Harnessing Time-Use Data for Evidence-based Policy, the 2030 Agenda for Sustainable Development and the Beijing Platform for Action

A resource for data analysis

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Disclaimer

Chapters 3-9 of this publication are based on material submitted by the respective authors mainly to demonstrate the potential of time-use data to inform public policy development and monitoring as well as to shed light on policy issues related to the 2030 Agenda for Sustainable Development and the Beijing Platform for Action. It is recognized that some of the materials used and presented for demonstration purposes may be dated and may not fully align with current international standards.

The Stata code in Chapters 4-9 is as provided by the primary contributor of the chapter material with limited validation by ESCAP. For some chapters, validation of the Stata code was not possible due to restricted or no access to the country dataset/s used in the chapter. Where possible, ESCAP has written codes also in R Markdown for the convenience of the user.

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ACRONYMS AND ABBREVIATIONS

ATUS	American Time-use Survey
BLS	U.S. Bureau of Labour Statistics
BPFA	Beijing Declaration and Platform of Action
CDS	current daily status
CPS	current population survey
CSV	comma-separated values
CTUS	China Time-use Survey
CWS	current weekly status
ESCAP	Economic and Social Commission for Asia and the Pacific
GDP	Gross Domestic Product
GWG	Global Working Group
HTUS	Henan Province Time-use Survey
ICATUS	International Classification of Activities for Time-Use Statistics
ICLS	International Conference of Labour Statisticians
ICT	Information and Communications Technology
ILO	International Labour Organization
ITUS	Indian Time-use Survey
LFS	labour force survey
OECD	Organisation for Economic Cooperation and Development
OLS	ordinary least squares (regression approach)
NSS	National Sample Survey
NSSO	National Sample Survey Office
SDGs	Sustainable Development Goals
SES	socio-economic status
SNA	System of National Accounts
TTUS	Turkish Time-use Survey
TUS	Time-use survey
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNSD	United Nations Statistics Division
UPS	usual principal status
UPSS	usual principal and subsidiary status

GLOSSARY OF TERMS AND DEFINITIONS

Except where otherwise indicated, the following are sourced from the ILO Glossary of Statistical Terms: Accessed 24 August 2020 at https://www.ilo.org/ilostat-files/Documents/Statistical%20Glossary.pdf.

Administrative records: Administrative records are utilised for administrative purposes such as keeping a record of the members, activities, staff, etc. of the corresponding agency or institution. They were not designed for statistical purposes, but they do have a significant underlying statistical potential, and can be used to produce statistics as a by-product. They are particularly useful in contexts where there are no regular household or establishment surveys in place and serve as an alternative source of statistics. In any given country, the administrative records found are numerous and varied and cover a wide range of topics. Some examples are population registers (population data), records of tax authorities (income data), registration of students in the educational system (education data) and medical registration (health statistics). When it comes to labour statistics, the main administrative records used are records of employment offices or unemployment benefits (data on registered unemployment), records of workers' organizations (data on unionization, strikes, etc.), collective agreements (data on 13 collective bargaining, wages, etc.) and labour inspection records (data on occupational accidents).

Big Data: Data sources that can be – generally – described as: high volume, velocity and variety of data that demand cost effective, innovative forms of processing for enhanced insight and decision making.[1]

Employment: Persons in employment are defined as all those of working age who, during a short reference period, were engaged in any activity to produce goods or provide services for pay or profit. They comprise employed persons "at work", i.e. who worked in a job for at least one hour; and employed persons "not at work" due to temporary absence from a job, or to working-time arrangements (such as shift work, flexitime, and compensatory leave for overtime).

Establishment survey: An establishment survey is a survey of a sample of establishments or enterprises which represent worksites for employees. Information about the jobs held by self-employed workers is typically excluded from such surveys. They are conducted from a production perspective and seek to describe labour as an input to production in establishments. Such surveys collect information on jobs rather than on persons employed, thus persons who have jobs in more than one establishment will be counted more than once. Moreover, they often only cover a subset of all establishments in an industry, normally those above a certain size limit, and typically sample only formal sector establishments. The agricultural sector is commonly excluded and sometimes such surveys are limited in scope to a key sector of the economy such as manufacturing. Such a survey is often conducted in order to provide estimates on employment, hours, and earnings of employees on nonfarm payrolls by industry. They may also provide information on variables such as employment or wages by occupation, labour cost, basic data for productivity, or employee benefits.

1 United Nations Economic Commission for Europe (UNECE, 2013).

Informal employment: Informal employment comprises persons who in their main job were: (a) own-account workers, employers or members of producers' cooperatives employed in their own informal sector enterprises; (b) own-account workers engaged in the production of goods exclusively for own final use by their household; (c) contributing family workers, irrespective of whether they work in formal or informal sector enterprises; or (d) employees holding informal jobs, whether employed by formal sector enterprises, informal sector enterprises, or as paid domestic workers by households.

Forms of work: Work comprises any activity performed by persons of any sex and age to produce goods or to provide services for use by others or for own use. There are five mutually exclusive forms of work, which are based on the intention of production (for own final use; or for use by others, i.e. other economic units) and the type of transaction (i.e. monetary or non-monetary transactions, and transfers), as follows:

1. own-use production work comprising production of goods and services for own final use;
2. employment work comprising work performed for others in exchange for pay or profit;
3. unpaid trainee work comprising work performed for others without pay to acquire workplace experience or skills;
4. volunteer work comprising non-compulsory work performed for others without pay;
5. other work activities (these include such activities as unpaid community service and unpaid work by prisoners, when ordered by a court or similar authority, and unpaid military or alternative civilian service, which may be treated as a distinct form of work for measurement)

Household survey: By definition, a household survey includes data on households. A household is defined to be a basic residential unit. Household-based surveys are best suited for collecting statistics of work and of the labour force covering the resident population, their participation in all jobs and in all forms of work – in particular, work in the informal economy, own-use production work, unpaid trainee work and volunteer work. The most common type of household survey used to produce labour statistics is the labour force survey.

Informal sector: Employment in the informal sector refers to all persons who, during a given reference period, were employed in at least one informal sector enterprise, irrespective of their status in employment and whether it was their main or a secondary job. An informal sector enterprise satisfies the following criteria:

- It is an unincorporated enterprise, which means that:
  - It is not constituted as a legal entity separate from its owners, and
  - It is owned and controlled by one or more members of one or more households, and
  - It is not a quasi-corporation (it does not have a complete set of accounts, including balance sheets);
- It is a market enterprise: this means that it sells at least some of the goods or services it produces. It therefore excludes households employing paid domestic workers;
- And at least one of the following criteria:
  - The number of persons engaged / employees / employees employed on a continuous basis, is below a threshold determined by the country

- The enterprise is not registered
- The employees of the enterprise are not registered.

Job: A job or work activity is defined as a set of tasks and duties performed, or meant to be performed, by one person for a single economic unit. The term job is used in reference to employment. Persons may have one or several jobs. Those in self-employment will have as many jobs as the economic units they own or co-own, irrespective of the number of clients served. In cases of multiple job-holding, the main job is that with the most hours usually worked, as defined in the international statistical standards on working time.

Labour force: The labour force comprises all persons of working age who furnish the supply of labour for the production of goods and services in exchange for pay or profit during a specified time-reference period. It refers to the sum of all persons of working age who are employed and those who are unemployed.

Labour force survey: A labour force survey (LFS) is a household-based sample survey focused on the labour force status of the working age population and related statistics. Survey respondents are members of sampled households. The LFS seeks to provide reliable, coherent information from a socioeconomic perspective about the total working age population and its components, in particular the labour force. Such surveys often allow disaggregations of the labour force by personal characteristics such as sex, age, educational attainment, and in some cases, by migrant status and ethnicity as well as information about the jobs held by employed persons (e.g. occupation and type of contract). Labour force surveys are the main source of statistics for monitoring labour markets, labour underutilization including unemployment, and the quality of jobs and working conditions of persons in employment and in unpaid trainee work.

Labour force underutilization: Labour underutilization refers to mismatches between labour supply and demand, which translate into an unmet need for employment in the population. Measures of labour underutilization include time-related underemployment, unemployment, and the potential labour force. Other dimensions of underutilization of labour at the level of individuals as well as the economy are skills mismatches and slack work, in particular among the self-employed.

National accounts: National accounts, based on the internationally recommended System of National Accounts (SNA), are a coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. National accounts provide a comprehensive accounting framework within which economic data can be compiled and presented in a format that is designed for purposes of economic analysis, decision making and policymaking. There are a number of aggregate measures in the national accounts, most notably gross domestic product (GDP), which is the most widely used measure of aggregate economic activity in a period.

Stata: A general-purpose commercially available statistical software package created in 1985 by StataCorp. Most of its users work in research, especially in the fields of economics, sociology, political science, biomedicine and epidemiology.[2]

Sustainable Development Goals: The 2030 Agenda and the Sustainable Development Goals (SDGs) were adopted in 2015 by the United Nations General Assembly. The 17 SDGs are a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity. They cover a broad range of social and economic development issues, including poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, the environment and social justice, with a focus on the most vulnerable and a commitment that "no one will be left behind."

Time-use statistics: A classification of all the activities a person may spend time on during the 24-hour day that is grouped in a meaningful way to facilitate international comparisons.[3]

Unemployment: Persons in unemployment are defined as all those of working age who were not in employment, carried out activities to seek employment during a specified recent period and were currently available to take up employment given a job opportunity. The unemployment rate expresses the number of unemployed as a percent of the labour force. For more information, refer to the Resolution concerning statistics of work, employment and labour underutilization.

Unpaid domestic work: Domestic services rendered without pay for household and family members.[4]

Unpaid care work: Caregiving services provided without pay for household and family members or members of other households.[5]

Unpaid work: For the purpose of this publication, unless otherwise stated, an activity that includes both unpaid care work and unpaid domestic work. In line with the International Classification of Activities for Time-Use Statistics 2016 (ICATUS 2016), this excludes forms of unpaid work such as volunteer work and unpaid trainee work.

Work: Work comprises any activity performed by persons of any sex and age to produce goods or to provide services for use by others or for own use:

- Work is defined irrespective of its formal or informal character or the legality of the activity
- Work excludes activities that do not involve producing goods or services (e.g. begging and stealing), self-care (e.g. personal grooming and hygiene) and activities that cannot be

2 Stata: Software for Statistics and Data Science: Accessed on 01 April 2021 at https://www.stata.com.

3 Accessed at https://unstats.un.org/unsd/classifications/Family/Detail/2083 on 01 April 2021.

4 This includes activities like: Food and meals management and preparation; cleaning; care of clothes and textiles (e.g., washing, ironing); house maintenance and repair; household management (e.g., paying bills, organizing); pet care; shopping for household and family members; traveling, moving, transporting or accompanying goods or persons related to this kind of unpaid domestic services.

5 This includes activities like: childcare; care for dependent adults; care for non-dependent adult household and family members; traveling and accompanying goods or persons related to unpaid care giving services for household and family members; other activities related to unpaid care giving services for household and family members.

performed by another person on one's own behalf (e.g. sleeping, learning and activities for own recreation).

- The concept of work is aligned with the general production boundary as defined in the System of National Accounts 2008 (2008 SNA) and its concept of economic unit that distinguishes between: (i) market units (i.e. corporations, quasi-corporations and household unincorporated market enterprises); (ii) non-market units (i.e. government and non-profit institutions serving households); and (iii) households that produce goods or services for own final use.
- Work can be performed in any kind of economic unit

PREFACE

Since their introduction in the early 1900s through social surveys, time-use statistics have become an essential component of the international statistical toolbox. As this publication elaborates, time-use data and statistics offer a number of special attributes that provide insights related to specific elements of the economic, social and environmental pillars of sustainable development, as reflected in the 2030 Agenda for Sustainable Development.

The material in this publication by preeminent international experts in the field details the unique contribution time-use surveys and related statistics have made in fields ranging from understanding the dynamics of poverty to gender inequality, education, health, the dynamics of and interface between formal and informal work, work-life balance, public infrastructure, employment and labour market policy, and transportation planning.

Time-use data in particular can shed light on the dynamics of gender inequality by providing visibility for the care economy as well as gender disparities at both the intra-household level and within wider formal and informal economies. Time-use data could potentially provide insights on several targets of the Sustainable Development Goals.

While there are several documents and tools available internationally to provide guidance and share experiences on the implementation of time-use surveys in different contexts, this publication seeks to complement these resources by focusing on *the use and analysis* of time-use data and statistics for the formulation and monitoring of public policies, as well as the monitoring of the Sustainable Development Goals.[6] Over thirty countries in the Asia-Pacific region have conducted time-use data collection exercises till date, yet the use and analysis of the data for policy purposes have been very limited.

The publication provides detailed step-by-step guidance on accessing, processing and analysing time-use data from selected national surveys to examine socio-economic dynamics in a range of areas while exploring public policy priorities and ways forward. In each case, links with relevant Sustainable Development Goals targets and indicators are made.

The publication is designed for reference and use by national statistical offices and other relevant national agencies contributing to policy research, analysis and formulation as well as Sustainable Development Goals implementation and monitoring. It could also serve as a resource for researchers, academia and civil society organizations with an interest in relevant policy analysis.

6 For a recent example, refer to Time-use surveys and statistics in Asia and the Pacific: A review of challenges and future directions, published by the International Labour Organization and United Nations Development Programme, 2018.

INTRODUCTION

INTRODUCTION

Time-use data: Critical contribution to evidence-based policy formulation and Sustainable Development Goals monitoring

Meeting the 17 Sustainable Development Goals (SDGs) by 2030 requires government leaders, policymakers and all relevant actors to have an in-depth understanding of the roles and contributions of women, men, girls and boys in all spheres of society and the ways their day-to-day activities can significantly affect both their own well-being and prospects and of the planet.

This publication provides a reference for researchers and analysts on the application of time-use data to formulate public policy and monitor its implementation, as well as to monitor SDG implementation. They are underpinned by a particular focus on the recognition and measurement of unpaid work contributions of women and men and the full scope of their productive activities, including those outside the production boundary of the System of National Accounts (SNA). Such applications can enable governments to better assess how socio-economic policies affect both women's and men's time-use and well-being through changes in domestic activities and care workloads. Household and care work activities are crucial in maintaining households and in reproducing the labour force, yet they have not generally been given serious attention in public policy formulation, national budget setting and public service design and delivery.

Further underpinning such linkages are commitments made by member States of the United Nations in the Platform of Action adopted at the Fourth World Conference on Women in Beijing, 1995. This recommended that national, regional and international statistical services and relevant governmental and United Nations agencies, in cooperation with research and documentation organizations, work to "improve data collection on the full contribution of women and men to the economy, including their participation in the informal sector(s)" and to "develop an international classification of activities for time-use statistics that is sensitive to the differences between women and men in remunerated and unremunerated work and collect data disaggregated by sex".[7]

Unique attributes of time-use surveys

Alongside approaches such as household surveys and labour force surveys (LFS), time-use surveys (TUS) have the unique advantage of detailed time accounting that allows for a comprehensive coverage of activities that people engage in through day-to-day life, including volunteer work, civic activities, training and learning. Whether by self-administered diary, recall interview, or short-task list method, time-use data collection records the different activities and tasks that a person undertakes during a given reference period, usually in the past 24 hours. Through providing more granular data, time-use surveys can thus provide insights on the patterns of activities (episodes/occurrences), activities which are simultaneous (for example, cooking and child-minding), subjective factors such as levels of personal satisfaction in specific areas, and the context in which activities are carried out.

7 Beijing Declaration and Platform for Action: Accessed on 01 April 2021 at https://www.un.org/en/events/pastevents/pdfs/Beijing_Declaration_and_Platform_for_Action.pdf.

Such features of time-use surveys have increased the accuracy of measuring the amount of time women and men spend in unpaid household and care work, the timing of labour market work, leisure and other activities, and determining the distributional pattern of household and care work burden within the household. Time-use data can further be used to put monetary values on the time people spend in doing productive work that is unpaid; thus, making visible the size of significant currently overlooked elements of national economies.[8]

In more specific terms within these broad areas, time-use data can provide insights in areas including:[9]

- time poverty (particularly for women)
- everyday well-being patterns, including sleep, eating, exercise and hygiene and how these are affected (for example) by time pressure
- the timing of market work (e.g. length of the working day) and unsociable working hours
- the reconciliation of work and family
- the measurement of human capital and its development through time spent by parents with their children (for example)
- access to and consumption of services, energy, communication technologies, etc.
- exposure to indoor and outdoor pollution.

Application of time-use data to public policy

Drawing on these attributes, time-use data analyses can thus provide crucial inputs into the formulation and monitoring of gender-responsive public policies and development strategies in a diverse range of areas with everyday implications for women and men and girls and boys. Such policy areas include education and healthcare at all levels, labour market policy and decent employment promotion, technical and vocational training (including reskilling and upskilling), quality and affordable childcare provision, parental leave, pensions and the care of older persons, availability of flexible working hours, urban safety and transportation, development of poverty reduction strategies, infrastructure development in areas such as water, energy and connectivity, availability of technologies to lift the burden of household work, and design of recreation and leisure services.

The material in this report focuses on selected areas to demonstrate ways in which time-use data can be used within this broader context to:

- identify the constraints faced by women in developing their capabilities, including participation in the labour market, education and training.
- examine gender differences and implications with respect to school homework time-use.
- demonstrate the manner in which unpaid work burdens can reinforce gender inequality, particularly in the labour market, and maintain poverty.

8 Extracted from material provided by Duncan Ironmonger and Michael Bittman to ESCAP Statistics Division in 2018.

9 Extracted from material provided by Michael Bittman to ESCAP Statistics Division in 2018.

- provide valuable insights on how unequal household division of labour can impact female and male labour supply and earnings.
- expand understandings of poverty to encompass the manifestations and implications of "time poverty," including impacts on health.
- demonstrate the benefits for women and girls of public investment in basic social services such as access to safe water and sanitation that are not captured in standard cost-benefit analyses and project appraisals.

Key international references for time-use data collection

A considerable body of international guidance exists to inform the design, application and analysis of time-use surveys. Key among these are the following two milestone documents, which continue to be influential in the development of time-use statistics approaches:

Resolution 1 on "Statistics of work, employment and labour underutilization," 19th International Conference of Labour Statisticians (ICLS), 2013

While definitions and insights concerning the world of work are evolving continuously,[10] this resolution continues to provide a major reference for ongoing international statistical efforts to capture the full scope of work, formal and informal, paid and unpaid. The resolution introduced a new statistical definition of work as comprising "any activity performed by persons of any sex and age to produce goods or to provide services for use by others or for own use" ("Resolution Concerning Statistics of Work, Employment and Labour Underutilization", 2013). It identifies five mutually exclusive forms of work based on the intention of production and type of transaction, namely:

- *own-use production work*, comprising production of goods and services for own final use;
- *employment work*, comprising work performed for others in exchange for pay or profit;
- *unpaid trainee work*, comprising work performed for others without pay to acquire workplace experience or skills;
- *volunteer work*, comprising non-compulsory work performed for others without pay;
- other work activities.[11]

A significant development in the above definition is the recognition that "work" includes the production of goods and services produced at home for personal use or for the use of other household members.

10 For example, the 20th International Conference of Labour Statisticians (ICLS) in October 2018 adopted an updated resolution concerning statistics on work relationships. This included an expanded scope to cover all productive activities (paid and unpaid forms of work); a new family of classifications and a new major category for Dependent Contractors, plus new detailed categories. These further developments built on the outcomes of the 19th ICLS Conference.

11 Refer to concepts of the Resolution at https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/normativeinstrument/wcms_230304.pdf (ILCS Resolution 1, 3.7). Accessed on 05 April 2021.

The International Classification of Activities for Time-use Statistics (ICATUS 2016)

The International Classification of Activities for Time-use Statistics (ICATUS) adopted in 2016 covers all the activities a person may spend time on during the 24-hour day.[12] It provides a standard framework for time-use statistics based on activities grouped into nine categories: (1) employment and related activities, (2) production of goods for own final use, (3) unpaid domestic services for household and family members, (4) unpaid care services for household and family members, (5) unpaid volunteer, trainee and other unpaid work, (6) learning, (7) socializing and communication, community participation and religious practice, (8) culture, leisure, mass-media and sports practices, and (9) self-care and maintenance. These apply regardless of the type of instruments used for data collection and are aligned with the forms of work framework introduced by the 19th ICLS resolution.

Additionally, ICATUS provides as an important framework for using time-use data to monitor progress made towards the achievement of the SDGs and targets. Central in this regard is SDG Target 5.4, which aims at "recognis[ing] and valu[ing] unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate. "Additionally related, SDG Indicator 5.4.1 emphasizes the proportion of time spent on unpaid domestic and care work, by sex, age and location.

Looking ahead - the evolving time-use data landscape

Annexes 2 and 3 provide an overview of commonly used approaches to time-use data collection as well as insights into the ways time-use data can capture complexity in areas, such as overlapping or simultaneous activities, patterns in the day (episode occurrences) and the subjective aspects of everyday activity.

Statistical instruments and approaches continue to evolve. Due to the resource intensiveness commonly found in traditional time-use surveys, there is need to explore the use of new technologies to improve efficiency in data collection and storage, as well as increased response rates and data quality. Big Data platforms, such as mobile phone data, also have the potential to inform how people use their time, and has fostered greater interest in better utilizing available mobile networks for time-use data collection.

The Expert Group on Innovative and Effective ways to collect Time-Use Statistics is a key global platform that has been working towards the operationalization of the ICATUS 2016 and the modernization of time-use surveys since 2018. The Group is composed of experts from national and international organizations with extensive experience in time-use survey instruments, data collection modes, coding, activity classification and data analysis.

The core focus of the Group currently is updating the *United Nations Guide to Producing Statistics on Time-use: Measuring Paid and Unpaid Work*, which is to be submitted to the UN Statistical Commission

12 Available at https://unstats.un.org/unsd/classifications/Family/Detail/2083 (accessed on 05 April 2021).

in 2023.[13] The revised guide will provide national statistical offices and policymakers with recommendations and best practices on collecting, processing, analysing and disseminating time-use statistics to inform research and the development of a broad range of policies including unpaid work, non-market production, well-being and gender equality. By exploring ways to modernize the collection of time-use data, including through the use of new technologies such as mobile phones, the guide will ensure that national statistical offices have access to a sustainable model to institutionalize the systematic collection of these data.

Other key work streams of the Expert Group include the drafting of a framework that addresses data collection methods of time-use data and defining the quality of data in the realm of time-use surveys and statistics. Specifically, various strategies and methods have been proposed to be adopted by countries to collect time-use data in their own national contexts, such as applying different modes and instruments ranging from full and light diaries to stylized questions. Additionally, the Group will identify quality assurance requirements anchored on agreed frameworks, such as the UN National Quality Assurance Framework, and determine quality standards by selecting a core set of quality indicators and their acceptable "cut off" values. The initiatives detailed here only provide a snapshot to the burgeoning relevance and scope of time-use data analysis in the achievement of sustainable development and the SDGs. The Expert Group continues to spearhead efforts to promote the awareness and relevance of time-use statistics to not only improve public policy and programme development and implementation, but also to strengthen SDG monitoring in relevant areas.[14]

Chapter snapshots: Harnessing time-use data to strengthen policy and SDG impact and monitoring

As outlined in Table 1 below, Chapters 1-3 provide background to Chapters 4-9. The latter illustrate different time-use data applications that address selected policy issues related to the SDGs. The chapters provide detailed step-by-step guidance to demonstrate how data can be (i) extracted from national time-use data collection exercises and (ii) organized and analysed to provide insights in key areas of public policy development and implementation.[15] Although each chapter elaborates the steps for data processing and analysis in ways which are specific to its objectives and thematic focus, they can be broadly broken down as follows:

1. Confirm clear objectives for the planned research in relation to the SDG, policy or programme area to be examined.
2. Identify the data source(s) and take the necessary steps, including obtaining formal permission to ensure access.

13 United Nations Department of Economic and Social Affairs, Statistics Division. (2005). Guide to Producing Statistics on Time-use: Measuring Paid and Unpaid Work. New York: Accessed at https://unstats.un.org/unsd/publication/seriesf/seriesf_93e.pdf on 05 April 2021.

14 For more information on the work of the Expert Group on Innovative and Effective Ways to Collect Time-Use Statistics and the future of time-use surveys, refer to E/CN.3/2020/17 Statistical Commission Fifty-First Session: Report of the Secretary General on Gender Statistics: https://unstats.un.org/unsd/statcom/51st-session/documents/2020-17-GenderStats-E.pdf (accessed on 05 April 2021).

15 Chapters 4-9 draw on national time-use surveys TUS conducted in China, India, Mongolia, South Africa, Turkey and the USA.

3. Identify and ensure familiarity with the data management, analysis and presentation software to be employed.
4. Determine the analytical and activity categories to be used and organize the data accordingly for processing and analysis.
5. Using regression analysis and/or other relevant analytical approaches.
6. Summarize and present the analysis and findings.

The primary statistical software package for data management and statistical analysis used by the experts that provided the material is Stata. Familiarity with this software is thus helpful to follow the examples provided in each of the chapters. It should be noted, however, that statistical software continues to develop and a range of other options are available and emerging. For selected chapters which have available open-source country data on time-use, Stata do-files and R Markdown files are also provided as separate attachments on the webpage for download and use.

Table 1. Overview of chapters

Setting the scene	
Chapter 1: Application of time-use surveys to major public policy areas *Includes edited extracts from material provided by Michael Bittman and Duncan Ironmonger.*	This chapter summarizes key points in the following chapters on the contributions of time-use data in selected areas relevant to evidence-based policy formulation and monitoring and SDG monitoring.
Chapter 2: Using time-use statistics to support implementation and monitoring of international development and gender frameworks	This chapter examines the contributions that can be made by time-use data to the implementation and monitoring of the SDGs and the commitments made on unpaid work and time-use by BPFA (1995).
Chapter 3: Time-use and labour force surveys – providing complementary insights *Based on material provided by Indira Hirway.*	This chapter elaborates how time-use data can complement the findings of labour force surveys, which are designed by governments to collect statistics on the labour force and characteristics of jobs including working conditions.[16] Critical contextual factors in this regard include the increased flexibility, casualization and intensity which have altered the characteristics of work and the labour force. In this context, time-use surveys provide insights on how people allocate time for productive activities on a given day, general work-life balance assessments, scheduling of paid work and combining paid work and care responsibilities and simultaneous activities.
Demonstrating the application of time-use data to selected public policy areas and SDGs	
Chapter 4: Providing insights into the time-use of those 'left behind'	This chapter makes use of the India 1998-1999 Time-Use Survey data to examine the gendered patterns and inter-relationships of employment, unemployment and education in rural and urban areas, particularly among youth. While the pattern of withdrawals

16 The labour force in a country essentially consists of all those who contribute to the production of goods and services, the value of which is accounted for in national income accounts. https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Labour_force (accessed 05 April 2021).

