have different consequences than a change in CSR. Rising ESR means freed up dollars that are no longer needed to subsidize dependent age groups, by contrast rising CSR frees up time. Dollars can be used to pay for care that may substitute for UCW, just as time can be exchanged for money to purchase market goods and services. More complex models will be needed to understand how these two ratios may work together, but the current research lays the empirical foundations for comparing the two.

4.2. Projected care support ratios

One reason that we should take note of the UCW economy has already been discussed – it represents a huge portion of the total economic activity in an economy, as shown by the per capita ratios in Table 2. Another reason we should care about the UCW economy is that it is an age-driven system providing the care that children and elders cannot provide for themselves (although for elders the net need is much less). Any age driven system will be affected by change in population age structures and, with the global trend toward lower fertility and longer lives continuing, population age structures are projected to change a great deal in the future. As discussed in the introduction, these changes can be summarized using care support ratios. In our projected future populations, will there be enough unpaid care available for those who need it, given the current age- and sex-specific patterns of care consumption and production? The UCW age profiles showed how different countries have different levels of production and consumption of UCW time by age currently. When we combine that current picture with projected population age structures over time we see if future changes in population age structure will make this system harder or easier to maintain.

This thought experiment makes a strong assumption that there will be no substitution between unpaid care and market-based care provision. We know, however, that such substitutions are likely and have historical precedent, with many societies growing the level of purchased care and household services substantially over time, although at different rates for different types of care. We will not be addressing that issue here, instead restricting the research question here to whether or not given current per capita consumption and production of unpaid care work, future populations will be able to meet the demand.

Figure 11 shows projected care support ratios of aggregate production relative to consumption in three different versions: the total UCW support ratio is shown in black, direct care in red, and indirect care in blue. The calculations begin in 2015 with the assumption that the system is in perfect balance: aggregate production equals aggregate consumption and all support ratios start at 1.0. Each year the

population changes as in the UN WPP's 2019 medium variant projection. The new aggregate care support ratio goes up or down from 2016 to 2065 based on whether the population age structure is changing to favor production over consumption, or the opposite.

What do we observe? For the relatively young countries whose fertility is projected to fall, care needs will be easier to meet. In Bangladesh, Ghana, India, Mexico, Mongolia, Senegal, South Africa, and Turkey, the red line for the direct care support ratio increases steadily because the very time-costly young children's share of the total population falls relative to their very productive parents and, to a lesser extent, grandparents. The blue lines for indirect care support ratios are mostly flat in these countries. This is mainly driven by the much flatter curves for both the production and consumption of indirect care relative to that for direct care. Flatter curves mean that age structure does not affect their balance over time as much as the highly age-differentiated curves for direct care. It is also impacted by fifty-year time frame in which population aging will not be so acute yet for these young countries. Combining direct and indirect care then gives largely positively sloped lines in these young countries, but with slower growth than direct care alone.

For the countries which already have low fertility and relatively small cohorts of new infants entering, the picture is different. Their direct care support ratios fall somewhat over the fifty-year projection period. In Germany, Italy, and Spain, the share of time-costly children will not fall that much, but the oldest old shares will grow relative to the more UCW time-productive ages in mid-life, leading to relatively lower supply of direct care relative to the demand.