Edited extracts from material provided by Sripad Motiram.	from the labour force, whether voluntary and involuntary, tend to vary across socio-demographic groups, time-use data shows that girls/women are more prone to entry and exit on a regular basis compared to boys/men, providing implications for public policy and services in this area.
Chapter 5: Time-use data reveals gender differences in out-of-school learning *Edited extracts from material provided by Seth Gershenson and Stephen Holt.*	This chapter draws on the American Time-use Survey (ATUS) for 2003-2016 to examine an important dimension of human capital that is often not taken into account when investigating gender gaps in educational attainment, namely the time spent outside of school on educationally productive activities. Time-use data can provide relevant information on the intensity of study time as well as the timing and sequencing of study, which are indicative of the quality of study time. The chapter explores the extent to which gender differences in out-of-school behaviours and work ethics partly explain gender gaps in educational attainment.
Chapter 6: Examining the role and responsibilities of women and men at home through time-use data *Edited extracts from material provided by Maria Floro.*	This chapter draws on the Henan Province segment of the 2008 China National Time-use Survey to demonstrate how time-use data can describe gender patterns in all activities, revealing both the amount of unpaid care and domestic work in the household and the unequal burden on women and men and on girls and boys. The chapter further demonstrates how time-use patterns can reflect the dynamic interaction between paid work and unpaid work, by showing how people allocate their time between these two forms of economic activity.
Chapter 7: Assessing the interference of unpaid care work with paid domestic work and men and women's earnings through time-use data. *Edited extracts from material provided by Xiao-yuan Dong and Liangshu Qi.*	This chapter draws on the 2010 South Africa Time-use Survey to introduce techniques for measuring the extent to which unpaid domestic and care work interferes with paid work and for evaluating the effects of unpaid care work on women and men's earnings. The results obtained show that the timing and flexibility aspects of unpaid care work are as important for understanding gender earnings differentials as the amount of unpaid care work.
Chapter 8: Expanding understandings of poverty: Time poverty revealed by time-use data *Edited extracts from material provided by Ozge Ozay.*	This chapter uses data from the 2014-15 Time-use Survey of Turkey to explore a dimension of poverty that has been largely ignored in policy discourses and poverty reduction programme evaluations, namely time poverty. Time poverty as a concept gives visibility and recognition to the significant amount of labour time that women spend on unpaid work activities and its impact on their options and on their well-being. The chapter demonstrates how time-use information on people's daily activities can help assess the quality of people's lives and provides indicators of individual well-being that complement standard indicators.
Chapter 9: Assessing the impact of public investments in water infrastructure through time-use data *Edited extracts from material provided by Mungusuvd Terbish and Maria Floro.*	This chapter uses data from the 2011 Mongolia Time-use Survey to examine the effect of public infrastructure investment in safe water delivery systems on the amount of time spent in performing household work among prime-aged women and men. Such interventions are particularly important to improve health and reduce the burdens, particularly on women, of having to obtain water from sources far from their homes. These burdens diminish time available for market work, education and leisure.

Annexes: Designing time-use surveys: Approaches, instruments and considerations	
Annex 1: Selected time-use survey reading, tools, guidebooks and manuals	This annex provides further reference material, particularly on the collection of time-use data, complementing the focus of this publication on their use for public policy and SDG purposes.
Annex 2: Overview of main approaches to time-use data collection *Edited extracts from material provided by Valeria Esquivel.*	This annex describes instruments and commonly used approaches for time-use data collection and highlights some of their strengths and weaknesses with respect to the quality of the data they produce.
Annex 3: Capturing complexity – special features of time-use surveys *Edited extracts from material provided by Maria Floro, Ignace Glorieux, Klas Rydenstam and William Michelson.*	This annex examines three vital aspects of the comparative advantage of time-use surveys. These are their ability to provide rich data on (i) overlapping and simultaneous activities, particularly for women's time-use, (ii) the episodic nature of human activity (namely the mean time spent on various main activities) and (iii) subjective dimensions of human activity (e.g. levels of happiness and satisfaction).

CHAPTER 1

APPLICATION OF TIME-USE SURVEYS TO MAJOR PUBLIC POLICY AREAS

CHAPTER 1: APPLICATION OF TIME-USE SURVEYS TO MAJOR PUBLIC POLICY AREAS

Chapter overview: The unique public policy applications of time-use data are multiple and varied. Drawing on the detailed material in chapters 3-9, this chapter summarizes the value of time-use data in the following selected public policy areas: employment policy and planning, monitoring structural change in the economy, informing human capital development, addressing the factors which undermine women's earnings and access to paid work, time poverty and the implications for healthcare, and maximizing the benefits of water infrastructure development for women and children.

Time-use and labour force surveys – providing complementary insights

Labour force surveys (LFS) and time-use surveys (TUS) both provide important insights on the world of work. Although the two maintain their own separate operations and objectives, there is increasingly greater integration between the two survey approaches, including the addition of background modules to time-use surveys to capture labour force characteristics (and vice versa) and shared samples. Indira Hirway highlights in Chapter 3 ways in which time-use data can complement labour force survey findings as a basis for relevant public policy design. For example, depending on the reference period involved, time-use surveys can capture data on subsistence work and work flexibility. Since such surveys collect information on how people spend their time, they are further able to provide insights on the varied activities performed by people, contributing to policies and programmes aimed at reducing informal and vulnerable work.

Time-use data further provide improved understanding of gender gaps in daily life, particularly with respect to the highly unequal distribution of unpaid domestic work between men and women in the household, along with the socio-cultural norms emanating from this imbalance. The burden of unpaid work carried by women is highlighted as a key barrier to human capital formation, reducing women's participation as well as their mobility and choice of work in the labour market. A number of policy priorities link to these findings in areas ranging from quality and affordable childcare provision to the availability of flexible working hours and technologies to lift the burden of household work.

Providing insights into the time-use of those 'left behind'

As elaborated in Chapter 4, time-use surveys can provide insights into population groups left behind in development initiatives by providing information about individuals who do not earn income or participate in market processes, and who may therefore be underrepresented or ignored in more conventional sources of data.

Key background considerations in this context include the characteristics of the agricultural sector in many countries (with its associated seasonality) and the urban, informal sector. Citing time-use findings, Sripad Motiram described in Chapter 4 that part-time work and withdrawals from the labour force (both voluntary and involuntary) are an important consideration for public policy and

programmes and are prevalent to a greater extent among women and girls. Time-use data can help put such issues onto academic and policy discourse agendas.

Making visible the gender dimensions of out-of-school learning

Time-use data related to the development of human capital can provide important insights to inform policies on economic growth, health, and upward social mobility in developing and transitioning countries (Glewwe and Kremer, 2006; Hanushek, 2013).

As an example, Seth Gershenson and Stephen Holt in Chapter 5 show how detailed time-use data in the American Time-use Survey (ATUS) allowed researchers to investigate socially important gaps in time spent developing academic skills through engaging in activities such as studying outside of the traditional school day. In particular, they show how subgroup analyses of time-use survey data can identify socio-demographic gaps in time spent on such activities, which is crucial to identifying demographic disparities in educational success and designing and targeting effective policies that can close such demographic gaps.

As the chapter elaborates, time-use data can help researchers gain valuable insights into both the intensity of study time and the timing and sequencing of studying. The timing and sequencing of study time can provide suggestive evidence of the quality of students' studying, helping to inform decisions on school start and end times and other policy interventions related to enhancing out-of-school learning.

Box 1
Recognizing and valuing the gender dynamics of household production

Broadly speaking, two types of productive work can be distinguished—paid work for which workers get wages and unpaid work for which the workers are unremunerated, but which creates valuable economic outputs. Taken together, these two types of work are parts of a single system of national accounts of economic production and consumption and expenditure and income. The household economy produces seven outputs: (1) accommodation, (2) meals, (3) clean clothes, (4) childcare, (5) transport, (6) volunteering, and (7) education (Ironmonger and Soupourmas 2009).

To provide a more comprehensive understanding of the full scope of national economies, time-use survey data can be used to put monetary values on the time people spend in doing productive work that is unpaid, particularly within the household economy. Ironmonger and Bittman observe that when the whole economy is estimated, i.e. all productive work whether paid or unpaid, the size of currently overlooked elements can be substantial, with significant implications for national policy and planning.

Ironmonger and Bittman highlight the particular usefulness of such data in developing and transitional economies. In such contexts, measuring only the market economy does not show the role of subsistence farming and substantial unregistered labour in family businesses, which is rewarded in-kind (rather by cash). Meeting the SDGs amidst these challenges requires government leaders and policymakers to have a better understanding of the roles, contributions, and well-being of children, men and women, especially in poor and vulnerable households, which standard economic and social indicators do not adequately convey.

Source: Edited extracts from material provided by Duncan Ironmonger and Michael Bittman to the ESCAP Statistics Division in 2018.

Addressing the factors which undermine women's earnings and access to paid work

Engagement in work - whether paid employment, housework, community service or childcare - constitutes an essential element of life. Therefore, as described in Chapter 6, Maria Floro states that any policy-related inquiry into people's welfare must not only ask how much people earn, but also how they use their time and conduct their work in order to acquire goods and services to meet their needs.

Historically many of the tasks carried out in the household to ensure daily survival and well-being have been invisible in economic models and policy discussions. Such tasks include cooking, washing clothes, making beds, housecleaning, shopping, washing dishes, throwing out the garbage, and caring for children, the sick, disabled, and the elderly.

Time-use data have shed significant light in this area, *inter alia* showing the ways that the unpaid work burden of women strongly affects their availability for paid work. As the chapter highlights, when women do participate in the labour market, the amount of household work they perform affects the type of jobs they undertake. The prevalence of women in part-time work, for example, is linked to their other responsibilities, especially raising children.

Empirical analyses of time-use data by Xiao-yuan Dong and Liangshu Qi in Chapter 7 further underscore the policy implications in which unpaid care interferes with paid work and the earnings of women and men. They show the timing and flexibility of unpaid care work are just as important for earnings as the amount. With time-use data, this aspect of unpaid domestic and care work can be quantified, and its effects on earnings can be assessed.

Key areas for policy attention in this context include promoting greater gender equality at home and family-friendly policies at the workplace. Xiao-yuan Dong and Liangshu Qi highlight the need for specific measures including educational campaigns that involve men in unpaid care work to change norms and attitudes, expanding state provision and financing of care services, and accommodating care duties in the workplace through flexible work schedules and provision of on-site care facilities (e.g. breast-feeding rooms and subsidized day care).

Maximising understandings of time poverty to inform health-related policy priorities

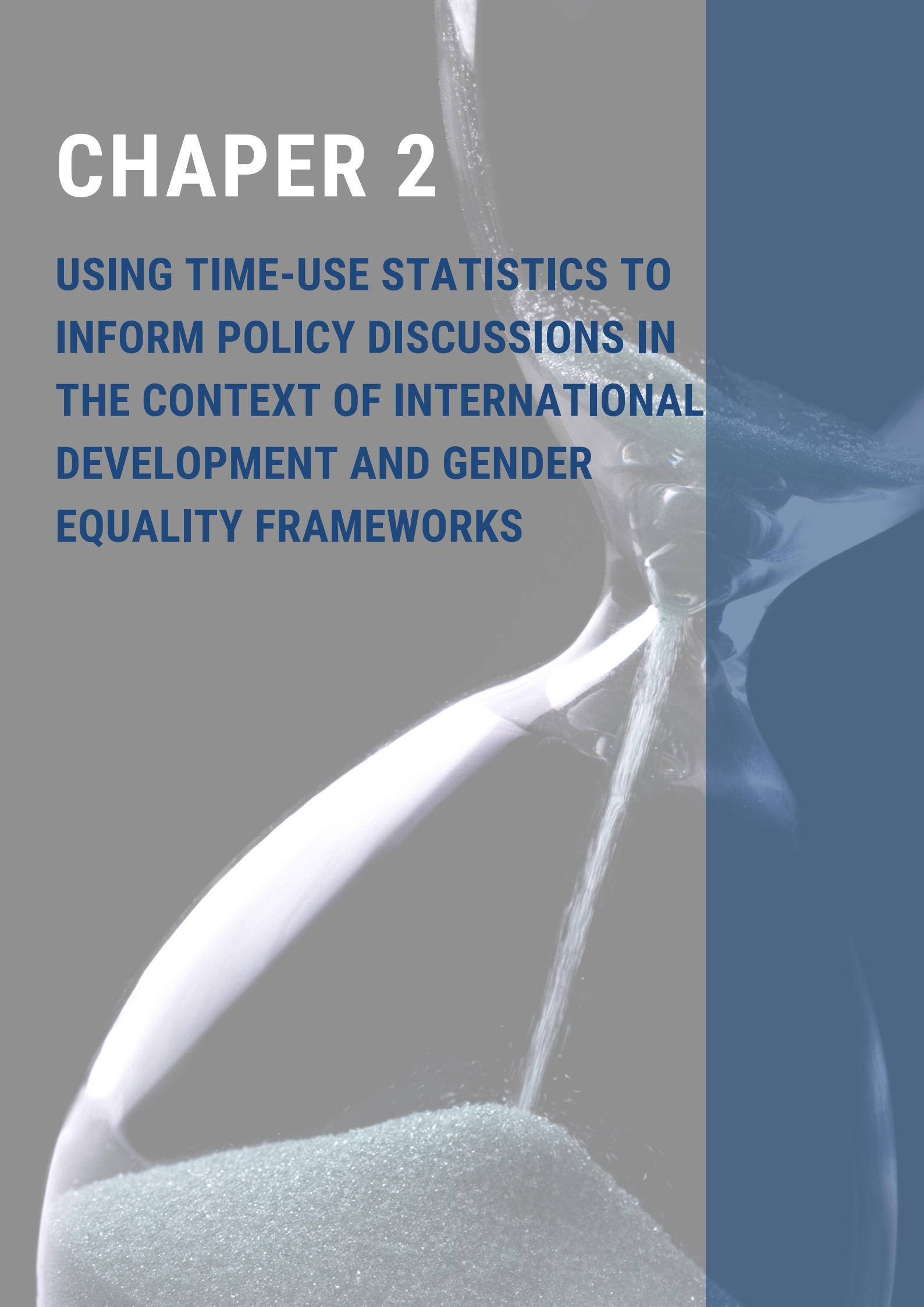
Ozge Ozay explains in Chapter 8 how time-poverty research has been made possible by the increased use of time-use surveys, especially in the last two decades, by countries in both the global North and the global South. *Inter alia,* time-use data have helped to expand international understandings of poverty by emphasizing time poverty, which occurs, particularly for women, from not having enough time for oneself due to working disproportionately long hours in paid employment, doing domestic chores, and/or taking care of dependents at home. The concept of time poverty has the advantage of making visible the significant amount of labour time that women spend on unpaid work activities, and of recognizing its impact on their options and well-being. As such, the concept is fundamental in acknowledging the unpaid economic activities, which are shouldered predominantly by women, that mainstream economics has generally been ignored.

Chronic and severe time pressures, for example through prolonged multi-tasking, have been shown in this context to have serious implications for a person's health and functioning (Beneria et al., 2016), and thus are relevant to the assessment of well-being factors such as the level of stress. Such findings have implications for public policy and services in areas such as the maintenance of physical health through exercise, food preparation and healthy eating.

Maximizing the benefits of infrastructure development to address gender inequality

Although there is extensive literature on the role of infrastructure investment in promoting development by increasing the efficiency of production and improving living standards, there is a serious gap regarding the role of public infrastructure in addressing gender inequalities. In Chapter 9, Mungo Terbish and Maria Floro note that fiscal policy researchers argue that gender issues are not relevant to mainstream public infrastructure because it is perceived to be necessary to meet everyone's needs, and hence is deemed gender-neutral. However, gender researchers argue that the prevailing gender norms and household division of labour mean that women and men are affected differently by infrastructure initiatives. Gender norms determine which members of the household are most affected by any such initiative, and therefore whose unpaid work burden is reduced by better delivery of the services involved.

Focusing in particular on implications of infrastructure development in the area of water and sanitation, Terbish and Floro show that time-use data can contribute to policy-related benefits ranging from enhanced health to improved employment prospects for women and school attendance for children, especially by releasing women and girls from time-consuming and energy-sapping tasks such as collecting water. Public infrastructure investment in basic services can also have indirect effects. For example, the availability of safe drinking water and sewerage systems lowers the spread of water-borne diseases, which in turn lowers the time spent caring for sick household members. Reducing the unpaid household and care work time of those who perform these tasks enables them to spend more time in the labour market, as well as have a healthier work-life balance.



CHAPER 2

USING TIME-USE STATISTICS TO INFORM POLICY DISCUSSIONS IN THE CONTEXT OF INTERNATIONAL DEVELOPMENT AND GENDER EQUALITY FRAMEWORKS

CHAPTER 2: USING TIME-USE STATISTICS TO INFORM POLICY DISCUSSIONS IN THE CONTEXT OF INTERNATIONAL DEVELOPMENT AND GENDER EQUALITY FRAMEWORKS[17]

Chapter overview: This chapter examines the potential of time-use data to inform policy issues as contained in international development goals such as the Sustainable Development Goals (SDGs) and the commitments made on unpaid domestic and care work and time-use by the Beijing Declaration and Platform of Action (BPFA 1995).

Sustainable Development Goals (SDGs)

As mentioned in the Introduction, time-use data have immense potential to provide insights to support policy discussions on several areas of the SDG framework. As noted, central to this focus is SDG indicator 5.4.1 — Proportion of time spent on unpaid domestic and care work, by sex, age and location. While no other SDGs include indicators that have an explicit time-use component, Table 2 illustrates that time-use data have the potential to provide broad insights on various SDG-related policy issues and in some cases to assess progress on specific SDG targets across the different goals. [18] Time-use data could be used together with data from other official sources for a more robust analysis of a range of policy issues.

Chapters 3-9 of this publication provide further elaboration on how objectives of time-use data analysis could be oriented to obtain insights on specific SDG-related policy issues. As well as SDG 5, each chapter relates to various SDGs, especially SDG 1 (End poverty in all its forms everywhere), SDG 3 (Ensure healthy lives and promote well-being for all at all ages), SDG 4 (Ensure inclusive and equitable quality education and promote lifelong learning for all), SDG 6 (Ensure availability and sustainable management of water and sanitation for all), and SDG 7 (Universal access to affordable, reliable and modern energy for all).

As also indicated in the Introduction, underpinning current developments in this regard are the commitments made by member States of the United Nations in the Platform for Action adopted at the Fourth World Conference on Women in Beijing, 1995. These are presented in detail in Table 3.

17 This chapter was compiled by Don Clarke and Sharita Serrao with research inputs from Adele Marchal and Janet Ying (ESCAP Statistics Division). Valuable inputs and comments were received from Cecilia Tinonin (Regional Office for Asia and the Pacific, UN Women).

18 This may require additional data and des

19 gn requirements, some of which are highlighted in Table 2.

Table 2. Linking time-use data and SDG-related policy issues

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]
SDG 1: End poverty in all its forms everywhere	• Assessment of time poverty (as a dimension of poverty), particularly with respect to women in the household, due to the unequal distribution of unpaid care and domestic work (also refer to SDG 5). • Opportunities (including availability of time) for women and men to engage in education and economic / livelihoods activities (including entrepreneurship) and employment (also refer to SDG 8). • Insights on time spent by women and men, particularly in low-income households, on unpaid domestic and care work due to lack of affordability to acquire goods and services from the market.	• Interviewing all individuals in the household or at least two individuals (one male and one female) to capture unequal distribution of time and tasks. • For time poverty, coverage of all activities in ICATUS 2016[22] in the survey instrument.[23] • Including an employment module in the background questionnaire as well as data items such as marital status and household composition/size. • Disaggregating time-use data by e.g. employment and marital status.	1.1. By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day. 1.2. By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.
	• Understanding impact of introducing social protection systems and measures to alleviate time poverty of women and men, including with respect to unpaid care and domestic work.	• Ex ante and ex post time-use data collection, ideally on the same sample. The background questionnaire to include whether individuals benefitted from the social protection scheme and/or caregiving services. Recommended frequency: 5 years.	1.3. Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable.

20 This list of potential policy issues is illustrative and not comprehensive.

21 For Overview of Main Approaches to Time-Use Data Collection and further readings, please see Annex 2 of this document.

22 Further information on SDG targets available at https://unstats.un.org/sdgs/indicators/indicators-list/ (accessed 05 April 2021).

23 United Nations Statistics Division, "International Classification of Activities for Time Use Statistics 2016", https://unstats.un.org/unsd/classifications/Family/Detail/2083 (accessed on 16 February 2021).

24 Time poverty is an evolving concept. For more information, refer to the selected readings at the end of the chapter and various studies from the Levy Economic Institute: http://www.levyinstitute.org/topics/time-poverty (accessed 05 April 2021).

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]

SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	• Insights on time spent by women and men e.g. in:
	  • Agricultural production, improving productivity, and farm/ non-farm employment and incomes.
	  • Maintenance of ecosystems and improving land and soil quality.
		• Add on time-use module to e.g. agricultural surveys, Living Standards Measurement Surveys or Labour Force Surveys.[24]	2.1. By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
			2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.
			2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.
			2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

25 See FAO, "Global Strategy to Improve Agricultural and Rural Statistics (2016) - Sex-Disaggregated Data and Gender Indicators in Agriculture. A Review of Data Gaps and Good Practices." Technical Report Series GO-12-2016.

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]
SDG 3: Ensure healthy lives and promote well-being for all at all ages	• Insights on mental health and well-being of women and men, particularly in the context of time pressures caused by multiple and simultaneous activities and lack of leisure time. • Implications on health outcomes for women and men depending on engagement/time spent on activities such as sleeping, exercising, leisure, etc.	• Inclusion of questions on subjective well-being in the background questionnaire. • Information on simultaneous/secondary activities captured through the diary.	3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.
	• Insights on women's health, including maternal health, based on time spent on water and fuel collection.	• Question to identify pregnant women and access to pre-natal and maternal health services included in the background questionnaire.	
	• Insights on time spent in unpaid provision of medical care to household and family members who are ill, sick, disabled, elderly or otherwise require support by sex, age groups; and need for institutionalized care facilities (noting that women spend a disproportionate amount of time performing such care-giving activities as compared to men in most societies).	• Interviewing all individuals in the household or at least two individuals (one male and one female) to capture unequal distribution of time and tasks.	
	• Insights on exposure to harmful pollutants, e.g. through time spent on home-cooking through use of open fires and time spent on travel, commuting and movement particularly	• Inclusion of questions e.g. on types of cooking fuels, location (place of residence and place of work) in background questionnaire. • Disaggregation by degree of urbanization.[25]	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

26 In its 51st session, the United Nations Statistical Commission endorsed the methodology for delineation of cities and urban and rural areas for international and regional statistical comparison purposes. See: A recommendation on the method to delineate cities, urban and rural areas for international statistical comparisons.

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]
	within polluted urban environments.	• GIS integration.	
SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	• Insights on enablers and barriers (particularly time-related) to female and male engagement in formal and non-formal education, including technical and vocational education and training; tertiary education; and after-school and out-of-school learning opportunities. Factors include e.g. commute time to school, time available for homework, other learning activities, childhood development activities etc. • Insights on implications on educational outcomes based on time available for learning activities and studying.	• Background questionnaire to collect data on access to formal and non-formal education. • The diary to capture e.g. travelling time to reach educational facilities, time for out-of-school learning etc. by age groups and sex. • For childhood development related activities, data collection may be required for ages 15 years and below.	4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and Goal-4 effective learning outcomes. 4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university. 4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.
SDG 5: Achieve gender equality and empower all women and girls	• Understanding women's and girls' safety and exposure to violence and psychosocial stress in the context of accessing (time spent on obtaining) remote water and fuel sources as well as sanitation facilities.	• Inclusion of a module on safety and violence against women and girls in the background questionnaire.	5.2. Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation.
	• Insights on intra-household dynamics related to distribution of unpaid domestic and care work between female and male household members. • Assessment of the relationship between availability of public services, infrastructure and social protection and related impact on time-use of women and men. • Understanding of time-related barriers	• Interviewing all individuals in the household or at least two individuals (one male and one female) to capture unequal distribution of time and tasks. • The context variable with whom should also be included in the diary posing attention to both household members and	5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate. *Key indicator: Indicator 5.4.1: Proportion of time spent on unpaid domestic and care*

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]
	potentially affecting the participation and role of women and girls in other aspects of social, economic, and cultural life, including e.g: • Participation in education at all levels, income generating activities, leisure time and well-being, use of information and communication technologies (ICT) for personal, educational and livelihood purposes; and • Access to health services (including those concerning sexual and reproductive health and rights).	family members living outside the household.[26] • Measurement of simultaneous activities is needed to capture passive care. • Measurement of informal and formal care.[27] • Inclusion of the context variables information and communications technology (ICT) usage in the diary and access to health in the background questionnaire.	*work, by sex, age and location*[28] 5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women.
SDG 6: Ensure availability and sustainable management of water and sanitation for all	• Highlighting the significance of water and sanitation infrastructure and population groups in need depending on engagement and time-use patterns of women, girls, men and boys in water collection (also refer to SDG 9).	• Interviewing all individuals in the household or at least two individuals (one male and one female) to capture unequal distribution of time and tasks. • Ex ante and ex post time-use data collection, ideally on the same sample. Recommended frequency: 5 years.	6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all. 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
SDG 7: Ensure access to affordable, reliable, sustainable and	• Insights on time spent by women, girls, men and boys in collecting fuel for	• Interviewing all individuals in the household or at least two individuals (one male and one female) to capture	7.1. By 2030, ensure universal access to affordable, reliable and modern energy services.

27 Refer to Resolution concerning statistics of work, employment, and labour underutilization, adopted at the 19th International Conference of Labour Statisticians, Geneva, 2013, and International Classification of Activities for Time Use Statistics 2016.

28 Please see for instance: ONS (Office of National Statistics) 2013. "Household Satellite Accounts, Valuing Informal Childcare in the United Kingdom," February 15, 2013.

29 Metadata for SDG indicator 5.4.1 recommends the disaggregation of time-use data by the following age groups: 15+, 15-24, 25-44, 45-54, 55-64 and 65+. For more information, refer to https://unstats.un.org/sdgs/metadata/files/Metadata-05-04-01.pdf (accessed 05 April 2021).

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]
modern energy for all	cooking and heating purposes. • Implications of access to electricity, clean fuels and related technology on time-use of women, girls, men and boys (also refer to SDG 3).	unequal distribution of time and tasks. • Ex ante and ex post time-use data collection, ideally on the same sample. Recommended frequency: 5 years.	
SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	• Implications of time spent by women and men in unpaid domestic and care work on employment and income-generating activities.	• Inclusion of a labour force module in the background questionnaire and/or time-use module attached to Labour Force Survey. • Disaggregation of time-use activities by e.g., marital status, household composition and employment status.	8.3. Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services. 8.5. By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.
	• Implications of time spent by the youth (aged 15–24 years) on unpaid domestic and care work on education, training or employment-related activities.	• Inclusion of an education module in the background questionnaire. • Disaggregation of time-use activities by e.g., age, education, employment and training.	8.6. By 2020, substantially reduce the proportion of youth not in employment, education or training.
	• Highlighting issues related to child labour based on time spent by children on unpaid work and income-generating activities.	• Inclusion of a time-use module for children (5-17 years) to measure child labour.[29]	8.7. Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms.

30 Refer to metadata for SGD Indicator 8.7.1: https://unstats.un.org/sdgs/metadata/files/Metadata-08-07-01.pdf (accessed 05 April 2021).

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]
SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	• Implications of infrastructure development (e.g. roads, transport, public facilities like water, energy, health care and economic assets) on time-use of women, girls, men and boys, including for instance time spent in commuting, time sent in accessing services etc. (also refer to SDG 3 and 11).	• Ex ante and ex post time-use data collection, ideally on the same sample. Recommended frequency: 5 years.	9.1. Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
SDG 10: Reduce inequality within and among countries	• Understanding of time-use dynamics of vulnerable population groups including women and men, youth, older persons and persons with disability, migrants etc. • Understanding of inequality prevalence and trends in society, including at the household and community levels and in the world of formal and informal employment.	• Disaggregation of time-use data e.g. by age groups, disability, income quintiles etc. • Inclusion in the background questionnaire questions on age, employment, informality, income and disability status. • Sampling design that takes into account the level of disaggregation needed to shed light on multiple inequalities. • Time-use module added-on to Labour Force Survey or Living Standards Measurement Survey.	10.2. By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status. 10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality.
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable	• Insights on time spent in commuting and travelling by women, girls, men and boys due to lack of safe, affordable, accessible and sustainable public transport systems (inter alia to contribute to design of safer cities with responsive public facilities and services addressing needs of all population groups).	• Inclusion of a context variable on mode of transport into the survey instrument and a question on access to public transport in the background questionnaire.	11.2. By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.
	• Insights on time spent in urban environments and consequent exposure by women, girls, men and boys to harmful air	• Inclusion of location in the background questionnaire and construct a degree of urbanization indicator.	11.6. By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]
	pollutants (also refer to SDG 3).	• GIS integration.	quality and municipal and other waste management.
SDG 12: Ensure sustainable consumption and production patterns	• Visibility of women and men's contribution to sustainable consumption and production patterns through engagement/time spent on e.g. paid or unpaid management and efficient use of natural resources, general and food waste management as well as sustainable tourism initiatives.	• Time-use module added-on to Labour Force Survey or Living Standards Measurement Survey. • Emerging standards. [30]	12.2. By 2030, achieve the sustainable management and efficient use of natural resources. 12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse. 12.b. Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products.
SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development	• Visibility of women and men's contribution to sustainable development through engagement /time spent in the paid and unpaid management of coastal and marine resources	• The design may require oversampling of individuals in coastal areas. • Time-use module added-on to Labour Force Survey or Living Standards Measurement Survey.	14.2. By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	• Visibility of women and men's contribution to sustainable development through engagement /time spent on natural resources management (recognising that women as primary care givers in households are in charge of food collection, meals management/preparation as well as natural resources and biodiversity management etc.)	• Emerging standards.[31]	15.1. By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements. 15.2. By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase

31 See for instance working paper ESCAP, UN Women, UNEP, IUCN (2019): Mainstreaming gender in environment statistics for the SDGs and beyond.

32 Ibid.

SDG	Potential of time-use data to inform policy issues[19]	Potential data and design requirements additional to usual time-use data collection and ICATUS 2016[20]	Relevant SDG targets[21]
			afforestation and reforestation globally.
SDG 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	• Highlight need for strengthened capacities, tools and approaches for the collection, analysis and use of time-use data to improve its contribution to relevant areas of monitoring SDG progress.	• Emerging standards[32]	17.18. By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts.

Beijing Declaration and Platform of Action (1995)

Table 3. Commitments on unpaid work and time-use, 4th World Conference on Women, Beijing 1995[33]

Critical area of concern and Strategic Objectives	Actions to be taken
A. Women and poverty	
A.4. Develop gender-based methodologies and conduct research to address the feminization of poverty	68. By national and international statistical organizations: (b) Devise suitable statistical means to recognize and make visible the full extent of the work of women and all their contributions to the national economy, including their contribution in the unremunerated and domestic sectors, and examine the relationship of women's unremunerated work to the incidence of and their vulnerability to poverty.
F. Women and the economy	
F.1. Promote women's economic rights and independence, including access to employment, appropriate working	165. By Governments: (g) Seek to develop a more comprehensive knowledge of work and employment through, *inter alia*, efforts to measure and better

33 For more information on the work of the Expert Group on Innovative and Effective Ways to Collect Time-Use Statistics and the future of time-use surveys, refer to E/CN.3/2020/17 Statistical Commission Fifty-First Session: Report of the Secretary General on Gender Statistics.

34 Report of the Fourth World Conference on Women, Beijing, China, 4–15 September 1995 (A/CONF.177/20/Rev.1). https://www.un.org/womenwatch/daw/beijing/pdf/Beijing%20full%20report%20E.pdf (accessed 05 April 2021).

Critical area of concern and Strategic Objectives	Actions to be taken
conditions and control over economic resources	understand the type, extent and distribution of unremunerated work, particularly work in caring for dependants and unremunerated work done for family farms or businesses, and encourage the sharing and dissemination of information on studies and experience in this field, including the development of methods for assessing its value in quantitative terms, for possible reflection in accounts that may be produced separately from, but consistent with, core national accounts.
F.2. Facilitate women's equal access to resources, employment, markets and trade	166. By Governments: (e) Create and modify programmes and policies that recognize and strengthen women's vital role in food security and provide paid and unpaid women producers, especially those involved in food production, such as farming, fishing and aquaculture, as well as urban enterprises, with equal access to appropriate technologies, transportation, extension services, marketing and credit facilities at the local and community levels;
F.5. Eliminate occupational segregation and all forms of employment discrimination	178. By Governments, employers, employees, trade unions and women's organizations: (n) Ensure that strategies to eliminate child labour also address the excessive demands made on some girls for unpaid work in their household and other households, where applicable.
H. Institutional mechanism for the advancement of women	
H.3. Generate and disseminate gender-disaggregated data and information for planning and evaluation	206. By national, regional and international statistical services and relevant governmental and United Nations agencies, in cooperation with research and documentation organizations, in their respective areas of responsibility: (e) Improve data collection on the full contribution of women and men to the economy, including their participation in the informal sector(s). (f) Develop a more comprehensive knowledge of all forms of work and employment by: (i) Improving data collection on the unremunerated work which is already included in the United Nations System of National Accounts, such as in agriculture, particularly subsistence agriculture, and other types of non-market production activities; (ii) Improving measurements that at present underestimate women's unemployment and underemployment in the labour market; (iii) Developing methods, in the appropriate forums, for assessing the value, in quantitative terms, of unremunerated work that is outside national accounts, such as caring for dependants and preparing food, for possible reflection in satellite or other official accounts that may be produced separately from but are consistent with core national accounts, with a view to recognizing the economic contribution of women and making visible the unequal distribution of

Critical area of concern and Strategic Objectives	Actions to be taken
	remunerated and unremunerated work between women and men. (g) Develop an international classification of activities for time-use statistics that is sensitive to the differences between women and men in remunerated and unremunerated work, and collect data disaggregated by sex. At the national level, subject to national constraints: (i) Conduct regular time-use studies to measure, in quantitative terms, unremunerated work, including recording those activities that are performed simultaneously with remunerated or other unremunerated activities; (ii) Measure, in quantitative terms, unremunerated work that is outside national accounts and work to improve methods to assess its value, and accurately reflect its value in satellite or other official accounts that are separate from but consistent with core national accounts.

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CHAPTER 3

TIME-USE AND LABOUR FORCE SURVEYS – PROVIDING COMPLEMENTARY INSIGHTS

CHAPTER 3: TIME-USE AND LABOUR FORCE SURVEYS – PROVIDING COMPLEMENTARY INSIGHTS

This chapter is based on material provided by Indira Hirway to the Statistics Division of ESCAP in 2018, with the permission of Oxford University Press (New Delhi, India).

Chapter overview: This chapter highlights ways in which time-use and labour force surveys can provide complementary findings to strengthen the basis for public policy design in areas related to the world of work. Time-use data provide improved understanding of gender gaps in daily life, particularly with respect to the highly unequal distribution of unpaid domestic work between men and women in the household. A number of policy priorities link to these findings in areas ranging from quality and affordable childcare provision to the availability of flexible working hours and technologies to lift the burden of household work.

3.1 Chapter focus

Time-use surveys and labour force surveys can complement each other in the design of realistic and relevant labour market interventions. Under the auspices of the 19th International Conference of Labour Statisticians in 2013, the revised international standards on statistics of work, employment and labour underutilization for labour force surveys sought to fully observe women and men's participation in all forms of work, paid and unpaid, provide a more comprehensive measurement of participation in subsistence activities, and capture problems of underutilization.[34] Time-use surveys attempt to reveal insights on subsistence work, such as estimating subsistence work through time spent on the collection of water, fuel wood, etc., and provide a deeper understanding of gender gaps through time-use on unpaid care and domestic work.

3.2 Labour force and time-use surveys: Enhancing complementarity

3.2.1 The System of National Accounts (SNA) and the production boundary

The SNA is the internationally agreed standard set of recommendations used to compile measures of economic activity. It describes a coherent, consistent and integrated set of macroeconomic accounts in the context of internationally agreed concepts, definitions, classifications and accounting rules.[35] The broad objective of the SNA is to provide a comprehensive conceptual and

35 Report II. Statistics of work, employment and labour underutilization: Report for discussion at the 19th International Conference of Labour Statisticians (Geneva, 2–11October 2013). Accessed on 01 April 2021 at https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_220535.pdf.

36 The first SNA was designed in 1947 by the Sub-Committee on National Income Statistics of the League of the National Committee of Statistical Experts. In 1953, the SNA was published under the auspices of the UN. Statistical Commission with limited coverage. The SNA has been revised periodically thereafter in 1960, 1964, 1968, 1993 and 2008. The 1993 revision of SNA as well as the 2008 revision, which is an update of SNA 1993, have addressed several new issues, brought about by changes in the economic environment, advances in methodological research and the needs of users (UN, 1993 and 2008).

accounting framework that can be used to create a macroeconomic database suitable for analysing the performance of an economy.

The production boundary of the SNA defines and describes the nature of the goods and services to be covered under national income accounts.[36] The production boundary in the SNA is more restricted than the general production boundary such that activities undertaken by households that produce services for their own use are excluded from the concept of production in the SNA.[37]

The coverage has expanded over the years, with several non-market activities entering into the purview of the production boundary including:[38]

- goods and services with monetary transactions, bartered goods and services, and those provided free as transfers in kind;
- production of goods for self-consumption that can potentially be sold in the market;[39]
- construction of own dwellings, production of building services for own final consumption; and
- collection of free goods, such as fuel wood, water, fish, vegetables, fruits, wood, etc.

The production boundary excludes services for own final consumption within households and voluntary services. These are included in the general production boundary.

A number of areas stand out in this context as requiring more systematic attention, such as multiple unpaid activities that are frequently performed during a day, particularly by women, simultaneous unpaid childcare and home-based work, unpaid domestic services and gainful SNA work, and subsistence work (production of goods for own use and the collection of a range of free goods for own consumption).

At the same time, the changes taking place in the structure of labour markets and the characteristics of the labour force also need to be reflected in labour statistics, which include the growing flexibility of both production and labour. In the context of growing competition and related uncertainties, production units are sub-contracting and outsourcing their production in smaller units, such as through home-based work and working from home. New types of work arrangements (part-time work, weekend work, compressed work and platform or gig economies, etc.) are spreading quickly.

In the case of home-based work, the timings can be irregular, ranging from early morning to late evening. Many of those who work from home in the formal sector also have irregular timings, as do the self-employed, formal or informal. Women in the labour market in many countries are

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37 Please refer to https://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf for the overall definitions about the general production boundary and the production boundary in the SNA (SNA 2008, 97:6.23 and 98:6.26, respectively). See 97:6.23- 99:6.31 for information regarding all elements that encompass the production boundary.

38 Except for services provided by owner-occupied dwellings and services produced by employing paid domestic staff. Please refer to https://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf (accessed on 05 April 2021) regarding the exclusion of the production boundary within households from the SNA (SNA 2008, 98:6.28- 99:6.31).

39 A general timeline of events and updates specific to the development of 2008 SNA can be found here, https://unstats.un.org/unsd/nationalaccount/timeline.asp (accessed on 05 April 2021). For more information regarding overall updates (both past and current) of the SNA, please refer to https://unstats.un.org/unsd/nationalaccount/snaUpdate.asp (accessed on 05 April 2021).

40 For example, agricultural goods, food, clothing, crafts, mats, baskets, etc.

furthermore concentrated in low productivity/low value activities, often in home-based work, with lower wages and less opportunities for upward mobility in the labour market.

To fully take account of these realities and trends, robust labour force/market related gender analysis also requires information on issues ranging from length of the working day to the intensity of work, activities undertaken during working hours and whether breaks are taken.

To capture all these dynamics, labour force surveys have been receiving comprehensive attention from the International Labour Organization (ILO) in recent years, including with respect to the addition of a time-use module to labour force surveys (refer Box 2).[40]

Box 2
Aligning Labour Force Surveys (LFS) with the 19th International Conference of Labour Statisticians (ICLS) standards

OVERVIEW

The revised international standards on statistics of work, employment and labour underutilization adopted in 2013 by the 19th ICLS seek to:[41]

- Fully capture women and men's participation in all forms of work, paid and unpaid, including assessing differences in their access to full and productive employment as well as in providing unpaid services for the household.
- Provide a more comprehensive measurement of participation in subsistence activities, specifically in agriculture and fishing for own final use, which remain poorly accounted for in official statistics.
- Capture problems of underutilization including discouragement affecting youth and persons living in rural areas particularly.
- Improve the overall statistical base of countries to improve targeted monitoring of participation and access to labour markets related to the creation of more decent jobs as well as the reduction of inequality and social exclusion through different forms of work.

In line with the revised ICLS standards, the ILO is updating its approach to LFS based on the findings of an LFS pilot programme launched in collaboration with national statistics offices. The pilot programme aimed to:

41 Such initiatives follow efforts over many years to better capture working dynamics in "difficult to measure" activities such as informal employment, which is highly heterogeneous and frequently scattered, sporadic, irregular and seasonal. One important global initiative in this context has been the work of the Expert Group on Informal Sector Statistics, commonly known as the "Delhi Group." This was set up in 1997 under the auspices of the United Nations Statistical Commission to address various methodological issues involved in the treatment of the informal sector. Inter alia this group, in collaboration with the International Labour Organization and other international bodies, has developed a manual "Measuring informality: a statistical manual on the informal sector and informal employment" and prepared an inventory of existing country practices with respect to informal sector data collection, processing and use. The report of the Delhi Group on Informal Sector Statistics to the forty-fourth session of the United Nations Statistical Commission, 26 February-1 March 2013 is available at https://www.ilo.org/stat/Publications/WCMS_222979/lang--en/index.htm (accessed on 12 March 2021).

42 Report II. Statistics of work, employment and labour underutilization: Report for discussion at the 19th International Conference of Labour Statisticians (Geneva, 2–11October 2013). Accessed on 12 March 2021 at https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_220535.pdf.

- Develop guidance for countries on how best to align their national LFS with the new international standards.
- Promote the sharing of good practice in LFS methodology among countries around the world.
- Foster greater comparability in labour market statistics across countries.

During the first phase of the programme, the ILO LFS team partnered with the national statistics offices of 10 countries from different regions to implement small-scale pilot studies to test and develop approaches for implementation of the new standards. Key changes to LFS methodologies subsequently introduced include revised questionnaires and approaches through the use of both qualitative and quantitative assessment methods to improve the measurement of employment, unemployment and other indicators of labour underutilization, as well as participation in own-use production work. The latter includes subsistence farming and fishing, fetching water and firewood, housework, care for family members, etc. in different socioeconomic contexts.

In addition, the ILO is developing a data collection strategy centred on the attachment of a time-use module to the LFS. The successful design of such an approach offers many potential advantages given the overlaps between the LFS and time-use surveys, including common target populations, and the high prevalence of LFS internationally.

Sources:

i. *International Labour Organization. (May 2018). ILO LFS pilot studies in follow up to the 19th ICLS: Background, objectives and methodology. ILO Department of Statistics. Geneva, Switzerland. Accessed on 03/12/2021 at https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_627873.pdf;*

ii. *International Labour Organization: Labour Force Survey (LFS) Pilot Study Programme: Accessed on 03/12/2021 at https://www.ilo.org/stat/Areasofwork/Standards/lfs/lang--en/index.htm;*

iii. *International Labour Organization. (August 2018). WHAT COUNTS? - Brief No.1. Exploring Light Time-Use approaches for measuring productive activities. ILO. Geneva, Switzerland. Accessed on 03/12/2021 at https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_635909.pdf; and*

iv. *Labour Force Survey (LFS) resources: The global reference for labour force survey design, accessed on 03/12/2021 at https://ilostat.ilo.org/resources/lfs-resources/.*

3.2.2 Using time-use surveys to complement labour force surveys

As indicated above, the linking of time-use and labour force surveys is already on the agenda of the ILO to not only provide data from a single source on unpaid care and domestic work and the labour force, but also enable robust analysis of the two.

Time-use statistics provide detailed insights on how individuals spend their time, on a daily or weekly basis, on many different activities: activities that fall within the purview of the SNA, non-SNA activities that fall outside SNA while still within the general production boundary, and personal activities that are non-delegable activities.[42] In other words, time-use statistics are quantitative summaries of how individuals allocate their time over a specified time period—typically over 24 hours of a day or over the seven days of a week. Time-use statistics have the potential to provide data on the time spent by individuals on different activities and the context in which activities are

43 Non-delegable services are those services that cannot be delegated to others, e.g. sleeping, watching TV.

carried out.[43] These open up immense possibilities for understanding the total economy (and society), including the paid and unpaid work of men and women.

Netting daily activity in a 24-hour period

Time-use surveys gather comprehensive information on how respondents spend their time on different activities, whether the activity is classified as "work" or "non-work". This information is then coded systematically with a relevant set of "context" variables and a well-designed activity classification.[44] Therefore, this information is unlikely to be biased in terms of identifying "work" and "workers" and exclude any activity due to its comprehensiveness.

Netting subsistence work

With the help of appropriate contextual variables, time-use surveys can provide information on subsistence work. For example, the "context" variable together with whether the activity/production is for sale or self-consumption, can help identify the production of goods and services for subsistence. Similarly, information on the time spent on collecting water, fuel wood, fodder, etc., can give an estimate of the time spent on subsistence work.

The OECD's *Handbook on Measurement of the Non Observed Economy* has pointed out that time-use surveys can be used for estimating the subsistence sector, particularly when labour is the main input in the production process. The time spent on these activities will capture the work (worker) and also help in the valuation of the output by multiplying the time spent by the prevailing wages (OECD 2002).

Netting multi-tasking and flexibility

Since time-use surveys collect complete information on how people spend their time, they are able to give full details about the multiple activities performed by people in a scattered manner. They can provide detailed data on the number of hours spent by workers on work, as well as on the scattered nature of their work. Similarly, time-use surveys can provide data on multitasking and simultaneous activities performed by both men and women.

Netting gender dynamics in the labour market

In combination with labour force survey findings, time-use data can further provide improved understanding of gender gaps in the labour market due to available information on the burden of unpaid domestic services and unpaid care work for men and women. The highly unequal distribution of unpaid domestic work between men and women in the household, along with the

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44 The "context" variable in time-use statistics usually refers to the location where the activity took place (where), the presence of other people when the activity took place (with whom), the beneficiary, person, or institution of the activity (for whom the activity was carried out), the motivation of the activity (e.g. whether the activity was paid or unpaid).

45 Refer to the International Classification of Activities for Time Use Statistics (ICATUS 2016) at https://unstats.un.org/unsd/statcom/48th-session/documents/BG-3h-ICATUS-2016-13-February-2017-E.pdf (accessed on 12 March 2021).

socio-cultural norms emanating from it, restricts human capital formation among women and often reduces women's participation, mobility and choice of work in the labour market.

3.3 Policy implications

Time-use surveys can therefore complement labour force surveys in the designing of realistic and relevant labour market interventions. It is also important to ensure that the following points are observed while conducting time-use surveys and analyzing the data:

- Since time-use surveys are still relatively less common in many countries, the methodology is often compromised. For useful results, it is necessary that time-use surveys use sound concepts and rigorous methodology. The survey must have a sound design, including a strong and representative time sampling (the reference period) and use of standard data collection methods.
- Building on current steps in this direction, compatibility should be systematically established between the results and datasets of labour force surveys and time-use surveys.
- There should be a systematic analysis to understand the linkages between men and women in their shares of unpaid non-SNA work and their relative status in the labour market.

On the policy side, it is important to address the unpaid work of women by:

- providing basic infrastructure and services, such as potable water supply, energy security, connectivity, etc.;
- providing universal childcare facilities, including day care facilities, by the government, by employers, or by the market at affordable prices;
- providing improved technology to reduce the drudgery of household work by bringing unpaid domestic work within the realm of technology policy through the government; and
- designing employment programmes for women, along with reducing their unpaid work.

Examples of labour market policies to which time-use surveys can add value in this context are:

- designing family-friendly policies, such as reducing the time demand of paid work through part-time work, modifying the rigidities of time schedules by using flexible hours, offering a compressed working-week, etc.;
- introducing policies for promoting the skills and employment of women through special programmes and schemes to enable them to improve their status in the labour market; and
- giving financial compensation and incentives to women workers for giving birth and taking care of children, e.g. by compensating women workers for their absence from work for child-bearing and child-rearing and providing financial incentives to employers for employing/training women.

In the case of developing countries, it is important to organize the interventions in such a way that the above policies can be accessed by informal workers. Specifically, it is essential to ensure that the interventions do not reinforce the role of women as caregivers and the role of men as breadwinners in the long run. Policies and interventions should seek to involve men in caregiving and other unpaid domestic work.

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CHAPTER 4

PROVIDING INSIGHTS INTO THE TIME-USE OF THOSE ‘LEFT BEHIND’

CHAPTER 4: PROVIDING INSIGHTS INTO THE TIME-USE OF THOSE 'LEFT BEHIND'

This chapter is an edited version of material provided by Sripad Motiram to the ESCAP Statistics Division in 2018.

Chapter overview: This chapter focuses on the collection and application of time-use data to complement data obtained from other surveys, particularly the Indian National Sample Survey (NSS), which shed light on gender differences, the status of youth unemployment, and the relationship between employment/unemployment and education. The chapter uses the pilot Indian Time-use Survey (ITUS, 1998-99).[45]

In specific terms, the chapter demonstrates how to employ time-use data to (i) provide insights on labour force participation, employment and unemployment; and (ii) to shed light on gender differences in this context. The reader should further be able to analyse the interactions between education and work.

Stata is used to perform the empirical analysis in this chapter.

4.1 Chapter focus

Several of the Sustainable Development Goals (SDGs) are linked with the concept of decent work.[46] For example, the first SDG on ending poverty is not achievable unless a substantial proportion of the working-age population in every country is involved in jobs that pay adequately. This is notwithstanding the availability of public transfers, social security and related policies, which are undoubtedly important. Similarly, evidence from developing countries (see e.g. Kotwal and Chaudhuri 2013; Motiram and Naraparaju 2015) suggests that the goals of poverty reduction and inclusive growth are closely linked to the creation of jobs that pay adequately.

While this chapter does not focus per se on the quality of work (i.e. the factors which constitute decent work), it sheds light on how time-use data can be used to better measure and understand specific elements of labour force dynamics and participation/non-participation within the context of decent work.

46 During the time period covered by this chapter, the National Sample Survey (NSS) was the primary source of statistics on labour force, activity participation of the population and structure of employment and unemployment in the country. Source: Instructions to Field Staff Volume – I, Design, Concepts, Definitions and Procedures, Periodic Labour Force Survey, National Sample Survey Office, National Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India, 2016, http://www.mospi.nic.in/sites/default/files/publication_reports/Instructions_12sep16.pdf (accessed on 05 April 2021).

47 The International Labour Organisation (ILO) defines decent work as involving opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men: https://www.ilo.org/global/topics/decent-work/lang--en/index.htm (accessed on 05 April 2021).

For a full understanding and more robust analysis of these issues, time-use data can complement household survey data from such surveys as the Indian National Sample Survey (NSS). In time-use surveys, all the activities performed by an individual are enumerated during a day, whether for short periods (e.g. 20 minutes or half-an-hour) or for long periods (e.g. four hours, eight hours), allowing for increased accounting and greater accuracy.

This contrasts NSS data on employment and unemployment situations, where an activity is performed for a full day or half-a-day, or not at all.[47] Moreover, in time-use data, activities that are performed simultaneously with other activities are enumerated and identified as such (e.g. working on the farm while taking care of children). This is not done in conventional surveys, and hence these may not represent or measure such activities accurately.

At the same time, the labour market institutions and norms that influence markets differ across rural and urban areas. For example, agriculture is predominantly a rural activity, displays specific features (e.g. seasonality) and is characterized by certain norms (e.g. allocation of tasks based upon gender).[48] Hence, it is important to conduct the analysis separately for rural and urban areas, as demonstrated this chapter.