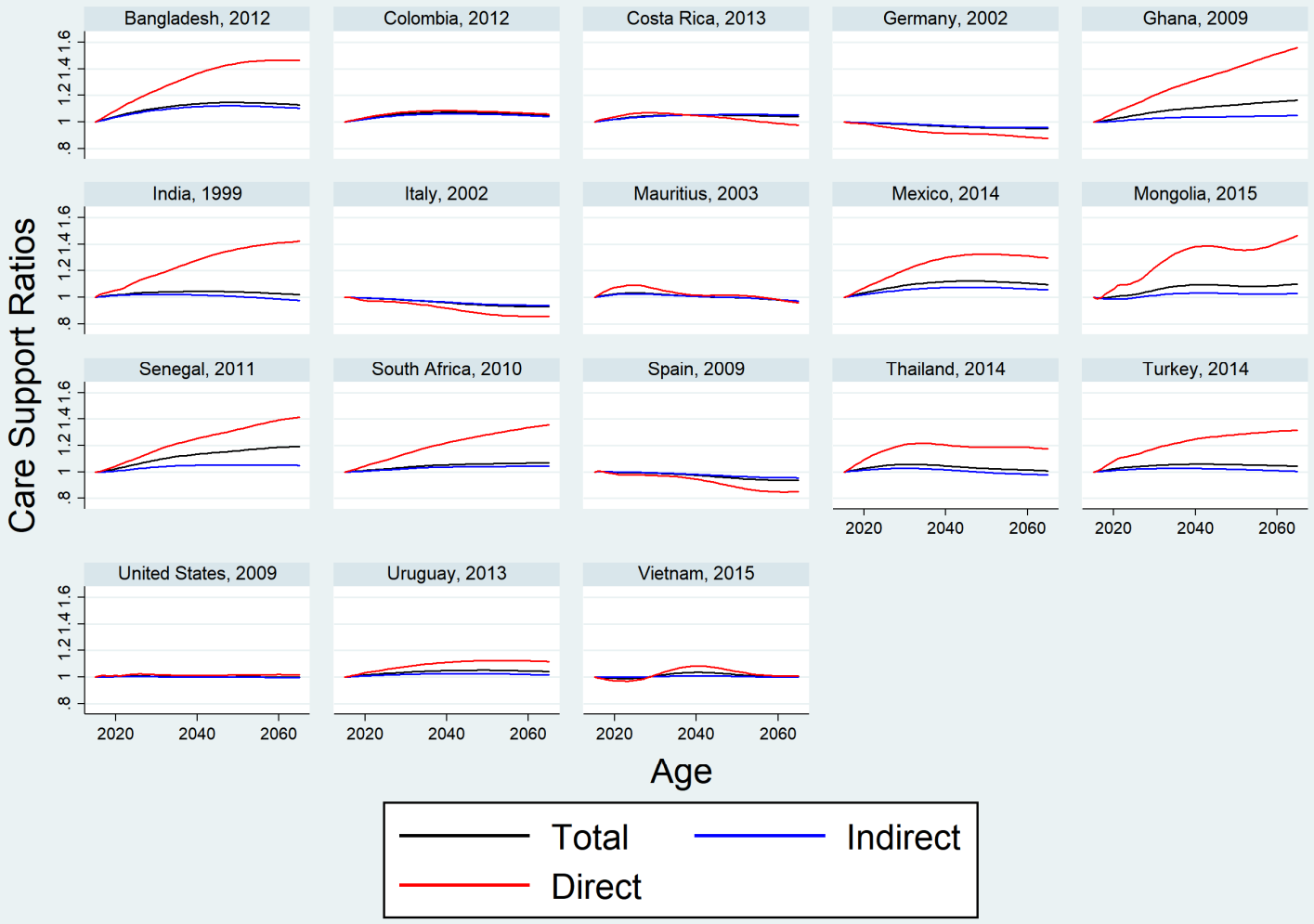
A few countries, such as the United States and Vietnam, remain quite stable. These countries seem to have a more diversified supply curve of care over age and sex.

4.3. Alternative scenarios for care support ratios

The analysis in the last section presented a very restricted scenario in which nothing changed in the unpaid care work economy other than the shares of the population by age and sex. Beyond this baseline scenario, many other scenarios can be imagined for how the UCW system might change in the future. Three simple scenarios are examined here:

- **QQ tradeoff**. As first imagined by Gary Becker (1960), instead of always preferring more children when they have more resources, parents may instead prefer to have fewer children but invest more in each child. There is evidence that this quantity-quality tradeoff occurs not just with market inputs into children, but unpaid care work as well (Vargha and Donehower, 2019). We can turn this into a scenario of change in the UCW system by imagining that the direct care support ratio remains fixed, even as the number of children changes. In other words, the age profile of direct care production stays fixed, the consumption of direct care rises because fewer consumers share the same amount, but the ratio stays fixed. With no change in the direct care support ratio, the overall UCW support ratio changes due only to changes in the shares of indirect care demand and supply.

Figure 11. Projected care support ratios, by type of unpaid care work, 2015 – 2065.



- **Men increase UCW to equalize total work with women**. As demonstrated in Figure 6, in most of the countries in our sample, women do more total work hours than men, adding UCW and market work together. The differences are not huge, but they are consistent. What if men's UCW production increased so as to eliminate any gaps in total work? There would still be gender specialization, but no gender gap in total work time and smaller gender gaps in UCW time. (The increase in men's UCW is divided into direct and indirect based on men's age-specific pro rata shares of these two types of work. For the few countries with parts of their UCW system where a total work gender gap is in women's favor, women's UCW time increases to eliminate the gap.)
- **Women decrease UCW to reduce market work gap with men.** What if women's time spent in market labor increases over the next fifty years to close the gender gap in market work with men by half, but at the same time, women decrease their UCW production by the same number

of hours so that their total work amount does not change? As in the "men increase UCW" scenario, there is still gender specialization, but it is less over time. Gender gaps in total work do not change in this scenario.

The results of these scenarios are evaluated by comparing the care support ratios they create in 2065 relative to 2065 ratios for the baseline scenario (the UCW system of the age profiles does not change). The purpose of these alternative scenarios is not to imagine that any one of them is more or less likely to occur, but to understand the magnitude of different types of change.

The results are shown in Table 3. The baseline scenarios as in Figure 11 are given just for the final year 2065 in the first set of columns. Moving to the right shows results for the first alternative scenario, "QQ Tradeoff." The 2065 values appear in the upper block of rows and the difference between baseline 2065 and the alternative 2065 appear in the lower block of rows. The basic idea of the QQ Tradeoff alternative scenario was that the age- and sex-specific consumption patterns of direct care would increase relative to the supply, no matter how that supply changed, so the direct care support ratios are all one here. What this means for the overall support ratios, however, is that there is no decreased demand for childcare due to population aging and thus the strong increases in care support ratios seen in the baseline scenario are either attenuated or changed into decreases. Even in the face of the challenge this may mean to provide care, the QQ Tradeoff scenario could still be welfare improving if it means greater investments in the care of children and ultimately more productive humans. However, given that we have empirical evidence that such a QQ Tradeoff is plausible, it is right to be cautious about lower fertility easing overall childcare burdens.

The next alternative scenario in the columns to the right is the "Men Increase UCW." This scenario only considers increases in UCW production, so the care support ratios increase for all countries and types of UCW. The scenario increases men's share of the UCW system only to the extent necessary to close any gender gaps in total work, though, so we see large increases in care support ratios in this scenario for countries with large gender gaps in total work, such as Mongolia and Senegal. For Bangladesh, Germany, and the United States, on the other hand, there is not much gap in total work to close.

Table 3. Projected care support ratios in 2065 by scenario, and the difference between alternative scenarios and baseline.