4.2 Relevance

4.2.1 Linkages with Sustainable Development Goals (SDGs)

The approach and steps outlined in the chapter are relevant to monitoring progress on SDG Target 5.4 on promoting shared responsibility within the household (Indicator 5.4.1 on the proportion of time spent on unpaid domestic and care work, by sex, age and location).

They are also relevant to the following targets and indicators of SDG 8 on decent work and economic growth: Target 8.3 on decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises (Indicator 8.3.1, Proportion of informal employment in non-agriculture employment, by sex); Target 8.5 on achieving full and productive employment and decent work for all women and men (Indicator 8.5.2, unemployment rate, by sex, age and persons with disabilities); and SDG Target 8.6 on substantially reduce the proportion of youth not in employment, education or training (Indicator 8.6.1: Proportion of youth (aged 15–24 years) not in education, employment or training).

4.2.2 Domestic policy implications

Time-use data has direct application to domestic policy formulation and monitoring in areas such as structural change in the economy (i.e. the relative balance between agriculture, industry and services), rural-urban migration, promoting opportunities for youth employment and reducing gender inequalities in access to employment and education.

Agriculture continues to be an important sector for many developing countries, employing a substantial proportion of the population. At the same time, the urban informal sector, fueled by

48 Note that this context and approach was quite specific to India at the time. While the associated analysis in this chapter remains valid for demonstration purposes, it may not have wide applicability to other contexts.

49 Certain activities (e.g. weeding and harvesting) are predominantly done by women (FAO 2011).

rural-urban migration is also beginning to be a significant contributor to employment. Of course, the contributions of agriculture and the urban informal sector to national income and employment vary across different regions of the developing world, including South Asia, Sub-Saharan Africa, Latin America and the Caribbean. Motiram and Naraparaju (2018) discuss this issue at length, with relevant details summarized below.

India has a relatively young population. However, if the youth of the country do not find adequate employment, this would result in a serious crisis. Employment and unemployment among the youth, particularly educated youth, has therefore attracted some attention. Time-use data can be useful to shed light on some of these critical issues concerning the youth and their use of time.

A general point made in Motiram and Osberg (2012) is that time-use surveys contain information about individuals who do not earn income or participate in market processes, and who may therefore be underrepresented or ignored in other sources of data such as establishment surveys or administrative records. This chapter illustrates this general point and addresses a crucial gap in the evidence base currently driving much policy development, implementation and monitoring.

4.2.3 Gender implications

The characteristics of the agricultural sector (with its associated seasonality) and the urban informal sector, in turn, imply that part-time work and withdrawals from the labour force (both voluntary and involuntary) are important phenomena. These phenomena are prevalent to a greater extent among certain groups, namely, women and girls, as compared to men and boys.[49] These issues have not been adequately appreciated in the academic literature or policy discourse.

NSS data on employment and unemployment since the 1990s (1993-94, 2004-05, 2009-10, and 2011-12) reveal that labour force participation among girls and women has been falling in rural areas in India. Some scholars (e.g. Rangarajan et al. 2011) have interpreted this decline in a positive manner, arguing that this is due to increased enrollment of girls in education and to a rise in household incomes.[50] On the latter front, they highlight the role of frameworks such as the National Rural Employment Guarantee Act in providing additional employment.[51] Other scholars (e.g. Kannan and Raveendran 2012) have used the same data and questioned these inferences. Intervening in this debate, Hirway (2012) has highlighted the advantages of time-use data in providing insights on labour force participation and employment in the Indian context.

50 For figures on India and some other references, see Motiram and Naraparaju (2018).

51 As is done in many studies in India, Rangarajan et al. (2011) compute labour force for the entire population (i.e. all age groups). Hence, there is an overlap with the younger age groups, which typically enroll in educational institutions.

52 The Mahatma Gandhi National Rural Employee Guarantee Act (MNREGA) 2005 promises "at least one hundred days of guaranteed wage employment in every financial year to every household whose adult members volunteer to do unskilled manual work" (Gazette of India 2005).

4.3 Step-by-step example

4.3.1 Background: The Indian Time-use Survey (ITUS) 1998-99

The ITUS was conducted by the Central Statistical Office of the Indian Ministry of Statistics, during the period June 1998 to July 1999.[52] The details of the survey, including the sampling methodology, are presented in the *Instruction Manual for Field Staff* (ITUS, 1998).[53] A total of 77,593 individuals were surveyed, of whom 53,981 were rural inhabitants and the remaining 23,612 were urban inhabitants. A total of 18,591 households, 12,750 rural and 5,841 urban, were surveyed. The survey was conducted in six states: Haryana, Gujarat, Madhya Pradesh, Orissa, Meghalaya, and Tamil Nadu. These states are in the Northern, Western, Central, Eastern, North Eastern, and Southern regions of the country, respectively. The survey is therefore geographically representative, covering all the major regions of the country. As discussed above, the issue of seasonality is important in developing countries, given that a substantial proportion of the population is involved in agriculture. By dividing the year into four rounds, the survey is consistent with this consideration.

Information was collected by teams comprising two persons (a male and a female), who stayed in each village or urban block for nine days. These teams first assessed the weekly pattern of time-use of respondent households. They then revisited them to compile the list of activities for each household member over six years of age for the previous day. The survey distinguished three different kinds of days: normal, abnormal, and weekly variant. A normal day is a usual day. Examples of abnormal days are: "that day of the week when guests arrive, any member of the household suddenly falls sick, any festival occurs, etc." (ITUS, 1998, p. 23). A weekly variant day is "determined according to the pattern of the major earner's holidays. If the major earner does not have holidays, then school children's holidays will be taken. If even this is not applicable, then the day of weekly *hat* (bazaar) may be taken" (ITUS, 1998, p. 23). On average, the proportion of abnormal and weekly variant days per week is quite low—0.44% and 0.05%, respectively (Hirway 2000). Hence, the analysis below focuses on normal days.

ITUS data is contained in two separate ASCII files for rural (D152R.TXT) and urban (D152U.TXT) areas. Each file contains data for four "levels" (the level being a variable specified in the file), which are described below:

- Level 1: Household Information Module. Contains information on the respondent household, e.g. household size, religion, caste, sex of the household head, presence of literate adult members, etc.
- Level 2: Individual Information Module. Contains information on individuals within the respondent household, e.g. age, sex, marital status, level of education, etc.
- Level 3: Day of the Week Module. Contains information on normal day, abnormal day, and weekly variant day for individuals.

53 The dataset used in this chapter is available for purchase. To purchase the data, refer to http://mospi.nic.in/sites/default/files/main_menu/data_discremination/Time_use_survey_rate_list.pdf (accessed on 05 April 2021).

54 The Instruction Manual provides all the relevant details of the survey. The methodology was similar to the one adopted in the National Sample Surveys.

- Level 4: Time-use Module. Contains information on activities for individuals aged six years or older. For each individual, it contains information on each activity that he or she performs, e.g. nature of the activity, time spent, whether it is done simultaneously with another activity, whether it is paid or not, whether it is done within or outside the household etc.

For demonstration purposes, this chapter uses data from level 2 (Individual Information Module) and level 4 (Time-use Module).

4.3.2 Empirical analysis

Stata is used to perform the empirical analysis.[54] The analysis involves basic knowledge of statistics and requires the computation of percentages and averages. Each ASCII file must first be read and separated into four files (for the various levels described above). As discussed above, the analysis is conducted separately for rural and urban areas, so the rural and urban files are not merged. There is a total of eight files: rlevel1.dta to rlevel4.dta for rural areas, and ulevel1.dta to ulevel4.dta for urban areas.

In India, policy discourse and most of the academic literature rely on employment and unemployment surveys conducted by the National Sample Survey Office (NSSO), which uses four different approaches to measure labour force participation, employment, and unemployment (described below), each based on a different reference period.[55] [56]

(i) The Usual Principal Status (UPS) approach

This approach is based on a reference period of one year (365 days preceding the survey) and a person's UPS being the major activity during the year. A person is considered to be in the labour force if, for the major part of the year, he or she was either working or searching for work. A person is considered unemployed if he or she was not working, but searching for work during the major part of the time he or she was in the labour force.

(ii) The Usual Principal and Subsidiary Status (UPSS) approach

In addition to those included using the UPS criterion, the labour force also comprises those who have worked for at least 30 days over the year (again, the last 365 days preceding the survey). A person is considered unemployed if he or she is in the labour force (according to the UPSS criteria) and has not worked for at least 30 days over the year. As mentioned above, the surveys on employment and unemployment situation conducted by the NSSO enumerate two activities per day during a reference week.

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55 Stata codes are as provided by the primary contributor of the chapter material and have been issued without validation as the data set is not publicly accessible.

56 This description draws upon Motiram and Naraparaju (2018), which itself draws upon various NSSO reports.

57 Note that the approaches described was quite specific to India at the time. While these remain valid for demonstration purposes, they may not have wide applicability to other contexts.

(iii) The Current Weekly Status (CWS) approach

The current weekly status is used as the reference period and classifies a person as being in the labour force if he or she was either working or searching for work for at least half a day in the preceding week. If this person sought work for the entire week, then he or she would be classified as unemployed.

(iv) The Current Daily Status (CDS) approach

This uses the Current Daily Status reference period. This classifies a person as being in the labour force if he or she was working, seeking work or available for work for a half-day. A person is classified as being unemployed if he or she was not working, but seeking work or available for work during the half-day.

How labour force participation and employment can be measured using time-use data, in particular using the ITUS, is discussed below.

Note: It is worth clarifying here that both the UPS and UPSS approaches can be used with ITUS data too (i.e. not just with NSS data). In the Individual Information (level 2) file in the ITUS, there is a variable for the UPS of every individual—with a reference period of one year. There is similarly a variable for the UPSS for every individual.

STEP 1: Estimating labour force participation and employment rates using the UPS approach:

Firstly, the UPS approach will be used in order to identify whether a person was in the labour force or not. To do so, examine the Individual file (level 2) and look at the variable corresponding to each individual's UPS. Perform this estimation for male and female respondents, in both rural and urban areas. The definition of work that has been used widely (including by policy makers) considers a person to be involved in work if the UPS is one of the following codes: 11, 12, 21, 22, 31, 32, 41, 51, 52, and 53.[57] To qualify as unemployed, the person's UPS should be that he or she did not work, but was available for or sought work (code 81). The labour force participation rate and unemployment rate are the fractions of the population that are in the labour force and that are unemployed, respectively. These are simple head count ratios. Examine these rates for the entire population (all age groups), the population of adults, and separately for each of the various age groups.

The Stata programme for rural areas is given below. The comments (/*) explain each of the commands. The variable cms (combined multiplier for the state) is the sampling weight to be used. See Deaton 1997, Chapter 1, for a detailed description of sampling weights and the necessity for using them in computing estimates such as the ones that are being derived (means, proportions, etc.). To put it in simple and non-technical terms, different households (or individuals) could have different probabilities to be selected into a sample, and this is handled by attaching different weights

58 These codes are taken from the household schedule of ITUS ("Work in household enterprises (self-employed)"): own-account worker – 11; employer – 12; worked as helper in household enterprise (unpaid family worker) – 21; worked as home-based worker – 22; worked as regular salaried/wage permanent employee – 32; worked as regular salaried/wage non-permanent employee – 33; worked as casual and contractual wage labour in public works – 41; in other types of works – 51; worked as trainee/intern (paid) – 52; worked as exchange labour – 53. (The NSS uses a similar classification). It is clear from these codes that this work could be paid or unpaid.

to these households (or individuals). Computing an estimate (e.g. an average) without using weights would give a biased estimate for the population.[58]

```
/*[59] Open level2 file for rural areas */

use "c:\rlevel2.dta"[60], clear

/* Calculation of Labour Force Participation Rate (LFPR) using the UPS method */

generate in_labour _force=0[61] /* in_labour _force=1 if individual is in labour  force
and 0 otherwise */
replace in_labour _force=1 if prinstat<91 /* 91 or above are not in the labour
force */

/* For Males (sex=1) */

tabstat in_labour _force [weight=cms] if sex==1 /* LFPR - percentage in labour
force */
tabstat in_labour _force [weight=cms] if sex==1 & age>=18 /* LFPR for adults */

/* For Females (sex=2) */

tabstat in_labour _force [weight=cms] if sex==2 /* LFPR - percentage in labour
force */
tabstat in_labour _force [weight=cms] if sex==2 & age>=18 /* LFPR for adults */

/* Calculation of Unemployment Rate (UR) using UPS method */

generate unemployed=0 /* unemployed=1 if individual is unemployed and 0 otherwise
*/
replace unemployed=1 if prinstat==81 /* 81 is for unemployed */

/* For Males (sex=1) */

tabstat unemployed [weight=cms] if sex==1 & in_labour _force==1 /* Percentage
unemployed */
tabstat unemployed [weight=cms] if sex==1 & age>=18 & in_labour _force==1 /* UR
adults */

/* For Females (sex=2) */

tabstat unemployed [weight=cms] if sex==2   & in_labour _force==1 /* Percentage
unemployed */
tabstat unemployed [weight=cms] if sex==2 & age>=18 & in_labour _force==1 /* UR
adults */

/* The programme for urban areas is similar except that the urban level 2 file
(ulevel2.dta) has to be used instead of the rural file. It is given below: */
```

59 To illustrate using a simple example, let there be three individuals with incomes of $100, $200, and $300 and corresponding sample weights of 0.5, 1, and 2. A simple/unweighted estimate for average income is ($100+$200+$300)/3 = $200, which would be biased. On the contrary, a weighted and unbiased estimate would be (0.5*$100+1*$200+2*$300)/(0.5+1+2) = $242.86.

60 ESCAP observation: The /* are indicators for comments in the code. Users may run into issues regarding the /* if copy and pasting the code into Stata. If this is the case, users may have to remove the /* and/or subsequent comment to execute code without errors. This action will need to be repeated whenever the /* are present. Otherwise, running the do-file directly in Stata should produce minimal errors.

61 ESCAP observation: Users should change the file path and folder to where the data is saved. This action will need to be repeated whenever importing the data.

62 ESCAP observation: There is a gap in the variable name in_labour _force (between labour and the underscore). This gap may cause errors since Stata does not read gaps/spaces in variable names, functions, etc. Users may need to remove the space if errors occur. The removal this gap will need to be repeated every time this variable appears.

```
/* Open level2 file for rural areas */

use "c:\ulevel2.dta", clear

/* Calculation of Labour Force Participation Rate (LFPR) using the UPS method */

generate in_labour _force=0 /* in_labour _force=1 if individual is in labour force
and 0 otherwise */
replace in_labour _force=1 if prinstat<91 /* 91 or above are not in the labour force
*/

/* For Males (sex=1) */

tabstat in_labour _force [weight=cms] if sex==1 /* LFPR - percentage in labour force
*/
tabstat in_labour _force [weight=cms] if sex==1 & age>=18 /* LFPR for adults */

/* For Females (sex=2) */

tabstat in_labour _force [weight=cms] if sex==2 /* LFPR - percentage in labour force
*/
tabstat in_labour _force [weight=cms] if sex==2 & age>=18 /* LFPR for adults */

/* Calculation of Unemployment Rate (UR) using UPS method */

generate unemployed=0 /* unemployed=1 if individual is unemployed and 0 otherwise
*/
replace unemployed=1 if prinstat==81 /* 81 is for unemployed */

/* For Males (sex=1) */

tabstat unemployed [weight=cms] if sex==1 & in_labour _force==1 /* Percentage
unemployed */
tabstat unemployed [weight=cms] if sex==1 & age>=18 & in_labour _force==1 /* UR
adults */

/* For Females (sex=2) */

tabstat unemployed [weight=cms] if sex==2 & in_labour _force==1 /* Percentage
unemployed */
tabstat unemployed [weight=cms] if sex==2 & age>=18 & in_labour _force==1 /* UR
adults */
```

Table 4.1 presents the results for labour force participation rates using productive activities drawn from the ITUS data (ITUS 1998).[62] The results show that the participation rates are different for men and women in both rural and urban areas. The participation rate in each area is much lower for women (34.5%—rural; 15.1%—urban) than for men (91.3%—rural; 86.5%—urban), with a substantial difference between rural and urban areas.

Table 4.2 presents the unemployment rates drawn from the ITUS data, which are quite low. As argued in Motiram and Naraparaju (2018), this could be because people are forced to take whatever

63 The ITUS productive activities used to calculate the percentages in *Tables 4.1* and *4.2* are: 1. Primary Production, e.g. crop farming, animal husbandry; 2. Secondary Production e.g. construction, manufacturing; and 3. Trade, Business, and Services e.g. buying and selling of goods, transporting goods. The classification of activities into primary (Group 1), secondary (Group 2), and tertiary (Group 3) is quite common in the Indian context, see e.g. various reports of the NSS (e.g. NSS 2000) and economic surveys. All activities from ITUS Groups 4 to 6 (4. Household Maintenance, Management, and Shopping for Own Household including, cooking, cleaning, etc., 5. Care for Children, the sick, elderly and disabled for own household, 6. Community Services and Help to Other Households) are treated as "Other"—a residual category. This is the activity classification that is used to analyse participation and average time spent in the extended labour force and work.

employment they are able to obtain. Computations using the NSS data are presented for comparison, showing that as expected, there are some differences.

Table 4.1. Labour force participation rates based on the UPS method, by age, sex and region

	Rural		Urban	
	Male	Female	Male	Female
ITUS				
Overall (All Ages)	57.8%	23.3%	58.1%	10.6%
Adults (18 or older)	91.3%	34.5%	86.5%	15.1%
Overall (NSS, 1999-2000)	53.3%	23.5%	53.9%	12.6%

Source: Chapter author's computations from ITUS. Estimates using NSS are from Krishnamurthy and Raveendran (2008).

Table 4.2. Unemployment based on the UPS method, by age, sex and region

	Rural		Urban	
	Male	Female	Male	Female
ITUS				
Overall (All Ages)	1.6%	0.3%	3.6%	4.5%
Adults (18 or older)	1.3%	0.2%	3.1%	4.0%
Overall (NSS, 1999-2000)	2.1%	1.5%	4.8%	7.1%

Source: Chapter author's computations from ITUS. Estimates using NSS are from Krishnamurthy and Raveendran (2008).

However, as Hirway (2012) has highlighted, the above method of determining the labour force has certain limitations. It does not take into account those whose UPS code is 92 ("attended domestic duties only") or 93 ("attended domestic duties and was also engaged in free collection of goods (vegetables, roots, fire wood, cattle feed etc.), sewing, tailoring, weaving, etc., for household use"). These people should be considered as working, but UPS codes 92 and 93 are not considered part of the labour force. Most of those involved in these activities are girls and women, and it is evident some of them should not be excluded from the labour force, e.g. those involved in the collection of free goods. The advantage of time-use data is that it allows the analysis of the actual time people spend in various activities, thereby avoiding reliance on UPS, which is based on a long period of one year.

Note: ITUS does not give any indication of the "quality" of the work/job, merely the activities performed and some attributes (e.g. paid or unpaid, whether activity was simultaneously done).

STEP 2: Estimating the participation rate and average times spent on activities on a normal day, conditional on participation

For this next step, use the variable that identifies the type of the day as normal or abnormal or weekly variant in the Time-use Module (level 4 file) to select normal days. Before estimating participation and average time, it will be useful to have a file that contains the individual identifier and some important individual characteristics, including the level of education and sampling weight. The Stata programmes for creating such files for rural and urban areas are given below.

STEP 3: Creating temporary files for individual characteristics

```
/* Creating a temporary file for rural areas */
use "c:\rlevel4.dta", clear /* Open the level4 file */

keep if daytype==1 /* Considering Only Normal Days */

egen ind_key=concat (id serial_mem) /* Create individual key */
duplicates drop ind_key, force /* Keep one individual record */
keep ind_key sex age cms educ /* Keep these variables for later calculations */
sort ind_key /* Sorting the file on the individual identifier */

save "c:\rtemp.dta"

/* Creating a temporary file for urban areas */
use "c:\ulevel4.dta", clear /* Open the level4 file */

keep if daytype==1 /* Considering Only Normal Days */

egen ind_key=concat (id serial_mem) /* Create individual key */
duplicates drop ind_key, force /* Keep one individual record */
keep ind_key sex age cms educ /* Keep these variables for later calculation */
sort ind_key /* Sorting the file on the individual identifier */

save "c:\utemp.dta"
```

STEP 4: Estimation using the temporary files created in Step 3

Having created these files, the Stata programme for estimating participation and average times in primary, secondary, and tertiary activities is given below for rural areas. The programme for urban areas is similar.

```
use "c:\rlevel4.dta", clear /* Open the level4 file */

keep if daytype==1 /* Considering Only Normal Days */
destring timespnt,replace

egen ind_key=concat (id serial_mem) /* Creating unique individual identifier */

/* Generating a one-digit code for activities so that they can be grouped into
primary, secondary, and tertiary */

generate activity_group=substr(actcode,1,1)

/* Initializing times spent on primary, secondary, and tertiary activities */

generate primary_time=0
generate secondary_time=0
generate tertiary_time=0

/* Assigning the time spent on primary, secondary, and tertiary activities - this
is at the activity level */

replace primary_time=timespnt if activity_group=="1"[63]
replace secondary_time=timespnt if activity_group=="2"
replace tertiary_time=timespnt if activity_group=="3"
```

64 ESCAP observation: Errors may occur if the string type of the variable activity_group does not match the value after the == . For example, if activity_group is a numeric or integer, the value 1 (without quotations) should run without errors. If activity_group is a character, then "1" (with quotations) would probably be necessary. If users encounter errors, try removing the quotations and run the code again. Please remove the quotations for activity_group == "2" and activity_group == "3" if the errors appear as well.

```
/* Constructing an individual level file by adding up times on primary, secondary
and tertiary activities for each individual */

collapse (sum) primary_time secondary_time tertiary_time, by (ind_key)

sort ind_key

/* Merging the individual file created above with the temporary file which contains
individual characteristics */

merge 1:1 ind_key using "c:\rtemp.dta"

/* Creating dummies to indicate whether an individual is involved in primary or
secondary or tertiary activities */

generate in_primary=0
replace in_primary=1 if primary_time>0

generate in_secondary=0
replace in_secondary=1 if secondary_time>0

generate in_tertiary=0
replace in_tertiary=1 if tertiary_time>0

/* Generating a dummy for participating in one of the three activities */

generate in_one_of_three=0
replace in_one_of_three=1 if in_primary==1|in_secondary==1|in_tertiary==1

/* Generating proportions of individuals involved in primary, secondary, and
tertiary activities. Note that the average of a dummy variable yields the proportion
*/
/* We do this for both men and women; for the entire population, and for various
age groups */

tabstat in_primary in_secondary in_tertiary in_one_of_three [weight=cms] if sex==1
tabstat in_primary in_secondary in_tertiary in_one_of_three [weight=cms] if sex==1
& age>=18 & age<30
tabstat in_primary in_secondary in_tertiary in_one_of_three [weight=cms] if sex==1
& age>=30 & age<66

tabstat in_primary in_secondary in_tertiary in_one_of_three [weight=cms] if sex==2
tabstat in_primary in_secondary in_tertiary in_one_of_three [weight=cms] if sex==2
& age>=18 & age<30
tabstat in_primary in_secondary in_tertiary in_one_of_three [weight=cms] if sex==2
& age>=30 & age<66

/* Generating average time spent in primary, secondary, tertiary activities for
those involved in these activities */
/* We do this for both men and women; for the entire population, and for various
age groups */

tabstat primary_time [weight=cms] if in_primary==1 & sex==1
tabstat secondary_time [weight=cms] if in_secondary==1 & sex==1
tabstat tertiary_time [weight=cms] if in_tertiary==1 & sex==1

tabstat primary_time [weight=cms] if in_primary==1 & sex==1 & age>=18 & age<30
tabstat secondary_time [weight=cms] if in_secondary==1 & sex==1 & age>=18 & age<30
tabstat tertiary_time [weight=cms] if in_tertiary==1 & sex==1 & age>=18 & age<30

tabstat primary_time [weight=cms] if in_primary==1 & sex==1 & age>=30 & age<66
tabstat secondary_time [weight=cms] if in_secondary==1 & sex==1 & age>=30 & age<66
tabstat tertiary_time [weight=cms] if in_tertiary==1 & sex==1 & age>=30 & age<66

tabstat primary_time [weight=cms] if in_primary==1 & sex==2
tabstat secondary_time [weight=cms] if in_secondary==1 & sex==2
tabstat tertiary_time [weight=cms] if in_tertiary==1 & sex==2

tabstat primary_time [weight=cms] if in_primary==1 & sex==2 & age>=18 & age<30
tabstat secondary_time [weight=cms] if in_secondary==1 & sex==2 & age>=18 & age<30
```

```
tabstat tertiary_time [weight=cms] if in_tertiary==1 & sex==2 & age>=18 & age<30

tabstat primary_time [weight=cms] if in_primary==1 & sex==2 & age>=30 & age<66
tabstat secondary_time [weight=cms] if in_secondary==1 & sex==2 & age>=30 & age<66
tabstat tertiary_time [weight=cms] if in_tertiary==1 & sex==2 & age>=30 & age<66

/* Generating educational groups based on the level of education */

generate educ_group=1 /* Not Literate */
replace educ_group=2 if educ>1 & educ<=7 /* Literate to Middle */
replace educ_group=3 if educ==8 | educ==9 /* Secondary or Higher Secondary */
replace educ_group=4 if educ>9 /* Higher than Higher Secondary */

/* Generating the estimates (proportions and average times) for various educational
groups */
tabstat in_primary in_secondary in_tertiary [weight=cms] if sex==1, by(educ_group)
tabstat in_primary in_secondary in_tertiary [weight=cms] if sex==2, by(educ_group)

tabstat primary_time [weight=cms] if sex==1 & in_primary==1, by(educ_group)
tabstat secondary_time [weight=cms] if sex==1 & in_secondary==1, by(educ_group)
tabstat tertiary_time [weight=cms] if sex==1 & in_tertiary==1, by(educ_group)

tabstat primary_time [weight=cms] if sex==2 & in_primary==1, by(educ_group)
tabstat secondary_time [weight=cms] if sex==2 & in_secondary==1, by(educ_group)
tabstat tertiary_time [weight=cms] if sex==2 & in_tertiary==1, by(educ_group)
```

Table 4.3 presents the relevant estimates for participation and average times spent on primary, secondary, and tertiary activities. The last row for each age group shows that a substantial proportion of men and women, in both rural and urban areas, participate in one of the three activities. The participation rates are much higher than those based on UPS (given in Table 4.1). For example, for girls and women in rural areas, the percentage participating in these three activities is 70%, whereas the corresponding estimate from UPS is 23.5%. This is to be expected since the UPS is based on a reference period of one year

In Table 4.3, however, the computations are based upon actual times spent on a normal day. The average times spent show that those who are spending time in primary, secondary or tertiary activities are, on average, spending a considerable amount of time on these activities such as, more than eight hours per day for men and boys in rural areas. We can observe clear rural-urban differences. For example, as expected, participation in primary activities is much higher in rural areas than in urban areas, e.g. for boys and men, it is 61.2% and 9.8%, respectively. The time spent by women and girls is lower than that for men and boys. In rural areas, men and boys spend 448.2 minutes in primary activities as compared to 265.7 minutes for women and girls. Younger and older age groups also have different participation rates and patterns of participation.

Table 4.4 presents similar estimates for various educational groups. As in the surveys conducted by the NSSO, ITUS does not contain information on years of education. However, it does contain information on the level of education. The population is divided into four categories (as in Motiram and Naraparaju 2018):

1. not literate;
2. literate to middle school;
3. secondary and higher secondary; and
4. above higher secondary.

As expected, moving up the educational ladder leads to increases in participation rates in tertiary (service-oriented) activities and decreases in primary (production-type) activities. In both rural and urban areas, and for all activities, there are differences between men and women. Of particular concern is that, in urban areas, a considerable proportion of women in the higher education categories are not involved in any of the three activities. The data does not outline the underlying factors of these phenomena, but they are linked to the ability to find jobs, which can be correlated with discrimination in the labour market.

Table 4.3. Participation and average time spent in educational activity, by sex and region

	Rural				Urban			
	Male		Female		Male		Female	
	minutes[a]	%[b]	minutes[a]	%[b]	minutes[a]	%[b]	minutes[a]	%[b]
Ages 18 to 30								
Primary Activities	453.0	*68.4*	248.5	*71.9*	388.7	*10.5*	89.2	*20.5*
Secondary Activities	472.3	*14.9*	241.2	*8.2*	541.7	*23.1*	248.9	*7.7*
Tertiary Activities	474.3	*16.9*	165.1	*6.9*	528.2	*48.3*	348.5	*14.8*
One of the three activities		*91.0*		*78.6*		*77.1*		*38.0*
Ages 30 to 66								
Primary Activities	471.0	*78.3*	286.7	*78.0*	330.1	*12.2*	126.5	*25.4*
Secondary Activities	409.9	*12.0*	227.8	*7.0*	553.5	*20.4*	268.9	*9.1*
Tertiary Activities	451.0	*17.4*	187.5	*7.9*	556.5	*67.0*	308.2	*17.1*
One of the three activities		*96.1*		*83.2*		*92.7*		*45.0*
Overall (Ages 6 or older)								
Primary Activities	448.2	*61.2*	265.7	*64.7*	327.3	*9.8*	110.7	*19.4*
Secondary Activities	428.6	*10.1*	238.5	*6.4*	546.7	*17.2*	261.2	*7.3*
Tertiary Activities	437.0	*13.7*	176.1	*6.5*	538.4	*47.2*	314.2	*13.6*
One of the three activities		*76.8*		*70.0*		*69.4*		*35.4*

Source: Chapter author's computations from ITUS.

Note: All computations are for a normal day.

a. Average time spent by those involved in primary activities. Similarly, for secondary and tertiary activities.

b. Percentage of those involved in primary activities. Similarly, for secondary and tertiary activities.

Table 4.4. Participation and average time spent (educational groups), by sex and region

	Rural				Urban			
	Male		Female		Male		Female	
	minutes[a]	%[b]	minutes[a]	%[b]	minutes[a]	%[b]	minutes[a]	%[b]
1. Not Literate								
Primary Activities	478.9	*81.6*	296.0	*77.8*	393.1	*26.0*	173.6	*30.3*
Secondary Activities	398.9	*10.3*	215.1	*6.7*	587.6	*25.5*	338.6	*8.8*
Tertiary Activities	343.4	*7.0*	147.0	*5.7*	532.4	*37.9*	332.3	*14.8*
2. Literate to Middle School								
Primary Activities	444.1	*54.4*	225.9	*51.3*	348.9	*10.0*	89.8	*17.8*
Secondary Activities	442.7	*10.1*	282.6	*5.8*	566.1	*19.7*	266.1	*7.4*
Tertiary Activities	424.0	*12.0*	169.7	*6.2*	536.8	*36.6*	270.5	*10.7*
3. Secondary and Higher Secondary								
Primary Activities	387.7	*52.1*	153.6	*48.4*	276.1	*7.2*	49.2	*15.5*
Secondary Activities	437.2	*10.2*	203.7	*7.9*	507.6	*16.7*	182.4	*5.8*
Tertiary Activities	499.5	*27.6*	260.3	*11.8*	549.7	*53.6*	307.6	*12.5*
4. Above Higher Secondary								
Primary Activities	317.4	*37.5*	106.5	*36.3*	115.2	*4.4*	48.3	*8.6*
Secondary Activities	401.0	*7.9*	122.4	*7.8*	477.1	*6.0*	133.4	*6.2*
Tertiary Activities	458.9	*44.5*	362.1	*27.9*	525.1	*71.5*	385.4	*29.8*

Source: Chapter author's computations from ITUS.

Note: All computations are for a normal day.

a. Average time spent by those involved in primary activities. Similarly, for secondary and tertiary activities.
b. Percentage of those involved in primary activities. Similarly, for secondary and tertiary activities.

Chapter summary

This chapter used the ITUS to illustrate how time-use data can be used to complement analyses based on other household surveys on employment/unemployment, noting that the approach used may be quite unique to India during that time period. The analysis reveals marked differences between time-use of Indian women and men in both rural and urban areas. It also showed that there is an interaction between education and work. While the chapter largely focused on gender differences, the ideas and analysis can be extended to other differences as well (e.g. urban/rural, age groups, educational achievement, etc.). Regular time-use surveys can therefore facilitate research and inform policy on related issues.

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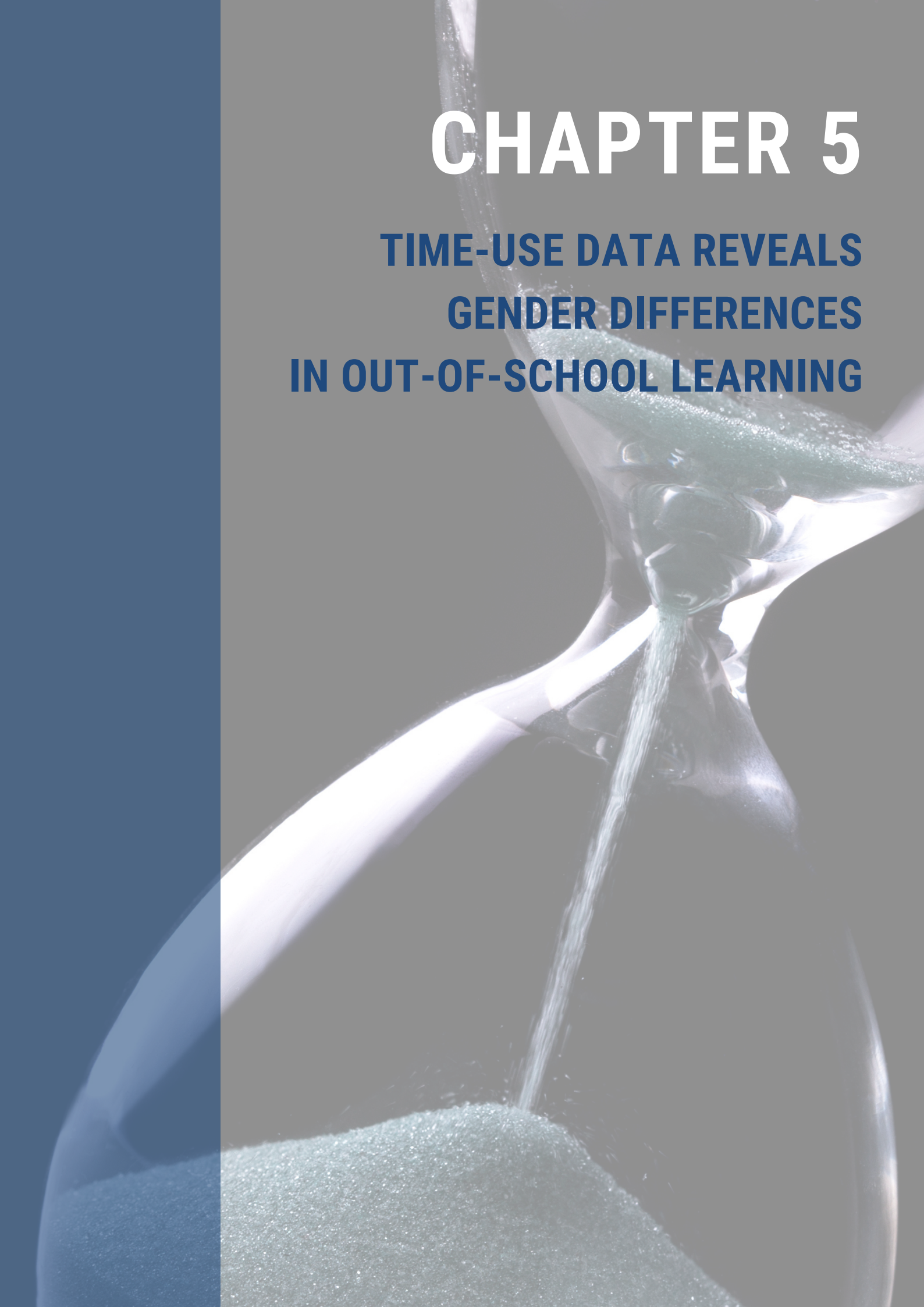
CHAPTER 5

TIME-USE DATA REVEALS GENDER DIFFERENCES IN OUT-OF-SCHOOL LEARNING



CHAPTER 5: TIME-USE DATA REVEALS GENDER DIFFERENCES IN OUT-OF-SCHOOL LEARNING

This chapter is an edited version of material provided by Seth Gershenson and Stephen B. Holt to the ESCAP Statistics Division in 2018.

Chapter overview: This chapter provides a general framework for using time-use data to investigate sociodemographic gaps in time spent outside school on educationally productive activities. This framework is presented through an analysis of gender dynamics in secondary school students' out-of-school study time in the USA. The chapter draws on the 2003-2016 waves of the American Time-use Survey (ATUS).

The chapter provides an understanding of how to organize rich time-diary data for analysis, tests for differences between groups of people in time spent on policy-relevant activities, and graphically presents information on who was present during specific activities.

Stata is used to perform the empirical analysis in this chapter. Stata do-files and R Markdown files are also available as separate attachments on the webpage for download and use. Multivariate regression analysis is also demonstrated in the chapter.

5.1. Chapter focus

Human capital is an important determinant of economic growth, health, and upward social mobility in developing and transitioning countries (Glewwe and Kremer 2006; Hanushek 2013). Accordingly, many countries (along with development goals and aid programmes) have focused on improving school quality and increasing access to schooling in the developing and transitioning world (Glewwe and Kramer 2006; Orazem and King 2007). While educational attainment in the developing and transitioning world has increased over the past 50 years, substantial within-country sociodemographic gaps remain (Barro and Lee 2013, Filmer and Pritchett 1999, Orazem and King 2007). For example, in many developing countries, men continue to complete more years of schooling than women (Barro and Lee 2013).

Detailed time-diary data, such as those contained in the American Time-use Survey (ATUS), allow researchers to investigate socially important gaps in time spent developing academic skills through engaging in activities such as studying outside of the traditional school day.

This chapter replicates the analysis in Gershenson and Holt (2015) of gender gaps in time spent on homework using more recent data and extends the analysis by testing for gender gaps in the quality of homework time. Specifically, the analysis treats the presence of other persons during the homework spell as a measure of the type or quality of the homework spell. Importantly for the methodological and pedagogical goals of this chapter, the examples provided here demonstrate the potential of time-use data such as the American Time-use Survey (ATUS) to rigorously analyse both the quantity and the quality of the time spent in a given activity. The approach presented can also be followed to document demographic gaps in the quantity and quality of time spent in a given activity.

5.2 Relevance

5.2.1 Linkages to the Sustainable Development Goals (SDGs)

In developed countries, gender gaps in educational attainment (the difference between men and women in the total years of education completed) have closed and even reversed in recent years (Bailey and Dynarski 2011; Bound and Turner 2011).[64] Although gender gaps have begun to close in some parts of the developing world as well, they remain stark in many South Asian and African countries (Barro and Lee 2013). Trends in the gender gap in educational attainment have received attention from policymakers, educators, scholars, and pundits. However, the underlying causes of these trends, and why these trends vary across countries, remain unclear (Bound and Turner 2011).

Answering these questions is critical to achieving SDG 4 (Quality Education) and SDG 5 (Gender Equality), as understanding gender gaps in educational success is crucial to devising policies to close them (Fryer and Levitt 2004).

5.2.2 Domestic policy implications

When assessing the impact of an educational input, the quality of a jurisdiction's educational system, or the educational performance of a population, it is important to accurately measure intermediate outcomes. As well as being affected by educational inputs, these are important determinants of long-run outcomes such as attendance, study skills, and non-cognitive skills (Gershenson 2016).

The step-by-step example highlights several insights that may benefit the research of policymakers and governments, including out-of-school learning behaviours. For example, patterns revealed in the timing and sequencing of students' study time can inform decision-making on school start and end times. School officials might set aside time after school for quiet studying and use thoughtful nudges to encourage participation. Schools might consider using text messaging to remind boys to study. Time-use survey data could improve the efficacy of the system and target reminders more precisely, by identifying times during the day when boys are most likely to be idle. Time-use analysis could also be used to identify potential patterns of drug use, childcare needs, and a variety of other activities to improve related public services and social outcomes.

5.2.3 Gender implications

Gender differences in human capital investments made outside of the traditional school day offer one possible explanation of the underlying causes which drive the above-mentioned trends and the variation observed between countries. If males and females form and respond to habits relating to education differently, such differences are likely to contribute to gender gaps in educational attainment.

In the U.S. context, Gershenson and Holt (2015) document robust, statistically significant one-hour weekly gender gaps in secondary school students' non-school study time by using time-diary data from the 2003-2014 waves of the ATUS. The time-use data analysis provided in that study is

65 Educational attainment refers to the highest level of education an individual completes (e.g. graduating from secondary school or completing a four-year degree at a university). As Bailey and Dynarski (2011) document, women complete more years of education than men in the United States, reversing historical trends.

replicated step-by-step below as a running example, using the most recent waves of the ATUS. These gender gaps, which affect females disproportionately, are not explained by gender differences in after-school time-use, parental involvement, educational expectations, course-taking, past academic achievement, or cognitive ability. The results suggest that gender differences in out-of-school behaviours and work ethics partially explain gender gaps in educational attainment. Similar analyses could easily, and fruitfully, be conducted in other contexts using other time-use data. This chapter lays the groundwork for doing so.

5.3 Analytical logic

The replication of Gershenson and Holt (2015) conducted here provides a clear, step-by-step example of using the ATUS to examine demographic differences in the aggregate time spent on a socially important, policy-relevant activity. Moreover, it shows that the main results documented in Gershenson and Holt (2015) carry over to the 2015 and 2016 waves of the ATUS.

However, the previous study did not test for differences by gender in the *quality* of time spent studying. For instance, multitasking and other distractions harm student performance (Junco and Cotten 2012; Sana et al. 2013; Bellur et al. 2015). The presence of other people, particularly siblings or friends, while studying may provide similar distractions and decrease the quality of study time (Vinopal and Gershenson 2017). Similarly, the time of day that schooling begins can impact student performance and retention of information (Cortes et al. 2012; Edwards 2012; Carrell et al. 2011; Jacob and Rockoff 2011). The ATUS allows analysts to test for potential gender differences in the quality of time spent studying by using information about the timing of students' study periods, the number of study episodes per day, the presence of other people while studying, and the location of students' study time.

5.4 Step-by-step example

5.4.1 Background: ATUS

The ATUS is nationally representative and has been administered annually by the U.S. Bureau of Labour Statistics (BLS) since 2003.[65] The 2003-2016 waves of the ATUS collect a 24-hour retrospective time diary from one individual over the age of 15 per household from a subset of the Current Population Survey (CPS) sampling frame and links each diary to sociodemographic household data from the CPS.[66] In addition, the ATUS collects a full household roster from the respondent, including the relationship of each household member to the respondent, to examine who is with the respondent during different activities. Since the ATUS can be linked to the larger CPS, the ATUS provides a means to examine time-use patterns across a variety of population characteristics, such as the activities of individuals with different employment statuses (unemployed versus employed) and professions, which can provide useful information for policy-makers.

66 The dataset used in this chapter can be publicly and freely accessed from https://www.bls.gov/tus/ (accessed on 05 April 2021). While the BLS website has been updated for 2017 ATUS data, for the purposes of this chapter only 2003-2016 waves of the ATUS are used.

67 See Hamermesh et al. (2005) for further discussion of the ATUS and its possible uses.

The ATUS provides multi-year files as well as single-year datasets, which can be appended to existing multi-year files as they are released. Unless interest is in a specific year, researchers should work with the multi-year file. In addition to the actual data, the BLS provides two important, clear pieces of documentation that analysts should download. These are:

1. The multi-year ATUS Coding Lexicon, which is a clean, searchable pdf document that articulates the ATUS activity codes central to any time-use analysis.[67] Activity codes are six digits that code activities at three levels:

i. The first two digits identify 18 unique "major categories" such as household activities and eating and drinking.

ii. The second two digits refine the major categories into subcategories. For example, household activities are broken down into subcategories such as housework, interior maintenance, food preparation, and so on.

iii. The final two digits code fairly specific activities. For example, housework is broken down into cleaning, laundry, sewing, and so on. Six-digit codes ending in 99 are a catchall (not elsewhere classified) category.

This coding scheme provides flexibility, as researchers can use the broad "major category" two-digit codes or the specific six-digit codes, depending on the question of interest.

2. Two **data dictionaries** which thoroughly document the respondent, diary day, and household member information available in the ATUS: (i) the interview data dictionary which describes the items used in ATUS-specific surveys; and (ii) the CPS data dictionary which details the CPS-related variables that can be linked to ATUS respondents.

Within this framework are several data files. Each serves a specific purpose and is described below as a necessary element of the analysis. Merging these files and knowing where to look for a specific piece of information are two of the more challenging aspects for first-time ATUS users. The separate data files are as follows:

- *Respondent:* Basic sociodemographic information about the diary respondent
- *Roster:* Sociodemographic information about other members of the respondent's household and the non-household children of the respondent
- *Activity:* Main time-use data for the respondent's diary day: type, start and end time, and location of each activity
- *Activity Summary:* Simpler version of time-use data that simply reports the total time spent by respondent in each type of activity on the diary day
- *Who:* Identifies who was present during each episode in the Activity File
- *ATUS-CPS:* CPS data on all household members
- *Eldercare Roster (new in 2011):* Information about people for whom the respondent provided care

68 For more information regarding the most updated ATUS Coding Lexicon, please see the pdf link provided here: https://www.bls.gov/tus/lexiconnoex0319.pdf (accessed 05 April 2021).

- *Replicate Weights:* ATUS sampling weights[68]

5.4.2 Data file description and definitions

The following steps use the respondent, roster, activity, who, and CPS files. The files are merged to one another using the unique case identifier 'tucaseid.' The contents of each are elaborated below:

Respondent file. The ATUS respondent file contains demographic, employment, and socioeconomic data on the ATUS respondent. The dataset also provides information about the diary day, month, and year when the respondent completed their time-use diary. The data are structured in a wide format with one line (data entry) per case, and allow us to code some basic information about the respondent. The respondent file provides some topline time-use aggregations, such as total time spent providing childcare, total time spent with different types of people in a day, and other categories of commonly examined activities. The aggregated data can be useful for more general analyses, or to practice working with time-use data in one self-contained dataset. The unique respondent identifier here is tucaseid.

Roster file. The roster file contains a roster of every person living in the respondent's household and their age, gender, and relationship to the respondent (e.g. parent, sibling, roommate, etc.). The roster file is structured in the long format containing a panel of household members for each case, where household members are uniquely identified by tulineno, which, together with the case identifier tucaseid, allows analysts to link the roster information to the who file.

Activity file. The activity file is the centerpiece of the ATUS and contains a rich panel of data, in long form, of every activity each case participated in over the 24-hour period of their diary day. Data are at the case-activity level and provide information on the start and end times of each activity, measures of cumulative and activity-specific time spent during the activity (in minutes), an activity category code, information on where the activity took place, and links for identifying who was present for each activity. Note that the data structured here is a panel while the information needed is at the individual person level. Converting information on the activities for this chapter into a useable format is a nontrivial task (described below).

Who file. The who file is a panel that mirrors the structure of the activity file and provides links to the roster file. It identifies which, if any, household members were present for each activity in the activity file. This allows analysts to examine time spent in different activities with specific people within households, such as parents and their young children or time shared between teenage siblings. The who file also provides a more general code for each activity that captures both the basic relationship to the respondent of each person present and categories for non-household members such as friends or coworkers that would not be captured in the who file. The case identifier and activity number (tuactivity_n), together, allow analysts to link who was present for an activity to each activity. Importantly, some activities will have multiple people present, and analysts will have to reshape parts of the data before merging the who file with the activity file.

---

69 It is generally good practice to use ATUS provided weights (tufnwgtp), which correct for the unequal probability of being included in the sample, the uneven distribution of diary days and months, and survey non-response.

CPS file. Finally, the CPS file contains the household-level socioeconomic, education, and demographic information necessary to create control variables and identify the high school students who constitute the analytic sample of interest. Like the roster file, the CPS file is a panel dataset with a line for each member of the respondent's household.

Respondent and case. The term "respondent" refers to the individual person sampled for the ATUS while "case" refers to the linked data collected about the respondent (e.g. household members, time diaries, etc.), which often include multiple observations per respondent.

5.4.3 Empirical analysis

The objective of the following steps is to update prior research regarding gender gaps in high school students' time spent studying, an important skill for future academic success, and examine differences between boys and girls in their study time *environments*.

The exercise begins with downloading and cleaning the ATUS datafiles in order to create a sample of high school students aged 15 to 19. This analytic sample can then be used to replicate the Gershenson and Holt (2015) analysis of gender gaps in study time. The exercise concludes with an examination of the distribution of boys and girls who study with other people present.

STEP 1: Data processing and control variable coding.

(i) Download the raw data. The data files come in a compressed .zip file that contains a comma-separated values (CSV) file and code files for generating a Stata, SAS, or SPSS dataset from the CSV file.[69] This chapter uses and presents Stata code.[70] After extracting the files, open the Stata do-file, copy the pathway to the folder where the CSV dataset has been saved, and run the do-file to create a Stata dataset for each data file. [ESCAP observation: Since the dataset on the BLS website has been updated since the time the original code for this chapter was written, please note users will need to change the raw data file name in the Stata code before importing the microdata and running the do-file (for example, change "rost0316.dta" to "rost0317.dta"].

(ii) Create the variables needed for the analysis from each dataset and then merge the datasets into one master dataset that will be used to construct the final analytic sample (high-school students 19 years old or younger). Start with the roster and CPS files to collect some basic information about respondents' household structures and proxies for socioeconomic status (SES). Stata has some built-in commands that will convert these variables from individual-level to case-level.

First, identify the respondent's family size and other siblings. Since the primary interest is in examining the gender gap in time spent studying, childcare responsibilities that may come with the presence of young children or many siblings might influence students' study habits differently across genders. Accordingly, open the roster file:

70 The .csv file could also be opened and analysed using Excel or another spreadsheet programme.

71 Stata codes are as provided by the primary contributor of the chapter material and have been issued with limited validation.

```
**Section 1. Start with HH characteristics from rosterfile and CPS.
**Section 1.1. First, HH characteristics, such as the number of children and
presence of young children to be used as controls later.

clear all
log using "C:\\datacode.log"[71], replace
set more off

use "c:\rost0316.dta"[72]
```

Then, make sure the data is sorted properly:

```
sort tucaseid tulineno
```

Finally, to count household size, the number of children in each household, and age of the youngest child in the household, use Stata's egen command, which applies the values of these variables to the whole case rather than the household member-specific line. Consequently, the last line of code below keeps one observation per case to create a set of individual-level roster summary variables for each respondent in the sample.

```
save "C:\\rost0316.dta", replace
egen hhsize = count(_n), by(tucaseid)
egen hhchild1 = count(_n) if teage <= 17, by(tucaseid)
egen hhchild = max(hhchild1), by(tucaseid)
egen ygchage = min(teage), by(tucaseid)
replace ygchage = 0 if ygchage < 0
gen yngchild = 0
replace yngchild = 1 if ygchage <= 2
gen spouse1 = 0
replace spouse1 = 1 if terrp == 20
egen spouse = max(spouse1), by(tucaseid)
gen partner1 = 0
replace partner1 = 1 if terrp == 21
egen partner = max(partner1), by(tucaseid)
by tucaseid: drop if _n > 1
replace hhchild = 0 if hhchild == .
save "C:\\hhvars.dta", replace
```

Next, use a combination of the roster and CPS files to identify respondents' parents and create variables that capture parents' educational attainment and employment status. In the U.S., educational attainment is highly correlated with other socioeconomic indicators, such as income, wealth, occupational prestige, and other important resources. Consequently, when studying

72 ESCAP observation: Users should change file path and folder to where the data is saved. This action will need to be repeated for the remainder of the code, such as when importing/saving data and running log files.