Scenario:	Baseline			QQ Tradeoff			Men Increase UCW			Women Decrease UCW		
	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
Projected Support Ratios in 2065 relative to 2015:												
Bangladesh, 2012	1.13	1.10	1.47	1.09	1.10	1.00	1.15	1.12	1.48	0.79	0.78	1.00
Colombia, 2012	1.05	1.04	1.06	1.02	1.04	1.00	1.18	1.13	1.23	0.92	0.89	0.95
Costa Rica, 2013	1.04	1.05	0.98	1.05	1.05	1.00	1.19	1.20	1.14	0.84	0.85	0.81
Germany, 2002	0.95	0.96	0.88	0.96	0.96	1.00	1.00	1.01	0.91	0.88	0.90	0.79
Ghana, 2009	1.16	1.05	1.56	1.03	1.05	1.00	1.42	1.25	1.98	0.95	0.85	1.31
India, 1999	1.02	0.98	1.42	0.98	0.98	1.00	1.13	1.06	1.70	0.65	0.61	0.97
Italy, 2002	0.93	0.94	0.85	0.95	0.94	1.00	1.11	1.12	1.03	0.82	0.84	0.72
Mauritius, 2003	0.97	0.97	0.96	0.98	0.97	1.00	1.07	1.08	1.07	0.81	0.81	0.79
Mexico, 2014	1.10	1.06	1.30	1.04	1.06	1.00	1.17	1.12	1.43	0.87	0.83	1.05
Mongolia, 2015	1.10	1.03	1.47	1.02	1.03	1.00	1.44	1.32	2.06	1.05	0.98	1.39
Senegal, 2011	1.19	1.05	1.41	1.03	1.05	1.00	1.54	1.42	1.72	0.92	0.82	1.07
South Africa, 2010	1.07	1.04	1.36	1.04	1.04	1.00	1.19	1.17	1.47	0.92	0.90	1.14
Spain, 2009	0.94	0.96	0.85	0.96	0.96	1.00	1.13	1.15	1.03	0.89	0.91	0.80
Thailand, 2014	1.01	0.98	1.17	0.98	0.98	1.00	1.17	1.12	1.39	0.85	0.83	1.00
Turkey, 2014	1.04	1.00	1.32	1.00	1.00	1.00	1.18	1.14	1.48	0.85	0.82	1.03
United States, 2009	1.00	1.00	1.02	1.00	1.00	1.00	1.06	1.06	1.08	0.93	0.93	0.93
Uruguay, 2013	1.04	1.02	1.12	1.01	1.02	1.00	1.21	1.17	1.33	0.92	0.90	0.99
Vietnam, 2015	1.00	1.00	1.01	1.00	1.00	1.00	1.09	1.10	1.09	0.97	0.97	0.97
Differences relative to baseline projection:												
Bangladesh, 2012				-0.04	0.00	-0.47	0.02	0.02	0.01	-0.34	-0.33	-0.47
Colombia, 2012				-0.03	0.00	-0.06	0.13	0.09	0.17	-0.13	-0.15	-0.11
Costa Rica, 2013				0.00	0.00	0.02	0.15	0.15	0.17	-0.20	-0.20	-0.16
Germany, 2002				0.01	0.00	0.12	0.05	0.05	0.04	-0.07	-0.06	-0.09
Ghana, 2009				-0.13	0.00	-0.56	0.25	0.20	0.42	-0.21	-0.20	-0.25
India, 1999				-0.04	0.00	-0.42	0.11	0.09	0.28	-0.37	-0.36	-0.45
Italy, 2002				0.02	0.00	0.15	0.18	0.18	0.17	-0.11	-0.10	-0.13
Mauritius, 2003				0.01	0.00	0.04	0.10	0.10	0.11	-0.16	-0.16	-0.17
Mexico, 2014				-0.05	0.00	-0.30	0.08	0.06	0.13	-0.23	-0.23	-0.25
Mongolia, 2015				-0.08	0.00	-0.47	0.34	0.29	0.60	-0.05	-0.05	-0.08
Senegal, 2011				-0.17	0.00	-0.41	0.35	0.37	0.30	-0.27	-0.23	-0.34
South Africa, 2010				-0.03	0.00	-0.36	0.12	0.12	0.11	-0.15	-0.14	-0.21
Spain, 2009				0.03	0.00	0.15	0.19	0.19	0.18	-0.05	-0.05	-0.05
Thailand, 2014				-0.03	0.00	-0.17	0.16	0.15	0.21	-0.15	-0.15	-0.17
Turkey, 2014				-0.04	0.00	-0.32	0.14	0.13	0.16	-0.20	-0.19	-0.28
United States, 2009				0.00	0.00	-0.02	0.06	0.06	0.07	-0.07	-0.07	-0.08
Uruguay, 2013				-0.03	0.00	-0.12	0.17	0.16	0.21	-0.12	-0.11	-0.13
Vietnam, 2015				0.00	0.00	-0.01	0.09	0.10	0.08	-0.04	-0.04	-0.03
			Average:	-0.03	0.00	-0.18	0.15	0.14	0.19	-0.16	-0.16	-0.19

Finally, we have a scenario in which gender gaps in market work close by half by 2065. For some countries still experiencing steady increases in female market labor force participation, this is realistic. For others where those increases have stalled, it is less so. The impact on care support ratios in this scenario comes from the idea that, in order not to exacerbate gender gaps in total work, women decrease their UCW time in exactly the amount that they increase their market work time. In the results for this scenario, most countries' total UCW support ratios fall by the end of the projection period. This is an important result in the context of many countries' hopes that women's increased market labor

force participation will buoy overall population productivity in the face of population aging. Without other policy interventions, then, more market labor for women means either greater potential time poverty for women who increase their total work, or potential problems meeting the demand for care.