73 ESCAP observation: Because the microdata is not in .dta format when downloaded from the BLS website, the data needs to be imported first and then saved as a .dta file before use. Furthermore, since the microdata has been updated to include the 2017 survey year, users may need to change the filenames in the code to reflect the filenames of the current/updated BLS dataset (for example, change "rost0316.dta" to "rost0317.dta"), though the chapter analyses data from 2003-2016 only. The following code below can be used to save the data as a .dta file and change the filename. This action will need to be repeated for the remainder of the code whenever importing the original microdata. Change the file path and rename the file to rost0317. Example below:

```
import delimited "C:\\atusrost_0317.dat"
save "C:\\rost0317.dta", replace
```

education-related behaviors, parental education is a useful proxy for SES. First, merge the roster and CPS data files together:

```
**Section 1.2. Second, we sort the rosterfile, merge it with the cps file, and
code the hh characteristics into variables usable in analysis. This captures:
parents' education, parents' age, and parents' employment status.
clear all
set more off
use "c:\cps0316"
sort tucaseid tulineno
save "c:\cps0316", replace
merge 1:1 tucaseid tulineno using "c:\rost0316.dta"
drop _merge
save "c:\rostcps.dta", replace
```

Then, use the combined dataset to identify which line contains the respondents' parents and use that flag to apply the parents' information to the respondent. Again, conclude by keeping only one observation per case.

```
sort tucaseid tulineno
gen resp = 0
replace resp = 1 if tulineno == 1
gen dad1 = 0
replace dad1 = 1 if terrp ==24 & tesex ==1
egen dad2 = max(dad1), by(tucaseid)
gen mom1 = 0
replace mom1 = 1 if terrp ==24 & tesex ==2
egen mom2 = max(mom1), by(tucaseid)
gen dage1 = 0
replace dage1 = teage if dad1==1
gen mage1 = 0
replace mage1 = teage if mom1==1
egen dage = max(dage1), by(tucaseid)
egen mage = max(mage1), by(tucaseid)
gen deduc1 = 0
replace deduc1 = peeduca if dad1==1
gen meduc1 = 0
replace meduc1 = peeduca if mom1==1
egen deduc = max(deduc1), by(tucaseid)
egen meduc = max(meduc1), by(tucaseid)
gen employd1 =0
replace employd1 = 1 if prempnot ==1 & dad1 ==1
gen employm1 =0
replace employm1= 1 if prempnot ==1 & mom1 ==1
egen employd = max(employd1), by(tucaseid)
egen employm = max(employm1), by(tucaseid)
sort tucaseid
by tucaseid: drop if _n > 1
save "c:\rostcps2.dta", replace
merge 1:1 tucaseid using "C:\\hhvars.dta"
drop _merge
save "C:\\rostcps2.dta", replace
```

Finally, merge the household variables previously created into the dataset and merge in the respondent file to create demographic, income, employment status, and diary day and month controls.

```
**Section 1.3. Merges in the respondent file and codes variables for respondent
characteristics, family characteristics, SES, and time diary day/month/year
variables.
clear all
set more off
use "C:\\rostcps2.dta"
```

```
merge 1:1 tucaseid using "C:\\resp0316.dta"
drop _merge
saveold "C:\\rostcpsresp.dta", replace
gen married = 0
replace married = 1 if pemaritl ==1 | pemaritl==2
gen metro = 0
replace metro = 1 if gtmetsta ==1 | gemetsta ==1
gen loinc = 0
replace loinc = 1 if (hufaminc <= 6 & hryear4 <= 2009) | (hefaminc <= 6 & hryear4
>= 2010)
gen inc2040 = 0
replace inc2040 = 1 if (hufaminc >=7 & hufaminc <=10 & hryear4 <= 2009) |
(hefaminc >=7 & hefaminc <= 10 & hryear4 >= 2010)
gen inc4060 = 0
replace inc4060 = 1 if (hufaminc >= 11 & hufaminc <= 12 & hryear4 <=2009) |
(hefaminc >= 11 & hefaminc <= 12 & hryear >=2010)
gen inc6075 = 0
replace inc6075 = 1 if (hufaminc == 13 & hryear4 <= 2009) | (hefaminc == 13 &
hryear4 >= 2010)
gen inc75100 = 0
replace inc75100 = 1 if (hufaminc == 14 & hryear4 <= 2009) | (hefaminc == 14 &
hryear4 >= 2010)
gen inc100150 = 0
replace inc100150 = 1 if (hufaminc == 15 & hryear4 <= 2009) | (hefaminc == 15 &
hryear4 >= 2010)
gen inc150p = 0
replace inc150p = 1 if (hufaminc == 16 & hryear4 <= 2009) | (hefaminc == 16 &
hryear4 >= 2010)
gen missing_dad = 0
replace missing_dad = 1 if mom2 == 1 & dad2 == 0
gen dnohsdip = 0
replace dnohsdip = 1 if deduc <= 38
replace dnohsdip = 0 if missing_dad == 1
gen dhsdip = 0
replace dhsdip = 1 if deduc == 39
replace dhsdip = 0 if missing_dad == 1
gen dsomcol = 0
replace dsomcol = 1 if deduc >= 40 & deduc <= 42
replace dsomcol = 0 if missing_dad == 1
gen dcoldeg = 0
replace dcoldeg = 1 if deduc >= 43
replace dcoldeg = 0 if missing_dad == 1
gen missing_mom = 0
replace missing_mom = 1 if mom2 == 0 & dad2 == 1
gen mnohsdip = 0
replace mnohsdip = 1 if meduc <= 38
replace mnohsdip = 0 if missing_mom == 1
gen mhsdip = 0
replace mhsdip = 1 if meduc == 39
replace mhsdip = 0 if missing_mom == 1
gen msomcol = 0
replace msomcol = 1 if meduc >= 40 & meduc <= 42
replace msomcol = 0 if missing_mom == 1
gen mcoldeg = 0
replace mcoldeg = 1 if meduc >= 43
replace mcoldeg = 0 if missing_mom == 1
gen eithrcol = 0
replace eithrcol = 1 if mcoldeg == 1 | dcoldeg == 1
gen bothcol = 0
replace bothcol = 1 if mcoldeg == 1 & dcoldeg == 1
gen single_parent = 0
replace single_parent = 1 if (missing_mom == 1 | missing_dad == 1)
gen married_parent = 0
replace married_parent = 1 if single_parent == 0
sum eithrcol bothcol
gen white = 0
replace white = 1 if ptdtrace ==1
gen black = 0
replace black = 1 if ptdtrace ==2
gen native = 0
```

```
replace native = 1 if ptdtrace==3
gen asian = 0
replace asian = 1 if ptdtrace ==4
gen pacisl = 0
replace pacisl = 1 if ptdtrace ==5
gen multi = 0
replace multi = 1 if ptdtrace >=6
gen male = 0
replace male = 1 if tesex ==1
gen otherrc = 0
replace otherrc = 1 if pacisl == 1 | multi == 1
gen hisp = 0
replace hisp = 1 if pehspnon ==1
gen wkend = 0
replace wkend = 1 if tudiaryday ==1 | tudiaryday ==7
gen tuthurs = 0
replace tuthurs = 1 if tudiaryday >= 3 & tudiaryday <= 5
gen sun = 0
replace sun = 1 if tudiaryday == 1
gen mon = 0
replace mon = 1 if tudiaryday == 2
gen tue = 0
replace tue = 1 if tudiaryday == 3
gen wed = 0
replace wed = 1 if tudiaryday == 4
gen thr = 0
replace thr = 1 if tudiaryday == 5
gen fri = 0
replace fri = 1 if tudiaryday == 6
gen sat = 0
replace sat = 1 if tudiaryday == 7
gen yr2003 = 0
replace yr2003 = 1 if tuyear == 2003
gen yr2004 = 0
replace yr2004 = 1 if tuyear == 2004
gen yr2005 = 0
replace yr2005 = 1 if tuyear == 2005
gen yr2006 = 0
replace yr2006 = 1 if tuyear == 2006
gen yr2007 = 0
replace yr2007 = 1 if tuyear == 2007
gen yr2008 = 0
replace yr2008 = 1 if tuyear == 2008
gen yr2009 = 0
replace yr2009 = 1 if tuyear == 2009
gen yr2010 = 0
replace yr2010 = 1 if tuyear == 2010
gen yr2011 = 0
replace yr2011 = 1 if tuyear == 2011
gen yr2012 = 0
replace yr2012 = 1 if tuyear == 2012
gen yr2013 = 0
replace yr2013 = 1 if tuyear == 2013
gen yr2014 = 0
replace yr2014 = 1 if tuyear == 2014
gen yr2015 = 0
replace yr2015 = 1 if tuyear == 2015
gen yr2016 = 0
replace yr2016 = 1 if tuyear == 2016
gen jan = 0
replace jan = 1 if tumonth == 1
gen feb = 0
replace feb = 1 if tumonth == 2
gen mar = 0
replace mar = 1 if tumonth == 3
gen apr = 0
replace apr = 1 if tumonth == 4
gen may = 0
replace may = 1 if tumonth == 5
gen jun = 0
replace jun = 1 if tumonth == 6
```

```
gen jul = 0
replace jul = 1 if tumonth == 7
gen aug = 0
replace aug = 1 if tumonth == 8
gen sep = 0
replace sep = 1 if tumonth == 9
gen oct = 0
replace oct = 1 if tumonth == 10
gen nov = 0
replace nov = 1 if tumonth == 11
gen dec = 0
replace dec = 1 if tumonth == 12
gen summer = 0
replace summer = 1 if (jun == 1 | jul == 1 | aug == 1)
gen employed_student = 0
replace employed_student = 1 if prempnot == 1
gen hs_enroll = 0
replace hs_enroll = 1 if (teschenr == 1 & teschlvl == 1)
gen college_enroll = 0
replace college_enroll = 1 if (teschenr == 1 & teschlvl == 2)
saveold "C:\\rostcpsresp.dta", replace
log close
```

After the merge, code all of the control variables, so they are ready for the analysis. Using the resulting individual-level dataset to code controls is straightforward (see below). Now a dataset has been created with all of the necessary non-time-use variables coded at the individual-level.

STEP 2: Dependent variable creation and sample identification

Now begins the more complicated task of coding the dependent variable of interest, time spent on homework or school-related research. This is followed by a summary of how to code time spent on other activities and who was present during study time. The activity file in Stata contains more than 3.5 million observations. To streamline things, keep only homework activities using the four-digit activity code (trtier2p):

```
clear all
set more off
log using "c:\\timecode.log", replace
use "c:\\act0316.dta"
sort tucaseid
**This isolates only study time activities
keep if trtier2p == 0603
```

Left with a sample of homework activities, sorted by the case identifier, code a variety of homework-related variables. First, use the activity duration provided in the ATUS and a process similar to the previous aggregation of household characteristics to summarize the total time spent on homework by each respondent.

```
**This creates the study time throughout the day for each case, used in
Gershenson and Holt (2015) paper
egen hw_tots = sum(tuactdur24) if trtier2p == 0603, by(tucaseid)
egen hw_tot = max(hw_tots), by(tucaseid)
sum hw_tot
by tucaseid: drop if _n > 1
saveold "C:\\hwtimevars.dta", replace
log close

**This merges with rest of case information
merge 1:1 tucaseid using "C:\\rostcpsresp.dta"
drop _merge
```

```
saveold "C:\\studytimeandx.dta", replace

**Section 1.4.1. This codes other activities time

clear all
set more off
log using "C:\\timecode_nonhw.log", replace
use "C:\\act0316.dta"
sort tucaseid
egen sprttime1 = sum(tuactdur24) if trtier2p == 1301, by(tucaseid)
egen wrktime1 = sum(tuactdur24) if trtier2p == 0501, by(tucaseid)
egen household_tots = sum(tuactdur24) if trtier1p == 02, by(tucaseid)
egen care_tots = sum(tuactdur24) if trtier2p == 0301, by(tucaseid)
egen xtracur_tots = sum(tuactdur24) if trtier2p == 0602, by(tucaseid)
egen sprttime = max(sprttime1), by(tucaseid)
egen wrktime = max(wrktime1), by(tucaseid)
egen household_tot = max(household_tots), by(tucaseid)
egen care_tot = max(care_tots), by(tucaseid)
egen xtracur_tot = max(xtracur_tots), by(tucaseid)
sum sprttime wrktime household_tot care_tot xtracur_tot
by tucaseid: drop if _n > 1
saveold "C:\\nonhwtimevars.dta", replace
log close

merge 1:1 tucaseid using "C:\\studytimeandx.dta"
drop _merge
saveold "C:\\analyticsample.dta", replace
```

Once again, merge the homework and non-homework time data into the analytic sample.

As noted in the introduction, the key point of interest in this example is the quality of students' study time. In particular, are boys and girls exposed to different distractions during study time, such as the presence of friends or family? Address this question by using the Who file to construct variables that indicate the type of other person (e.g. friends, parents, siblings, etc.) present while the student was studying. Begin by merging the Who and Activity files, again keeping only the study time activities. Note that after the merge, the analyst must create a new identifier, caseact, which combines the case identifier and the activity identifier. The Who file reports each individual present for each activity as an observation. As a result, to get the data to the individual student-level, the analyst must identify the case and activity of interest.

```
**Section 1.4.2. This codes the who file to the act file and merges the who
variables onto the analyticsample

clear all
set more off
use "C:\\who0316.dta"
egen caseact = group(tucaseid tuactivity_n)
merge m:1 tucaseid tuactivity_n using "C:\\act0316.dta"
drop _merge
keep if trtier2p == 0603
sort tucaseid
```

Since many students study several times throughout the day, the analyst must identify each student's longest study period to capture differences in the presence of others during the longest study spell while still maintaining individual-level data for analysis. To do this, instead of summing the spells of studying in the 24-hour period, tell Stata to apply the maximum value of the spells. Then, identify the longest study period using this variable and restrict the file to only the longest study periods for each student.

```
egen longest_study = max(tuactdur24), by(tucaseid)
```

```
gen longflag = 0
replace longflag = 1 if (tuactdur24 == longest_study)
by tucaseid: keep if longflag == 1
```

After identifying the sample of the longest study periods comes the trickiest part of working with the Who file. The ATUS provides a Who code (tuwho_code) for each person present during an activity. The Who code is a categorical variable that tells analysts the type of person present, containing a broad range of categories. First, examine the maximum number of people present during a student's longest study period for coding purposes.

```
sort caseact
by caseact: gen whonum1 = _n
order whonum1, after(caseact)
tab whonum1
```

Notice that the maximum number in the sample is 8. Now create 8 variables, one for each potential person present, run a loop to apply each code to the full case, and reduce the sample to the individual-level once again.

```
by caseact: gen tuwho_code_1s = tuwho_code if whonum == 1
by caseact: gen tuwho_code_2s = tuwho_code if whonum == 2
by caseact: gen tuwho_code_3s = tuwho_code if whonum == 3
by caseact: gen tuwho_code_4s = tuwho_code if whonum == 4
by caseact: gen tuwho_code_5s = tuwho_code if whonum == 5
by caseact: gen tuwho_code_6s = tuwho_code if whonum == 6
by caseact: gen tuwho_code_7s = tuwho_code if whonum == 7
by caseact: gen tuwho_code_8s = tuwho_code if whonum == 8
foreach x of varlist tuwho_code_1s tuwho_code_2s tuwho_code_3s tuwho_code_4s
tuwho_code_5s tuwho_code_6s tuwho_code_7s tuwho_code_8s{
       egen `x'1 = max(`x'), by(caseact)
       drop `x'
}
egen whonum = max(whonum1), by(caseact)
by caseact: drop if _n > 1
saveold "C:\\whoact0316.dta", replace
rename tuwho_code_1s1 whocode1
rename tuwho_code_2s1 whocode2
rename tuwho_code_3s1 whocode3
rename tuwho_code_4s1 whocode4
rename tuwho_code_5s1 whocode5
rename tuwho_code_6s1 whocode6
rename tuwho_code_7s1 whocode7
rename tuwho_code_8s1 whocode8
sort tucaseid
keep tucaseid whocode1 whocode2 whocode3 whocode4 whocode5 whocode6 whocode7
whocode8 whonum tuwho_code tewhere tuactdur24 tuactdur tustarttim tustoptime
saveold "C:\\whoact0316.dta", replace
```

Finally, use these cleaned, individual-level Who codes to create categorical and binary variables that capture everyone who was present during each student's longest study period. Start by creating flags for each type of person present.

```
**Section 1.4.3. To code who was present, start by creating dummy flags for
categories of people who were present.
gen alone = 0
replace alone = 1 if (whocode1 == 18 | whocode1 == 19)
gen siblings_present = 0
replace siblings_present = 1 if (whocode1 == 25 | whocode2 == 25 | whocode3 == 25
| whocode4 == 25 | whocode5 == 25 | whocode6 == 25 | whocode7 == 25 | whocode8 ==
25)
```

```
gen parents_present = 0
replace parents_present = 1 if (whocode1 == 24 | whocode2 == 24 | whocode3 == 24
| whocode4 == 24 | whocode5 == 24 | whocode6 == 24 | whocode7 == 24 | whocode8 ==
24)
gen other_HH_present = 0
replace other_HH_present = 1 if (whocode1 >= 20 & whocode1 <=23) | (whocode1 >=
26 & whocode1 <= 30) | (whocode2 >= 20 & whocode2 <=23) | (whocode2 >= 26 &
whocode2 <= 30) | (whocode3 >= 20 & whocode3 <=23) | (whocode3 >= 26 & whocode3
<= 30) | (whocode4 >= 20 & whocode4 <=23) | (whocode4 >= 26 & whocode4 <= 30) |
(whocode5 >= 20 & whocode5 <=23) | (whocode5 >= 26 & whocode5 <= 30) | (whocode6
>= 20 & whocode6 <=23) | (whocode6 >= 26 & whocode6 <= 30) | (whocode7 >= 20 &
whocode7 <=23) | (whocode7 >= 26 & whocode7 <= 30) | (whocode8 >= 20 & whocode8
<=23) | (whocode8 >= 26 & whocode8 <= 30)
gen friends_present = 0
replace friends_present = 1 if (whocode1 == 54 | whocode2 == 54 | whocode3 == 54
| whocode4 == 54 | whocode5 == 54 | whocode6 == 54 | whocode7 == 54 | whocode8 ==
54)
gen other_nonHHfamily_present = 0
replace other_nonHHfamily_present = 1 if (whocode1 >= 51 & whocode1 <= 53) |
(whocode2 >= 51 & whocode2 <= 53) | (whocode3 >= 51 & whocode3 <= 53) | (whocode4
>= 51 & whocode4 <= 53) | (whocode5 >= 51 & whocode5 <= 53) | (whocode6 >= 51 &
whocode6 <= 53) | (whocode7 >= 51 & whocode7 <= 53) | (whocode8 >= 51 & whocode8
<= 53)
gen other_people_present = 0
replace other_people_present = 1 if (whocode1 > 54 & whocode1 != . | whocode2 >
54 & whocode2 != . | whocode3 > 54 & whocode3 != . | whocode4 > 54 & whocode4 !=
. | whocode5 > 54 & whocode5 != . | whocode6 > 54 & whocode6 != . | whocode7 > 54
& whocode7 != . | whocode8 > 54 & whocode8 != .)
```

Next, use these flags to create a categorical variable that captures who was present.

```
gen cat_whopresent = 1 if alone == 1
replace cat_whopresent = 2 if (parents_present == 1 & siblings_present == 0 &
friends_present == 0 & other_HH_present == 0 & other_nonHHfamily_present == 0 &
other_people_present == 0)
replace cat_whopresent = 3 if (parents_present == 0 & siblings_present == 1 &
friends_present == 0 & other_HH_present == 0 & other_nonHHfamily_present == 0 &
other_people_present == 0)
replace cat_whopresent = 4 if (parents_present == 0 & siblings_present == 0 &
friends_present == 1 & other_HH_present == 0 & other_nonHHfamily_present == 0 &
other_people_present == 0)
replace cat_whopresent = 5 if (parents_present == 0 & siblings_present == 0 &
friends_present == 0 & other_HH_present == 1 & other_nonHHfamily_present == 0 &
other_people_present == 0)
replace cat_whopresent = 6 if (parents_present == 0 & siblings_present == 0 &
friends_present == 0 & other_HH_present == 0 & other_nonHHfamily_present == 1 &
other_people_present == 0)
replace cat_whopresent = 7 if (parents_present == 0 & siblings_present == 0 &
friends_present == 0 & other_HH_present == 0 & other_nonHHfamily_present == 0 &
other_people_present == 1)
replace cat_whopresent = 8 if cat_whopresent == .
replace cat_whopresent = . if tuwho_code < 0
label define whopresent 1 "Alone" 2 "Parents" 3 "Siblings" 4 "Friends" 5 "Other HH"
6 "Non-HH family" 7 "Other people" 8 "Mixed"
label values cat_whopresent whopresent
```

Conclude this process by merging the Who variable with the analytic sample data file.

```
saveold "C:\\whoact0316.dta", replace
keep tucaseid cat_whopresent
sort tucaseid
by tucaseid: drop if _n > 1
saveold "C:\\whovars0316.dta", replace
merge 1:1 tucaseid using "C:\\analyticsample.dta"
drop _merge

**This merges these last controls into the primary datafile
saveold "C:\\masterdata.dta", replace
```

```
**This labels the variables for easily interpretable graphs and tables.
label define weekend 0 "Weekday" 1 "Weekend" , replace
label values wkend weekend
label define summer_season 0 "School Year" 1 "Summer" , replace
label values summer summer_season
label var married "R is married"
label var metro "Urban area"
label var loinc "HH income $20K or less"
label var inc2040 "HH income $20K to $40K"
label var inc4060 "HH income $40K to $60K"
label var inc6075 "HH income $60K to $75K"
label var inc75100 "HH income $75K to $100K"
label var inc100150 "HH income $100K to $150K"
label var inc150p "HH income $150K or more"
label var dnohsdip "Father less than HS diploma"
label var dhsdip "Father HS diploma"
label var dsomcol "Father has some college"
label var dcoldeg "Father has college degree"
label var mnohsdip "Mother less than HS diploma"
label var mhsdip "Mother HS diploma"
label var msomcol "Mother has some college"
label var mcoldeg "Mother has college degree"
label var white "White"
label var black "Black"
label var native "Native American"
label var asian "Asian"
label var pacisl "Pacific Islander/Hawaiian"
label var multi "Multiple races"
label var male "Male"
label var otherrc "Other race"
label var hisp "Latino(a)"
label var wkend "Weekend"
label var tuthur "Tuesday through Thursday"
label var sun "Sunday"
label var mon "Monday"
label var tue "Tuesday"
label var wed "Wednesday"
label var thr "Thursday"
label var fri "Friday"
label var sat "Saturday"
label var jan "January"
label var feb "February"
label var mar "March"
label var apr "April"
label var may "May"
label var jun "June"
label var jul "July"
label var aug "August"
label var sep "September"
label var oct "October"
label var nov "November"
label var dec "December"
label var summer "Summer"
label var employed_student "R employed"
label var dage "Father's age"
label var mage "Mother's age"
label var employd "Father employed"
label var employm "Mother employed"
label var hhsize "HH size"
label var yngchild "Child younger than 2 present"
label var xtracur_tot "Time spent on extracurricular activities"
label var sprttime "Time spent playing sports"
label var wrktime "Time spent working"
label var household_tot "Time spent on household tasks"
label var care_tot "Time spent caring for HH members"
label var single_parent "Single parent"
```

```
gen hw_tot2 = hw_tot if hw_tot > 0[73]
gen zero_study = 0
replace zero_study = 1 if hw_tot == 0
label var hw_tot2 "Daily T|T > 0"
label var hw_tot "Daily homework time (T; in minutes)"
label var zero_study "Zero homework time (T=0)"
gen weekly_hw = ((hw_tot*7)/60)
label var weekly_hw "Weekly homework time (in hours)"

gen month1 = 1 if sep == 1
replace month1 = 2 if oct == 1
replace month1 = 3 if nov == 1
replace month1 = 4 if dec == 1
replace month1 = 5 if jan == 1
replace month1 = 6 if feb == 1
replace month1 = 7 if mar == 1
replace month1 = 8 if apr == 1
replace month1 = 9 if may == 1
label define schoolmonths 1 "September" 2 "October" 3 "November" 4 "December" 5
"January" 6 "February" 7 "March" 8 "April" 9 "May"
label values month1 schoolmonths
label var month1 "School year"
foreach x of varlist care_tot xtracur_tot household_tot sprttime wrktime{
       replace `x' = 0 if `x' == .
}

gen gapsep = (male * sep)
gen gapoct = (male * oct)
gen gapnov = (male * nov)
gen gapdec = (male * dec)
gen gapjan = (male * jan)
gen gapfeb = (male * feb)
gen gapmar = (male * mar)
gen gapapr = (male * apr)
gen gapmay = (male * may)

label var gapsep "September"
label var gapoct "October"
label var gapnov "November"
label var gapdec "December"
label var gapjan "January"
label var gapfeb "February"
label var gapmar "March"
label var gapapr "April"
label var gapmay "May"
saveold "C:\\masterdata.dta", replace
```

Finally, limit the sample to only respondents enrolled in high school (hs_enroll == 1) and aged 15 to 19 (teage <= 19), which is the age range of a typical high school student in the United States.[74]

```
keep if hs_enroll == 1 & teage <= 19

saveold "C:\\analyticsample_chapter11.dta", replace
```

74 ESCAP observation: Potential errors and discrepancies may occur later on when creating summary statistics (in Section 2 of the code). Due to the variable hw_tot having non-numerical values (. equates NA in Stata), these values cannot be evaluated when performing numerical comparisons, such as > (greater than) commands. It is suggested that users change the non-numerical value (.) to zero first before executing this line of code. See and run the code below first and then continue: replace hw_tot = 0 if hw_tot == .

75 ESCAP observation: It is suggested to drop the 2017 survey year to maintain the same regression results in the TUS publication before saving the analyticsample_chapter11.dta data. Use code: drop if tuyear == 2017

STEP 3: Derivation of summary statistics

Replicate the main results in Gershenson and Holt (2015). Begin by summarizing study time in the analytic sample using the Stata commands estpost, eststo, and esttab.[75] These three commands are useful for generating summary statistics, storing the estimates, and using the stored estimates to generate a formatted CSV table that, with moderate editing, can be copied into a report or manuscript directly. Also, run a short loop, using the foreach function in Stata, to estimate a bivariate regression of each variable in the table on the male indicator. The estimated *t*-statistics test the significance of the unconditional difference in means between boys and girls in their study time. Stata commands are provided below.

```
**Section 2. Make tables of analysis.
**Section 2.1. Start with summary statistics tables.
**Table 5.1 in chapter.

set more off
log using "C:\\table1.log"[76], replace
estpost tabstat male hw_tot zero_study hw_tot2 weekly_hw [aweight=tufnwgtp],
statistics(mean sd count) columns(statistics)
est sto all
estpost tabstat male hw_tot zero_study hw_tot2 weekly_hw [aweight=tufnwgtp] if male
== 1, statistics(mean sd count) columns(statistics)
est sto male
estpost tabstat male hw_tot zero_study hw_tot2 weekly_hw [aweight=tufnwgtp] if male
== 0, statistics(mean sd count) columns(statistics)
est sto female
esttab all male female using C:\\table1, cell(mean(fmt(2)) sd(par)) label unstack
compress obslast csv replace mtitles("All" "Males" "Females") addnotes("Standard
deviations in parentheses; The statistical significance of mean differences between
males and females is tested using t tests. *p < .10 **p < .05 ***p < .01.")

foreach x of varlist hw_tot zero_study hw_tot2 weekly_hw{
       reg `x' male [pweight=tufnwgtp], r
}
log close
```

76 ESCAP observation: Users may need to install "estout" first. Use code: ssc install estout

77 ESCAP observation: The file path should be changed to the current working directory (the folder which users are using) in this line of code and the esttab line of code for Table 5.1. The file path will also need to be changed for Table 5.2 below.

Table 5.1. Summary statistics of homework time overall and separately by sex, 2003-2016

	(1)	(2)	(3)
	All	Males	Females
Respondent is male	0.52	1.00	0.00
Daily homework time (T; in minutes)	49.82 (85.83)	43.29*** (79.94)	56.82 (91.21)
Zero homework time (T=0)	0.57	0.61***	0.54
Daily T|T > 0	116.53 (97.25)	109.91*** (94.36)	122.56 (99.45)
Weekly homework time (in hours)	5.81 (10.01)	5.05*** (9.33)	6.63 (10.64)
Observations	7,388	3,828	3,560

*Standard deviations in parentheses and means are weighted using ATUS weights that adjust for unequal probabilities of sample selection; the statistical significance of mean differences between males and females is tested using t tests. *p < .10 **p < .05 ***p < .01.*

The estimates in Table 5.1, which include previously unavailable years 2015 and 2016, look very similar to the estimates reported in Table 1 in Gershenson and Holt (2015). The unconditional difference between boys' and girls' time spent on homework decreased slightly, from 17.1 minutes to about 13.5 minutes, and the change seems driven by a slight decrease in girls' time spent studying. However, among students with non-zero study time, both boys and girls have increased their time spent studying.

STEP 4: Regression analysis

Now, estimate the regressions that examine the conditional gender gap in homework time spent by high-school students aged 15 to 19.[77] More specifically, estimate the following equation using the Ordinary Least Squares (OLS) approach:

$$T_i = \alpha + \delta Male_i + \gamma SES_i + \beta X_i + \varepsilon_i \,,$$

where T_i is the dependent variable, $Male_i$ is the main explanatory variable, and a vector of socioeconomic status (SES_i) variables (e.g. parents' education, household income) and time spent on other activities (X_i) are the control variables.

Here, the analysis focuses on the extent to which the gender gap in time spent studying displayed in Table 5.1 can be explained by other observable characteristics. For instance, boys may spend more time on other activities that aid in developing noncognitive skills, such as work or extracurricular activities, that leads to a gender gap in study time. Adding controls iteratively allows analysts to examine the sensitivity of observed differences across groups of people to different controls, which may provide insights regarding alternative explanations of these differences. Again, use eststo and esttab to create a formatted table. See below for the code.

78 The regression analysis described here replicates the results in Table 2 in Gershenson and Holt (2015).

```
**Section 2.2. Table 5.2 in chapter.

log using "C:\\table2.log", replace
**This sets macros to simplify our regression codes and make adding and subtracting
variables easier.
local basecontrols black native asian pacisl multi otherrc hisp wkend tuthurs mon
tue wed thr fri sat feb mar apr may jun jul aug sep oct nov dec summer
employed_student employd employm hhsize yngchild metro single_parent teage
local ses dnohsdip dhsdip dsomcol dcoldeg mnohsdip mhsdip msomcol mcoldeg inc2040
inc4060 inc6075 inc75100 inc100150 inc150p
local otheractivities care_tot xtracur_tot household_tot sprttime wrktime
local monthint gapsep gapoct gapnov gapdec gapjan gapfeb gapmar gapapr gapmay
local basecontrols2 black native asian pacisl multi otherrc hisp wkend tuthurs mon
tue wed thr fri sat jan feb mar apr may sep oct nov dec employed_student employd
employm hhsize yngchild metro single_parent

reg hw_tot male i.tuyear [pweight=tufnwgtp], cluster(gestfips)
est sto m1
reg hw_tot `ses' i.tuyear [pweight=tufnwgtp], cluster(gestfips)
est sto m2
reg hw_tot male `ses' i.tuyear [pweight=tufnwgtp], cluster(gestfips)
est sto m3
reg hw_tot male `ses' `basecontrols' i.tuyear [pweight=tufnwgtp], cluster(gestfips)
est sto m4
reg hw_tot male `ses' `basecontrols' `otheractivities' i.tuyear [pweight=tufnwgtp],
cluster(gestfips)
est sto m5
reg hw_tot male `ses' `basecontrols' `otheractivities' i.tuyear i.gestfips
[pweight=tufnwgtp], cluster(gestfips)
est sto m6
esttab m1 m2 m3 m4 m5 m6 using C:\\table2, replace b(2) se(2) ar2(2) star(* 0.10
** 0.05 *** 0.01) compress nogaps obslast csv label keep(male `ses') order(male
`ses') addnote("Standard errors (in parentheses) are clustered at the state level.
All regressions are weighted by ATUS sampling weights that adjust for unequal
probabilities of sample selection. ATUS = American Time-use Survey; OLS = ordinary
least squares; R = respondent; HS = high school; HH = household; FE = fixed effects.
*p < .10 **p < .05 ***p < .01.")

**Code for figure from the Gershenson and Holt (2015) paper.[78]

reg hw_tot male `basecontrols2' `ses' `otheractivities' `monthint' i.tuyear
i.gestfips [pweight=tufnwgtp] if summer == 0, cluster(gestfips)
coefplot, keep(may `monthint') order(`monthint' may) vertical recast(bar)
fcolor(blue) fintensity(50) levels(95) xlabel(, valuelabel angle(45))
ciopts(color(red) recast(rcap)) citop ytitle("Minutes per Day") p1(label("Gender
gap")) p2(label("95% confidence interval")) legend(order(1 "Gender gap" 2 "95%
confidence interval"))
graph save C:\\gapbymonth.gph[79], replace
graph export C:\\gapbymonth.png, replace

log close
```

79 ESCAP observation: Users may need to install "coefplot" first. Use: ssc install coefplot

80 ESCAP observation: File path should be changed to current working directory/folder. The same needs to be done for the histogram in Figure 5.1.

Table 5.2. Daily homework time-use regressions (all students, OLS estimates), 2003-2016.

	(1)	(2)	(3)	(4)	(5)	(6)
Male	-13.52***	Omitted	-13.31***	-14.05***	-13.06***	-13.43***
	(2.05)		(2.02)	(1.87)	(1.83)	(1.85)
R's father						
Not in HH	Omitted					
No HS diploma		6.81**	7.18**	2.03	2.26	2.98
		(2.87)	(2.89)	(4.25)	(4.26)	(4.17)
HS diploma		5.90*	(3.44)	0.25	0.98	1.63
		(3.48)		(5.46)	(5.42)	(5.34)
Some college		7.92**	8.31***	1.63	1.61	1.54
		(3.06)	(3.06)	(5.14)	(5.15)	(5.12)
College degree		27.00***	27.25***	18.02***	17.75***	17.14***
		(4.20)	(4.18)	(5.09)	(5.15)	(5.24)
R's mother						
Not in HH	Omitted					
No HS diploma		5.00	3.49	2.84	2.62	1.18
		(6.64)	(6.39)	(5.38)	(5.39)	(5.43)
HS diploma		1.25	0.09	4.02	4.03	3.85
		(5.51)	(5.28)	(4.97)	(4.86)	(5.11)
Some college		3.02	1.84	6.21	5.90	5.43
		(6.33)	(6.11)	(5.19)	(5.28)	(5.36)
College degree		21.18***	19.83***	22.27***	21.53***	21.43***
		(5.43)	(5.38)	(5.62)	(5.71)	(5.74)
HH income						
< $20K	Omitted					
$20K to $40K		-1.95	-2.49	-1.60	-1.77	-1.79
		(3.32)	(3.28)	(3.04)	(3.07)	(3.08)
$40K to $60K		5.79	5.60	5.05	4.77	4.17
		(4.22)	(4.25)	(3.92)	(3.88)	(3.90)
$60K to $75K		-2.18	-3.08	-2.20	-2.19	-3.15
		(5.17)	(5.08)	(4.78)	(4.67)	(4.69)
$75K to $100K		6.28	5.80	7.53*	7.25*	5.50
		(4.72)	(4.72)	(4.15)	(4.10)	(3.99)
$100K to $150K		-0.92	-1.04	-0.59	-1.29	-1.82
		(7.44)	(7.41)	(6.32)	(6.26)	(6.30)
> $150K		15.47**	14.87**	12.18**	12.14**	9.63
		(6.34)	(6.25)	(5.72)	(5.59)	(5.79)
Base controls	No	No	No	Yes	Yes	Yes

	(1)	(2)	(3)	(4)	(5)	(6)
"Other activities"	No	No	No	No	Yes	Yes
State FE	No	No	No	No	No	Yes
Adjusted R-squared	0.01	0.05	0.06	0.14	0.15	0.16

*N=7,388. Standard errors (in parentheses) are clustered at the state level. All regressions are weighted by ATUS sampling weights that adjust for unequal probabilities of sample selection. ATUS = American Time-use Survey; OLS = ordinary least squares; R = respondent; HS = high school; HH = household; FE = fixed effects. *p < .10 **p < .05 ***p < .01.*

The resulting output, with some slight formatting modifications, is given in Table 5.2, and replicates the analysis in Table 2 of Gershenson and Holt (2015). Consistent with the unconditional means reported in Table 5.1, the inclusion of more recent years yields a slightly smaller conditional gender gap in time spent studying. However, boys, on average, still spend 13 fewer minutes per day studying than girls, and the gap cannot be explained by gender differences in demographics, SES, or time spent in other activities (e.g. sports, childcare, working, household chores, or extracurricular activities). Assuming a five-day school week, the 13-minute gender gap represents a 65-minute gender gap in time spent studying each week, a consequential gap in time invested in academic skills. Despite the homework time gap favoring girls, another possibility is that girls spend more of their study time with distractions present, such as siblings or friends, than boys, suggesting lower quality homework time.

STEP 5: Distribution of company during study time

Conduct a simple analysis of the distribution of boys and girls who study with different types of people present. In most analytic contexts, this would simply be the starting point for a more rigorous analysis. Here, however, it simply demonstrates the use of the Who file for examining policy-relevant behaviors by proxying for the quality of students' study time.

Using the twoway graphing command in Stata and the categorical variable of who was present during students' longest study period, create a histogram of the types of people present during study time by sex of student. The histogram will allow analysts to visually examine differences in the proportion of boys and girls studying alone or with other people present. Intuitively, a larger share of students studying alone would be an indicator of high-quality study time, while a larger share of students studying with friends or a mix of people present suggests a more distracted study environment. First, code is provided that creates two histograms, one for males and one for females, which are combined into one figure. Because study habits during the week likely differ from those on the weekend, separate figures are produced for weekdays and weekends using the by () option in Stata.

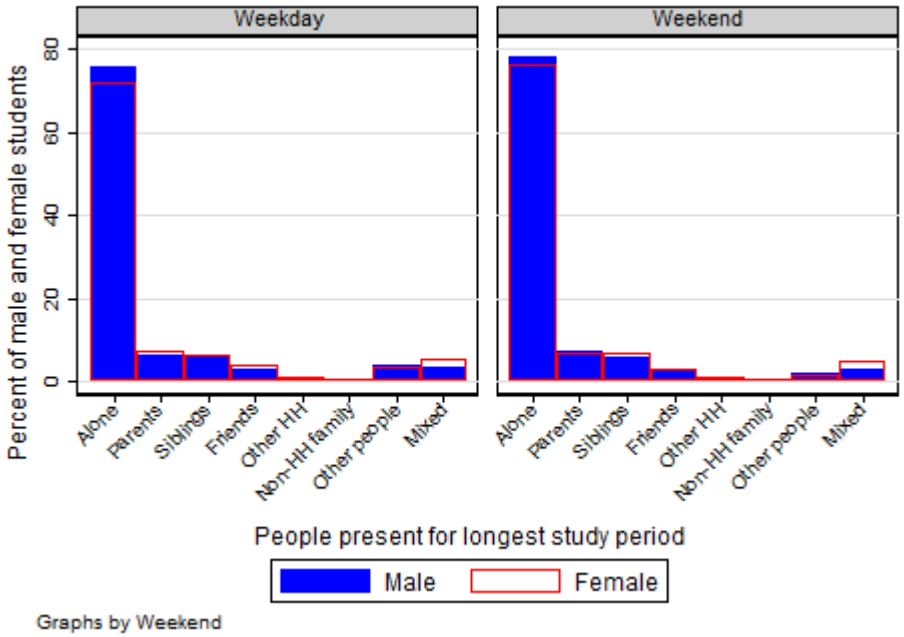
```
twoway (histogram cat_whopresent if male==1, fcolor(blue) lcolor(blue) percent
discrete xlabel(1(1)8,valuelabel angle(45))) (histogram cat_whopresent if
male==0, lcolor(red) fcolor(none) percent discrete xlabel(1(1)8,valuelabel
angle(45))), legend(order(1 "Male" 2 "Female")) by(wkend) ytitle("Percent of male
and female students")
graph save C:\\who.gph, replace

graph export C:\\who.png, replace
```

In the code, the options after the comma allow analysts to modify the appearance of the elements in the graph for clarity, depending on the analytic context and purpose of the graph. The code above produces the following figure.

Figure 5.1

Distribution of company present during longest study period, by gender and time of week, 2003-2016



Examining the distribution of the people present while students study suggests that girls are slightly more likely than boys to have other people present while studying. From here, an analyst could use the components just created to further analyze the quality of the study environment for boys and girls. For instance, an analyst could estimate the precise difference between boys and girls in doing homework with others present, run statistical tests to confirm that the difference is not simply random noise, and examine other measures of study quality, such as the location of students' study time.

Chapter summary

The chapter illustrated how nationally representative time-diary data can help policy analysts investigate population trends in time spent on socially important, educationally productive behaviours. Importantly, time-diary data avoids social desirability bias to provide policy analysts a more accurate measure of time spent in such activities, which is crucial to evaluating the quality of an educational system, the impact of educational interventions, and the educational achievement of a population (SDG 4). The timing and sequencing of study time can provide suggestive evidence of the quality of students' studying and inform policy-makers in determining school start and end times and other policy interventions.

The chapter replicated previous work by Gershenson and Holt (2015) using more recent ATUS data to test the hypothesis that boys under-invest in study time, a behaviour that develops academically-important non-cognitive and cognitive skills. Using additional components of the ATUS, this work was extended to test for gender differences in the quality of students' study time by examining the presence of other individuals during study spells. Overall, the results of the extension suggested that boys engage in study time with fewer distractions. The distribution of company during study time provided suggestive evidence that while boys spend less time studying, they may experience fewer distractions during their study time.

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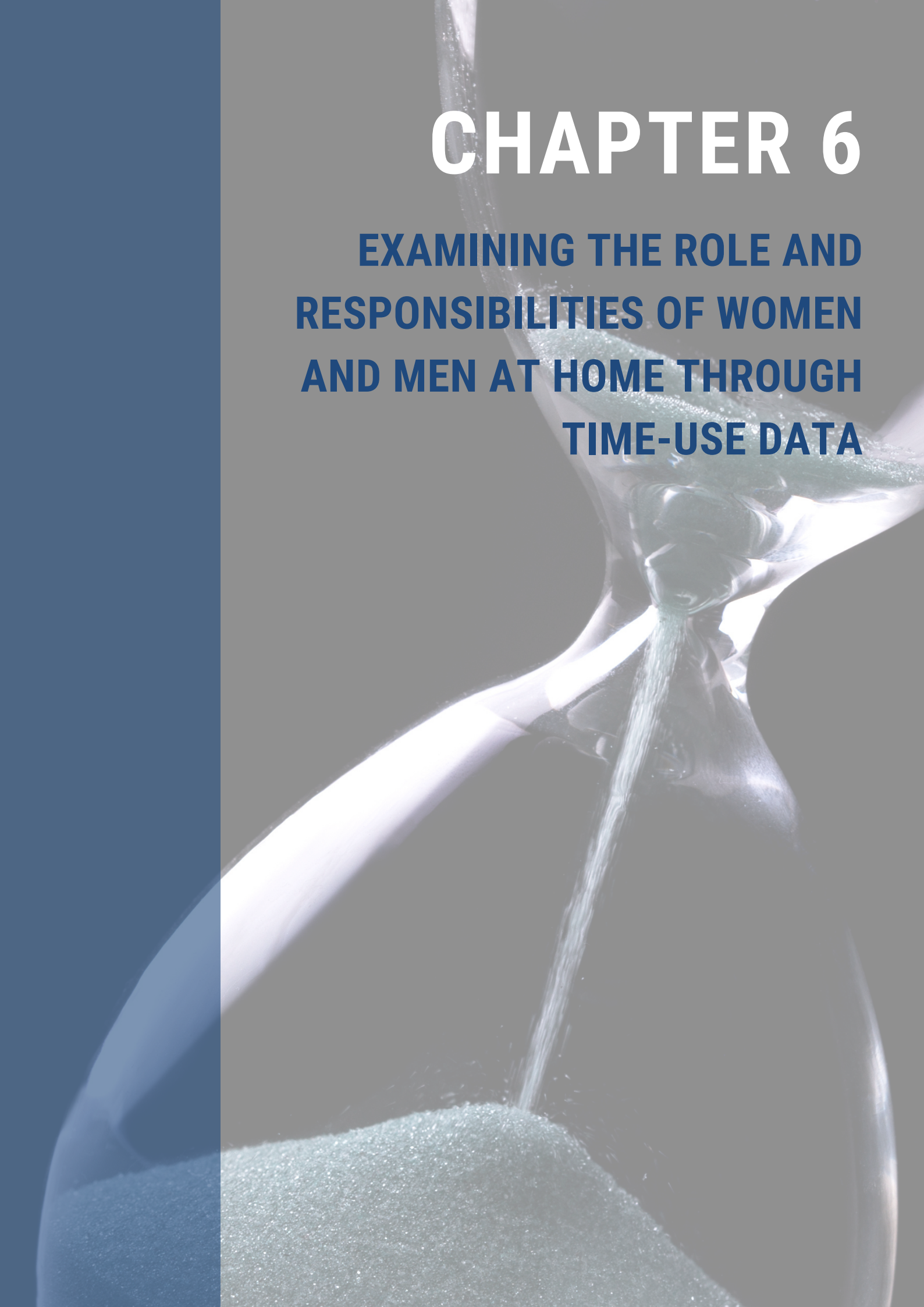

CHAPTER 6

EXAMINING THE ROLE AND RESPONSIBILITIES OF WOMEN AND MEN AT HOME THROUGH TIME-USE DATA

CHAPTER 6: EXAMINING THE ROLE AND RESPONSIBILITIES OF WOMEN AND MEN AT HOME THROUGH TIME-USE DATA

This chapter is an edited version of material provided by Maria Floro to the ESCAP Statistics Division in 2018.

Chapter overview: This chapter demonstrates how time-use data have the potential to describe gender patterns in all activities, revealing both the amount of time spent on unpaid care and domestic work in the household and the unequal burden have on women and men and girls and boys. The chapter introduces the concept of time allocation and discusses the role of gender in influencing the time-use of women and men. It demonstrates how to utilise time-use data to estimate the proportion of time spent on unpaid work performed by female and male household members.

In specific terms, the chapter demonstrates how to (i) estimate the average time spent by married women and men in performing certain activities; (ii) compress time-use information into useful activity categories by aggregating them; (iii) estimate the participation rates and the average time spent by participating married women and men on each of the main activity categories concerned; and (iv) estimate the share of total household work performed by the husband and the wife.

The chapter uses data from the Henan Province Time-use Survey (HTUS), which is drawn from the 2008 China Time-use Survey (CTUS). Stata is used to perform the empirical analysis in this chapter and multivariate regression analysis is used. Stata do-files and R Markdown files are also available as separate attachments on the webpage for download and use.

6.1 Chapter focus

This chapter focuses on the role of gender in influencing the time-use of women and men. Firstly, it demonstrates the method of estimating the average time spent by married women and men in performing activities such as:

- wage employment,
- household production in primary industry,
- household-based production in manufacturing and construction industries,
- household-based services to generate income,
- housework for households' own consumption,
- care for household members (children and the elderly, sick or disabled), help to other households and community volunteer services,
- education and training,
- recreation, leisure and social contact,

- and rest and personal care.

Second, the chapter demonstrates how to compress time-use information into useful activity categories by aggregating them. For example, the different activities can be grouped into three main categories, namely: (a) market work, (b) household work, and (c) non-work.

Third, the chapter demonstrates the estimation of participation rates and average time spent by participating married women and men on each of the main activity categories by using the Henan province sub-sample. Since the activities are recorded both on weekdays and weekend days, the chapter shows, by way of example, the pattern of time-use on a weekday only.

In showing the step-by-step approach for estimating the above information, the chapter illustrates how time-use data can show gender patterns in time allocation, particularly the amount of unpaid care and domestic work performed by women compared to men, and the distribution of unpaid work within households.

6.2 Relevance

6.2.1 Linkages with the Sustainable Development Goals (SDGs)

Being able to estimate the proportion of unpaid household work performed by female and male household members is vital for tracking SDG target 5.4, particularly indicator 5.4.1 on the proportion of time spent on unpaid domestic and care work. This is important for understanding the extent of shared responsibility within the household and the family. In turn, these can provide some insights on e.g. SDG indicator 8.6.1, the proportion of youth (aged 15–24 years) not in education, employment or training disaggregated by sex, as the burdens of unpaid domestic and care work impinge on the ability of young women to engage in economic and social life outside the household.

6.2.2 Domestic policy implications

Engagement in work, whether paid employment, housework, community service or childcare, constitute an essential element of life. Therefore, any policy-related inquiry into people's welfare must not only ask how much people earn, but also how they use their time and conduct their work in order to acquire goods and services to meet their needs. Similarly, the amount of leisure and the way in which an individual is able to balance work, family life and time with friends or to pursue learning opportunities, hobbies, and cultural enrichment can provide vital information about the quality of life. Standard indicators, such as the gross domestic product per capita or the human development index, fail to convey this information.

A significant part of the work performed to meet daily needs, such as earning a living as farmers, wage and salaried earners, or the self-employed, are widely acknowledged, measured, and statistically visible to policymakers. But a range of daily chores and activities are also performed, including cooking, washing clothes, making beds, housecleaning, shopping, washing dishes, throwing out the garbage, and caring for children, the sick, disabled, elderly, and those who depend on others. Although the performance of these tasks ensures one's daily survival and well-being, historically they have been invisible in economic models and policy discussions.

The 19th International Conference of Labour Statisticians (ICLS) has recently revised the statistical definition of work to address this serious problem, acknowledging that work can be done in any type of economic unit, such as market and non-market units and households producing goods or services for own consumption (para 6 of 19th ICLS resolution, ILO 2013).[80]

However, the services provided by unpaid labour in households, such as childcare, eldercare, cleaning, washing dishes, etc., remain outside the production boundary of the System of National Accounts (SNA) and are not included in the SNA or national income accounts, labour statistics and other economic indicators.[81] As a result, the labour involved in maintaining households and taking care of people through a myriad of unpaid tasks is still invisible in policy analysis. The absence of these forms of labour in economic policy discourses and development plans seriously inhibits advancement towards gender equality, as most of these tasks are done by women. Thus, making unpaid household labour visible in policy dialogue and formulation has important implications for government policymaking in areas ranging from child-care provision to early childhood education and family-friendly formal work practices.

6.2.3 Gender implications

As well as demonstrating the manner in which unpaid and paid work are intrinsically linked, time-allocation patterns can also identify the gender-related distribution of work within households. The increasing participation of women in the paid labour force in recent decades has reinforced the importance of knowing how paid and unpaid work are shared among household members.

Evidence from time-use survey data indicates that norms regarding the traditional household division of labour evolve slowly (Beneria et al 2015). Instead of replacing time in unpaid work with time in paid work and shifting compensating amounts of reproductive work to men, women tend to increase their total work time. Families that have traditionally been able to count on the unpaid work of other female relatives and kin are finding this option less feasible, as urbanization, migration, smaller families and the growth of nuclear households have undermined extended family support networks. Women therefore are increasingly taking on the responsibility of being both income earners and caregivers, and the conflict between these two roles has intensified.

The fact that women continue to do most of the unpaid reproductive work strongly affects their availability for paid work (Floro and Meurs 2009). When women do participate in the labour market, the amount of household work they perform affects the type of jobs that women undertake. The prevalence of women in part-time work, for example, is linked to their other responsibilities, especially raising children. Household work and care responsibilities are furthermore cited as one of the reasons women often turn to informal employment.

Unpaid work burden and role conflicts are heightened during periods of economic crisis, as real wages decline and government expenditures on social services and welfare programmes are severely cut, thereby making more women in marginalized households both "time-poor" and

81 For further information, refer to https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_220535.pdf (accessed on 05 April 2021).

82 Services produced by households for own-final use are included in the SNA "general" production boundary (para 10 of 19th ICLS resolution), and are part of SNA "satellite" accounts for household production.

"income-poor" (Floro 1995). In addition, the demographic changes observed over the last few decades in many countries, such as lower fertility rates, longer life expectancy and urbanization, have intensified the need for care, especially among older persons.

At the same time, the level of unpaid work and the gender division of household labour continue to change in response to labour market conditions, policy reforms, and a host of demographic and social forces such as urbanization, migration, and divorce rates. Changes in technology, earnings and access to social services can cause households and individuals to shift time between activities. Changes in economic conditions, such as those brought about by modern globalization, can also affect the level and distribution of unpaid work in a household (Beneria et al., 2015). Studies in developed countries have shown that while large differences persist in men's and women's time in paid and unpaid work, these discrepancies began to converge between the 1960s and the 1990s (World Bank 2011). That is, as women increasingly engage in market work, men have somewhat increased their time in unpaid work. Time-use studies in Australia, for example, show a seemingly narrowing of the gender division of labour in households with children during the 1990s, as a result of women's increased labour force participation.