4.4. Care support ratios compared to economic support ratios

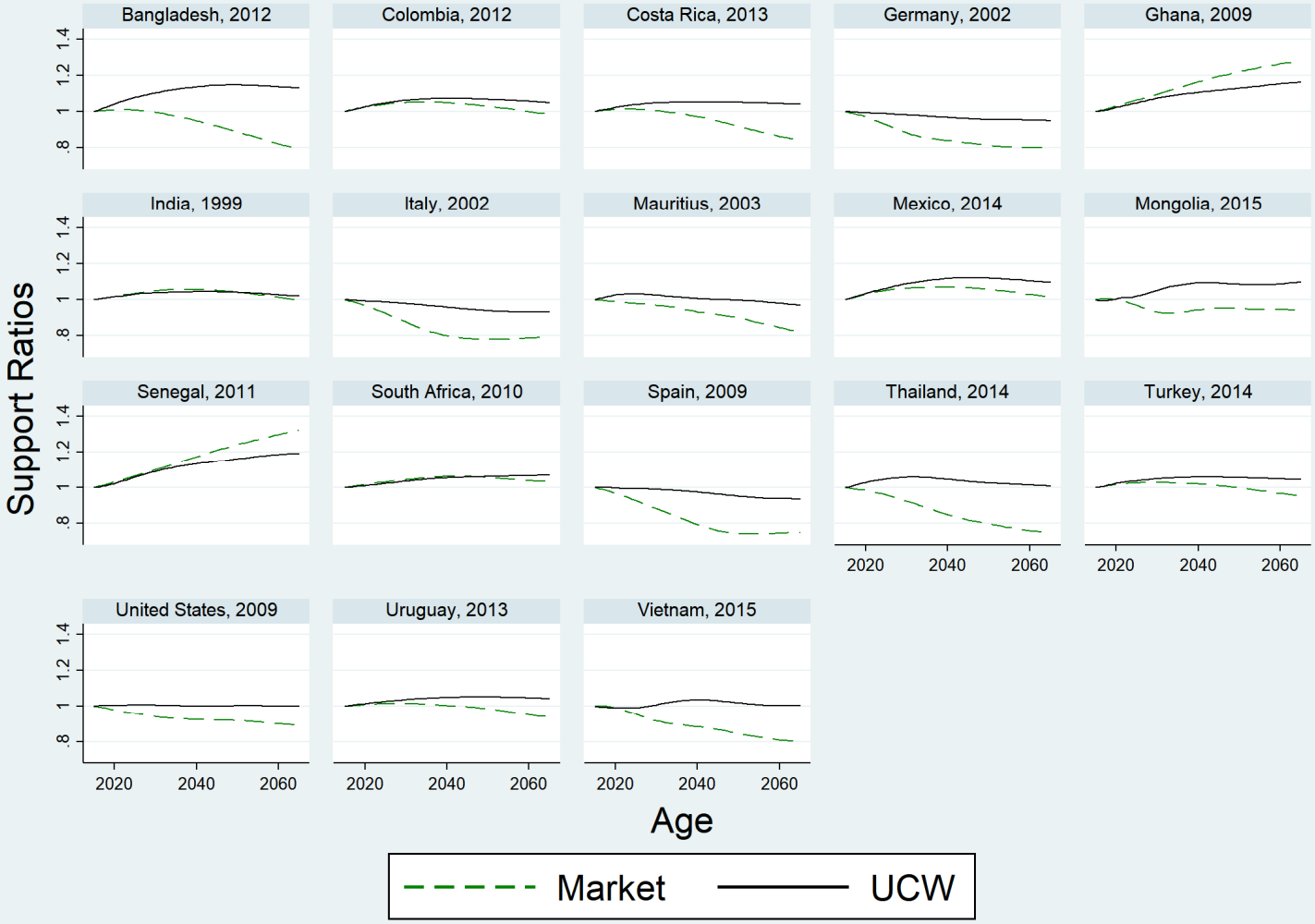
The final set of results compares traditional economic support ratio (ESR) indicators of market demographic dividends with care support ratios (CSR) that estimate the demographic dividends that might accrue from future changes in age structure affecting the care economy. Figure 12 shows the same total care support ratios as shown in Figure 11 (the black lines), but now also includes economic support ratios (green dashed lines). As in Figure 11, the paths are all calibrated to equal one in 2015 and then change based on projected demographic change until 2065.

Ghana and Senegal are the only countries with increases in the ESR greater than those available in the care economy, and even for these two countries the CSR is still large. In countries like Bangladesh, Germany, Italy, Spain, Thailand, and Vietnam, where population aging is expected to present challenges to the market economy, the CSR shows a much rosier picture. What does this mean for policy? It means that time dynamics in the unpaid care economy may be able to ease some of the strains in the market economy. It also means that in the near future, the challenge of population aging will no longer be just a rich country phenomenon. Lower- and middle-income countries will end their demographic dividend phase when those green dashed lines start to fall. What we see in many of the CSRs in those economies is that attention paid to unpaid care work could help extend the dividend phase a little longer and help these countries get richer as they get older.

How could this happen? Unpaid caregivers could take the time "freed up" by relatively lower demands for unpaid care work and shift that work to the market economy. If some of the freed up time came from reducing time spent in low-productivity activities like gathering water or fuel, or household drudgery, that would enhance overall population productivity. However, in the previous analysis showing care support ratios for direct versus indirect care, we saw that most of these gains represent time freed up in direct childcare. Productivity there is hard to quantify, but probably safe to say that it is higher productivity than sweeping floors. Given evidence that parents tend to reinvest the freed up time in more intensive childcare for fewer children, this could still produce a benefit in the future, but it would be delayed by a generation while the children who received this potentially productivity-enhancing investments made their way into the labor market.

If policymakers sought a transition of this free time into market work, however, they would likely need coordinated policies that made mothers feel welcome in the labor force. That means opening all fields of employment to women and dismantling social and institutional barriers to women entering traditionally male dominated occupations. It means high quality public education and daycare available for their children, and a social environment accepting of mothers combining work and family. It also means a work world that does not pretend workers have no obligations outside of paid employment, but rather supports them with flexible family leave policy, good quality decent jobs, and work schedules that are conducive to family life.

Figure 12. Projected total unpaid care support ratios and economic support ratios, 2015 – 2065.



5. Discussion

Using time use data and an attention to patterns by age and sex, this work has revealed how much productive capacity goes into unpaid care work, mostly by women. This work is vital to society now and in the future. Combining the focus on unpaid care work with data on market work as well demonstrates that we live in gendered economies, with men and women and girls and boys leading different lives. This gendered system, being so universal across countries, likely originated in our past population regime of high fertility necessitated by the very high mortality of children and childbearing women. Those conditions no longer hold, and we see evidence of this system changing all over the world, exemplified by the global diversity in the degree to which gendered economies still prevail. These cultural institutions can be very entrenched, however, continuing to shape lives long after the conditions that gave rise to them have changed completely.

Demographic dividend analysis, long focused on how population changes affect our market economy, tells only half the story when it ignores the closer links between population changes and family formation and change. Demographic change is just as salient inside the household in our unpaid work lives as it is inside a firm where we are paid. The most important point here, though, is that policies to take advantage of unpaid care work demographic dividends must be much more gender-aware and family-aware than is usually the case. Specifically, the usual demographic dividend policy emphases are on family planning and reproductive health, education and health investments, and good governance policies to make countries desirable destinations for foreign direct investment. The policies that will allow the realization of dividends from changes in the UCW economy are targeted gender equity and social change policies: removing legal and cultural barriers to women's full participation in market work, enhancing the cultural acceptability and expectations around men's participation in UCW, and labor market policies which make the combining of market work and UCW easier.

There are, of course, some large unknowns in the analysis and major areas that call out for better data and new thinking on methods. The health of elders will be an important part of our aging future, as will the ability of our labor markets to create good jobs. More time use data in more countries is necessary to truly understand how our unpaid care work economies function, and better methods to measure eldercare will help us avoid an avalanche of unforeseen demand for eldercare. Finally, in terms of this particular analysis, future work will focus on a way to tie the market and household sectors together to create overall demographic dividend analyses that include dynamics between market labor and unpaid care work, and between paid and unpaid care work as well.

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