But these trends can easily reverse. For instance, the trend towards convergence in Australia seemed to stop and reverse between 1997 and 2006 within the context of increasing labour market deregulation and the spread of "long-hours culture" (Craig et al. 2010). As a result, the division of unpaid work in households with children in 2006 was not significantly different from that in 1992. This is evidence of the influence of social policies and macroeconomic conditions on the amount of time spent in housework and care work and the distribution between women and men.

6.3 Analytical logic

The above gender dynamics which operate across societies are examined in the following example. This section provides a step-by-step approach to creating a time-allocation table that estimates the share of unpaid (household and care) work performed by husband and wife using the Henan Province time-use data (refer Section 6.4.1 for description):

- First, it describes the data and sample preparation.
- Second, it estimates the average time spent by married women and men in the 10 activity categories of the data set and then aggregates them into three main activity categories: a) labour market work; b) household and care work; and c) non-work.[82]
- Third, it estimates the participation rate of married women and men for each main activity and the average time spent by the participating spouses on each of the main activity categories. Although the activities are recorded both on weekdays and weekend days, the chapter shows the patterns of time-use on a weekday (Monday-Friday). Finally, the chapter demonstrates

83 a) Labour market work refers to employment performed for others in exchange for pay or profit, as well as work producing goods (but not services) for own final use. These are the activities counted in the SNA. They include: wage employment, household production in primary industry, household-based production in manufacturing and construction industries, and household-based services to generate income. b) Housework and care work involve own-use production of services and are outside the SNA production boundary. These include: housework for households' own consumption, care for household members (children and the elderly, sick or disabled), and help to other households and community volunteer services. c) Non-work refers to all other activities such as education and training, recreation, leisure and social contacts, personal care and self-maintenance.

how to estimate the share of total household work performed by married women and married men.

6.4 Step-by-step example

6.4.1 Background: The Henan Province (China) Time-use Survey (2008)

The Henan Province Time-use Survey (HTUS) data is drawn from the 2008 China Time-use Survey (CTUS).[83]

The national survey (CTUS) covered 37,142 individuals between the ages of 15 and 74 from 16,661 households in 10 provinces—Beijing, Hebei, Heilongjiang, Zhejiang, Anhui, Henan, Guangdong, Sichuan, Yunnan and Gansu. The sample consisted of 18,215 males and 18,927 females. All household members between the ages of 15 and 74 were surveyed using a time diary. They were asked to document a 24-hour period for both a weekday and a weekend day in ten-minute intervals beginning at 4:00 am. Each individual also completed a personal questionnaire, which provided information on sex, age, relationship to household head, marital status, educational attainment, monthly income (categorical), and occupation. Additionally, the questionnaire recorded context variables, indicating where the primary activity took place, with whom the primary activity was performed, and any secondary activity performed simultaneously with the primary activity.

The HTUS sample covered 5,003 individuals from 2,398 households in this province. Henan is the most populated province and relies heavily on agriculture. As with the rest of the 2008 CTUS, the HTUS dataset divides the different activities into 10 one-digit-level categories, 61 two-digit level categories, and 113 three-digit level categories. The ten one-digit categories are:

- personal care and self-maintenance (0).
- wage employment (1),
- household production in primary industry (2),
- household-based production in manufacturing and construction industries (3),
- household-based services to generate income (4),
- housework for households' own consumption (5),
- care for household members (children and the elderly, sick or disabled), help to other households and community volunteer services (6),
- education and training (7),
- recreation, leisure and social contact (8),
- other (unclassified) activities (9).[84]

STEP 1. Data and sample selection

84 The dataset used in this chapter is not available publicly. For more information on accessing the data, please see http://www.stats.gov.cn/english/ (accessed on 14 January 2021).

85 In this example, "other" activities are classified as non-work.

Depending on the purpose of the data analysis or study, a subsample can be selected for the analysis of time allocation based on selected respondents' characteristics. Here are some examples:

- Subsample A: married women and men respondents
- Subsample B: older (16-19 years old) daughter and son respondents
- Subsample C: elderly (62-74 years old) women and men respondents
- Total Sample: all household member respondents, both male and female, aged 16-74 years old.

For this example, use Subsample A (married women and men only) and focus on the average time spent by married women and men for each of the 10 activities on a given weekday. In addition, take into account that some of the activities are performed as secondary activities and estimate the average time spent on secondary activities as well.

To create Subsample A, use the Stata command:[85]

```
use "2008_Henan_TUS_Training_Dataset.dta"[86]
keep if married == 1
save, replace
```

STEP 2: Data preparation and creating time-allocation table

Next, sort the respondents by sex for each sample type and group the 10 different activities into three main categories (market work, household work, and non-work) by using the following Stata command:

```
use "2008_Henan_TUS_Training_Dataset.dta"

preserve
keep if female == 0
local x cat1 cat2 cat3 cat4 cat5 cat6 cat7 cat8 cat9 cat0
foreach var of local x{
       mean `var'_wkd
}
restore

preserve
keep if female == 1
local x cat1 cat2 cat3 cat4 cat5 cat6 cat7 cat8 cat9 cat0
foreach var of local x{
       mean `var'_wkd
}
restore
```

86 Stata codes are as provided by the primary contributor of the chapter material and have been issued with limited validation.

87 ESCAP observation: Users should change the file path and folder to where the data is saved. This action will need to be repeated whenever importing the data. Under standard data analysis conventions, it is recommended to save this subsample data under a different name in order to not overwrite the original data file. Example: save 2008_Henan_subsampleA_married.dta, replace

To estimate the average time married women and men spend on secondary activities, use the following Stata command:

```
preserve
keep if female == 0
local x cat1 cat2 cat3 cat4 cat5 cat6 cat7 cat8 cat9 cat0
foreach var of local x{
       mean `var'_wkd_s
}
restore

preserve
keep if female == 1
local x cat1 cat2 cat3 cat4 cat5 cat6 cat7 cat8 cat9 cat0
foreach var of local x{
       mean `var'_wkd_s
}
restore
```

Once the log file is obtained, create Table 6.1. This provides the week-day time allocation of married women and men for primary and secondary activities using the estimated means in the output or log files.

Table 6.1 gives the estimated average time spent (minutes per day) by activity and the percent of total time (1440 minutes=total time) spent in a given activity.

Table 6.1. Time allocation of married women and married men on primary and secondary activities in a weekday

	Married Women		Married Men	
	N=2257		N=2115	
	Average time (min per day)	**Percentage distribution**	**Average time (min per day)**	**Percentage distribution**
Primary activities				
Labour market work (subtotal)	**273.21**	**18.97%**	**373.18**	**25.92%**
Wage employment	164.91	11.45%	251.58	17.47%
Household production in primary industry	93.15	6.47%	90.79	6.30%
Household-based production in manufacturing and construction industries	6.05	0.42%	16.18	1.12%
Household-based services to generate income	9.10	0.63%	14.63	1.02%
Household work (subtotal)	**237.59**	**16.50%**	**89.09**	**6.19%**
For own consumption	189.74	13.18%	68.68	4.77%
Carework and community service	47.85	3.32%	20.41	1.42%
Non-work activities (subtotal)	**929.20**	**64.53%**	**977.73**	**67.90%**
Learning	2.57	0.18%	1.89	0.13%

	Married Women		Married Men	
	N=2257		N=2115	
	Average time (min per day)	Percentage distribution	Average time (min per day)	Percentage distribution
Leisure and recreation	192.52	13.37%	218.03	15.14%
Rest and sleep, and personal care	693.33	48.15%	701.93	48.75%
Other activities	40.78	2.83%	55.88	3.88%
Total	1440	100%	1440	100%
Secondary activities				
Labour market work (subtotal)	**3.54**	**0.76%**	**4.00**	**0.80%**
Wage employment	1.86	0.40%	3.32	0.67%
Household production in primary industry	1.18	0.25%	0.54	0.11%
Household-based production in manufacturing and construction industries	0.08	0.02%	0.00	0.00%
Household-based services to generate income	0.42	0.09%	0.15	0.03%
Household work (subtotal)	**21.27**	**4.59%**	**8.18**	**1.64%**
For own consumption	10.09	2.18%	2.73	0.55%
Carework and community service	11.18	2.41%	5.45	1.09%
Non-work activities (subtotal)	**438.76**	**94.65%**	**486.80**	**97.56%**
Learning	0.02	0.00%	0.15	0.03%
Leisure and recreation	116.39	25.11%	113.13	22.67%
Rest and sleep, and personal care	25.16	5.43%	55.56	11.13%
Other activities	297.19	64.11%	317.96	63.72%
Total	463.57	100%	498.99	100%

Next, demonstrate how to compress time-use information into useful activity categories by aggregating them. For example, the different activities can be grouped into three main types namely:

- market work (1-4),
- household work (5-6),
- non-work activities (7-9 and 0).

```
gen market_wkd = cat1_wkd + cat2_wkd + cat3_wkd + cat4_wkd
gen household_wkd = cat5_wkd + cat6_wkd
gen nonwork_wkd = cat7_wkd + cat8_wkd + cat9_wkd + cat0_wkd

gen market_wkd_s = cat1_wkd_s + cat2_wkd_s + cat3_wkd_s + cat4_wkd_s
gen household_wkd_s = cat5_wkd_s + cat6_wkd_s
gen nonwork_wkd_s = cat7_wkd_s + cat8_wkd_s + cat9_wkd_s + cat0_wkd_s
```

Then, estimate the three main categories as primary activity and secondary activity by sex.

```
preserve
keep if female == 0
local x market household nonwork
foreach var of local x{
       mean `var'_wkd `var'_wkd_s
}
restore

preserve
keep if female == 1
local x market household nonwork
foreach var of local x{
       mean `var'_wkd `var'_wkd_s
}
restore
```

Table 6.1 now includes the estimated average time spent (minutes per day) and the percent of total time (1440 minutes=total time) spent by married women and men for labour market activities, household work activities, and non-work activities.

STEP 3: Estimation of participation rates and average time per activity

Using the married women and men subsample, demonstrate the procedure for the estimation of activity participation rates. A participation rate refers to the number of respondents who spent at least 10 minutes of their time on the activity, divided by the total number of respondents. For example, the participation rate of married women on market work is equal to: [1635/2257] x 100=72.44%. Also, estimate the average time spent by married women and men, conditional on participation, i.e. the respondent spending at least 10 minutes in the said activity. The estimations are performed for both primary and secondary activities.

First, create a do-file using the following Stata commands:

```
local x market_wkd household_wkd nonwork_wkd market_wkd_s household_wkd_s
nonwork_wkd_s
foreach var of local x{
       gen `var'_prtc = 1 if `var' > 10
       replace `var'_prtc = 0 if `var'_prtc == .
}

preserve
keep if female == 1
local x market_wkd household_wkd nonwork_wkd market_wkd_s household_wkd_s
nonwork_wkd_s
foreach var of local x{
       count if `var'_prtc == 1
}
restore

preserve
keep if female == 0
local x market_wkd household_wkd nonwork_wkd market_wkd_s household_wkd_s
nonwork_wkd_s
foreach var of local x{
       count if `var'_prtc == 1
}
restore

local x market_wkd household_wkd nonwork_wkd market_wkd_s household_wkd_s
nonwork_wkd_s
```

```
foreach var of local x{
mean `var' if female == 1 & `var' > 10
       mean `var' if female == 0 & `var' > 10
}
```

This yields an output or log file.

Then, create Table 6.2. This provides summary information regarding the time allocation of married women and men in terms of participation rates and average time, conditional on participation, using the estimated means from the output file.

Table 6.2. Participation rates and average time spent on primary and secondary activities of married women and men, conditional on participation, on a weekday

	Married Women		Married Men	
	N= 2257		N= 2115	
	Participation rate	**Average time (min per day), conditional on participation**	**Participation rate**	**Average time (min per day), conditional on participation**
Primary activities				
1. Labour market work	68.94	396.23	81.94	455.42
2. Household work	95.30	249.27	66.38	133.74
3. Non-work activities	100.00	929.20	100.00	977.73
Secondary activities				
1. Labour market work	3.06	115.07	2.51	159.25
2. Household and care work	21.58	97.89	10.21	79.03
3. Non-work activities	100.00	438.76	99.95	487.03

STEP 4: Estimation of married women's and married men's share of total household work performed by the couple

Finally, estimate the share of the combined household work performed by married women and men on a given weekday, by using the following Stata commands. For illustration purposes, focus on primary activities only.

```
*1.Women's household work and market work shares

egen femhh=sum((female == 1)*household_wkd), by(hhid)//[87] total time spent on
household work by women in the household
egen tot_hh=sum(household_wkd), by(hhid) //total time spent on household work by
all household members
gen femhh_sh= femhh/tot_hh //share of total women's hh work to total hh work time
replace femhh_sh = 0 if femhh_sh == .
```

88 ESCAP observation: The forward slashes (//) are indicators for comments in Stata. Users may run into errors regarding the // if copy and pasting the code into Stata. If this is the case, users may have to remove the // and/or subsequent comment to execute code without errors. This action will need to be repeated whenever the // are present. Otherwise, running the do-file directly in Stata should produce minimal errors.

```
egen femmkt=sum((female == 1)*market_wkd), by(hhid)
egen tot_mkt=sum(market_wkd), by(hhid)
gen femmkt_sh= femmkt/tot_mkt
replace femmkt_sh = 0 if femmkt_sh == .

*2.Men's household work and market work shares

egen malehh=sum((female == 0)*household_wkd), by(hhid) //total men's hh work time
gen malehh_sh= malehh/tot_hh //share of men's hh work time in total hh work
replace malehh_sh = 0 if malehh_sh == .

egen malemkt=sum((female == 0)*market_wkd), by(hhid)
gen malemkt_sh= malemkt/tot_mkt
replace malemkt_sh = 0 if malemkt_sh == .

*3. Calculating the share of unpaid work and market work time on a household
level

preserve
duplicates drop hhid, force //drops the duplicates of observations with the same
household
local x femhh_sh malehh_sh
foreach var of local x {
       sum `var' if tot_hh ~= 0
}

local x femmkt_sh malemkt_sh
foreach var of local x {
       sum `var' if tot_mkt ~= 0
}
restore

save "2008_CTUS_Exercise.dta"
```

Table 6.3 provides the summary information for married women and men using the estimated means from the output file.

Table 6.3. Share of total household work and labour market work performed by married women and men on a weekday, primary activities only

	All Women	All Men
Unpaid household work	74%	26%
Labour market work	44%	56%

Chapter summary

This chapter introduced the notion of time allocation and the role of gender in influencing the time-use of women and men. Using the Henan province subsample of married women and men drawn from the 2008 China Time-use Survey dataset, the chapter presented an example exercise that described the method for producing a time allocation table and estimated the proportion of time spent on unpaid domestic and care work, by sex.

It demonstrated how the allocation of time between women and men can reveal the pattern of household division of labour and the extent to which women shoulder household work. Moreover, it showed how the time-use pattern can reflect the dynamic interaction between paid work and unpaid work production by showing how people allocate their time between these two forms of economic activity.

The chapter described the time-use survey data used and the steps needed for preparing and processing the data for analysis. Such estimation provides an important input for the monitoring of the progress of SDG indicator 5.4.1 in particular.

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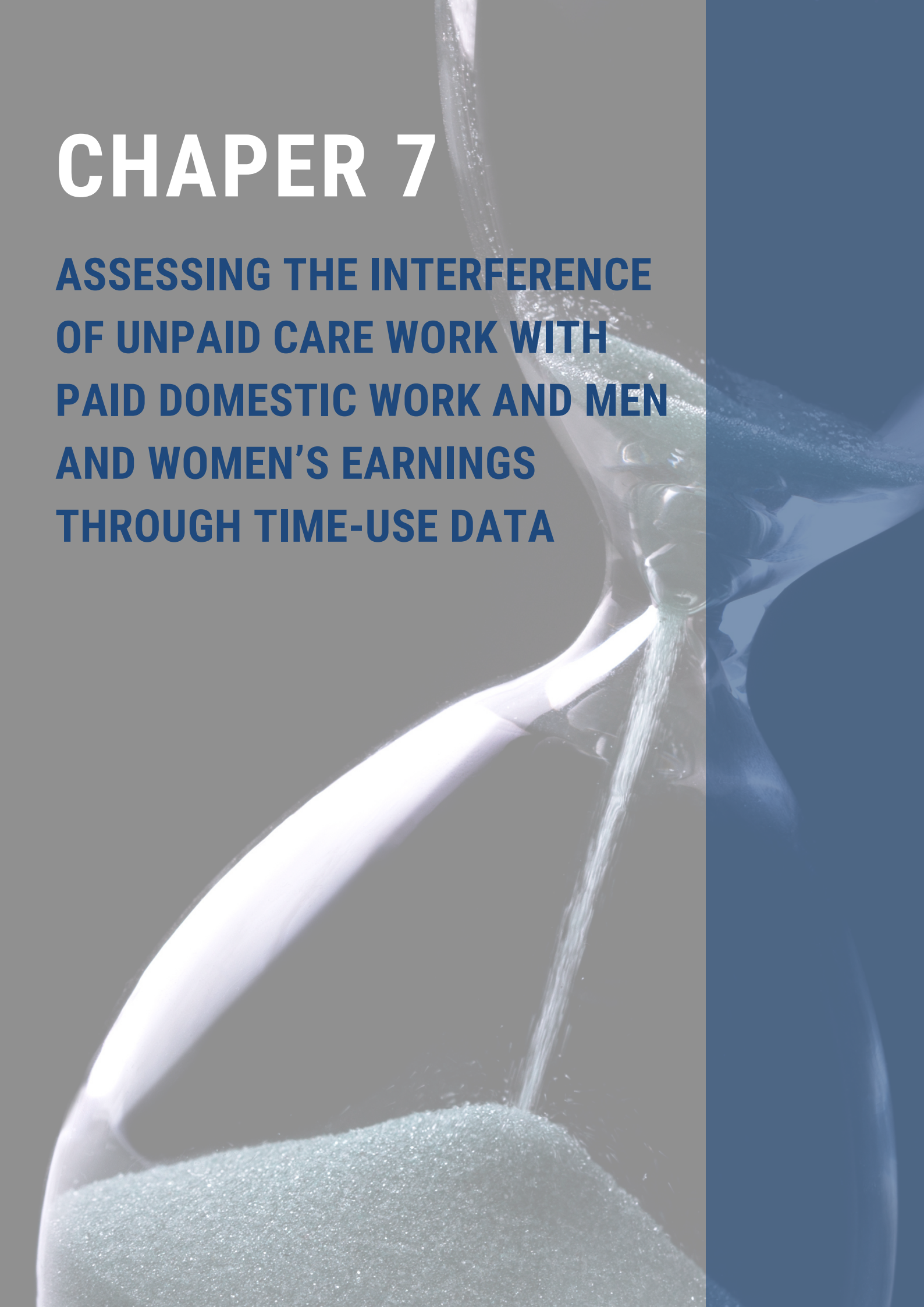

CHAPER 7

ASSESSING THE INTERFERENCE OF UNPAID CARE WORK WITH PAID DOMESTIC WORK AND MEN AND WOMEN'S EARNINGS THROUGH TIME-USE DATA

CHAPTER 7: ASSESSING THE INTERFERENCE OF UNPAID CARE WORK WITH PAID DOMESTIC WORK AND MEN AND WOMEN'S EARNINGS THROUGH TIME-USE DATA

This chapter is an edited version of material provided by Xiao-yuan Dong and Liangshu Qi to the ESCAP Statistics Division in 2018.

Chapter overview: This chapter introduces techniques that can be applied (1) to measure the extent to which unpaid domestic and care work interferes with paid work, and (2) to evaluate the effects of unpaid care work on men's and women's earnings. Understanding the gendered nature of unpaid care work and its link with labour market outcomes is essential for formulating gender relevant social and economic policies.

The chapter demonstrates how to (i) use time-use data on episode occurrences and sequences to measure the degree to which unpaid care work interferes with paid work, and (ii) estimate its effects on men's and women's earnings.

The chapter uses data from the 2010 South Africa Time-use Survey. Stata is used to perform the empirical analysis in the chapter. Regression analysis using the ordinary least squares (OLS) approach is demonstrated. Stata do-files and R Markdown files are also available as separate attachments on the webpage for download and use.

7.1 Chapter focus

Chapter 6 demonstrated how time-use data can describe gender patterns in all activities, revealing both the amount of unpaid care and domestic work in the household and the unequal burden on women and men and girls and boys. This chapter extends the focus to explore the impact of unpaid domestic and care work on the ability to engage in paid work, as well as the effects of unpaid care work on men's and women's earnings.[88]

There exists a large body of literature indicating that women, especially married women, spend substantially more time on unpaid domestic and care work than men do (for example, Burda et al. (2007) in 25 rich and poor countries ranging from the US to Benin and Madagascar; Budlender (2010) in Argentina, India, Japan, Nicaragua, South Africa, South Korea, and Tanzania; Dong and An (2014) in China). Gender differences exist not only in the amount of unpaid domestic and care work, but also in the nature of this work in terms of timing and flexibility. Noonan (2001) and Hersch and Stratton (2002) found in their studies for the United States that women are commonly responsible for domestic activities that need to be performed on a daily basis and at specific times during the day, such as preparing meals, washing dishes, or picking up children from day care.

In contrast, the domestic activities typically performed by men, such as home and yard maintenance and auto repairs, are more flexible to schedule and can be dealt with on a non-working day. As a

89 Throughout the chapter, the term "unpaid domestic and care work" is used for such activities as domestic chores and care of people at home and in communities performed for no explicit monetary reward.

result, women's unpaid domestic and care work is more intertwined with their paid work than those of men. Similarly, Bonke et al. (2005) find that Danish women are more likely to perform unpaid care work right before or after paid work than Danish men do. Qi and Dong (2016) found that Chinese women are more likely than their male counterparts to attend to domestic chores during working hours, either by forgoing work breaks or by directly disrupting paid work. The gender differences in the amount, the timing and flexibility of unpaid care work are expected to influence the achievements of women and men on the job.

7.2 Relevance

7.2.1 Linkages with the Sustainable Development Goals (SDGs)

Being able to estimate the impact of unpaid domestic and care work on the ability to engage in paid work, as well as the effects of unpaid care work on men's and women's earnings, contributes to the tracking of SDG Target 5.4 on promoting shared responsibility within the household (Indicator 5.4.1 on the proportion of time spent on unpaid domestic and care work, by sex, age and location); SDG Target 8.5 on achieving full and productive employment and decent work for all women and men (Indicator 8.5.1 on the average hourly earnings of female and male employees by occupation, age and persons with disabilities); and SDG Target 8.6 on substantially reduce the proportion of youth not in employment, education or training (Indicator 8.6.1: Proportion of youth (aged 15–24 years) not in education, employment or training).

7.2.2 Domestic policy implications

Explaining causes of interference with paid work - three theories

Understanding the causes of unpaid domestic and care work interference with paid work is vital for formulating effective policy measures to mitigate such interference. Three main theories have been proposed to explain how unpaid domestic and care work could affect men and women's earnings:

(i) Effort deficits

Economist Gary Becker (1985) explains the effects on earnings of unpaid domestic and care work with a model in which an individual's decision about alternative activities is not only subject to a time constraint, but also an energy (or effort) constraint. Because domestic and care work requires time and consumes energy, individuals who have greater household responsibilities are expected to exert less effort on paid work and therefore have lower earnings.

The relationship between unpaid domestic and care work time and earnings is expected to be nonlinear: only individuals whose unpaid domestic and care work time exceeds a certain threshold find that it adversely affects their productivity on the job and their earnings (Stratton 2001). Moreover, the effects of unpaid domestic and care work on job performance and earnings may vary with the timing of unpaid care work. Bonke et al. (2005, p.45) argue, "Housework that is timed relatively close to market work hours may have more punitive effects on wages than housework that is timed farther away from market work hours because individuals may need to interrupt their market work hours in order to undertake such activities or experience higher levels of stress or fatigue while trying to balance the conflicting needs of the job and the household."

(ii) Compensating wage differentials

The second explanation for the earnings effects of unpaid domestic and care work is derived from the theory of compensating wage differentials (Rosen 1986). In accordance with this economic theory, individuals who bear higher domestic burdens may seek jobs that offer convenient hours, flexible working schedules, or require less effort. In a competitive labour market, these individuals may have to accept lower wages to compensate employers for accommodating their preferences (Becker 1985; Hersch 1991).

(iii) Employer prejudice

The third mechanism through which unpaid domestic and care work affects earnings is employers' prejudice against workers with household responsibilities. Williams (2000) argues that workers who bear greater household responsibilities may receive lower wages even though household responsibilities have no effect on their productivity. These workers are penalized for bearing household responsibilities because their employers believe that they would be tired and distracted at work and therefore less productive than other workers.

7.2.3 Gender implications

The earnings effects of unpaid domestic and care work have been examined empirically in developed countries through standard wage equations augmented by various measures (see Maani and Cruickshank (2010) for a survey). Most of the existing studies focus on the amount of time spent on unpaid domestic and care work. The studies have obtained consistent evidence that an increase in the amount of time spent on unpaid domestic and care work has a negative wage effect for women. However, the evidence obtained for men is inconclusive.

Compared to the literature focusing on the effects of the time spent on unpaid domestic and care work, the literature on the timing and flexibility aspects is relatively sparse. Hersch (1991) found that in the state of Oregon in the United States, unpaid domestic and care work performed on a working weekday decreased women's wages, but it had no effect if performed on a weekend day. Noonan (2001) and Hersch and Stratton (2002) classify unpaid domestic and care work into "female-type" and "male-type" in their studies for the United States. The estimates obtained by these studies show that only the time spent on typically "female" tasks have a negative effect on wages. Bonke et al. (2005) found that the wages are lower for Danish women who spend more time on unpaid domestic and care work or perform domestic chores immediately before and after paid work during a workday. The estimates obtained by this study also showed that the timing and flexibility aspects of unpaid work have a greater punitive wage effect than the amount of time. Qi and Dong (2016), in their study for China, introduced three indicators to measure the degree to which unpaid domestic and care work may interfere with paid work, either by directly interrupting it or by being intertwined with it. Their estimates showed that the interference of unpaid domestic and care work with paid work lowers the earnings for both men and women, but the effect is larger for women.

The empirical analyses reviewed above suggest that the timing and flexibility aspects of unpaid care work are just as important for earnings as the amount. With time-use data, this aspect of unpaid domestic and care work can be quantified, and its earnings effects can be assessed.

As highlighted by the analytical examples which follow, key areas for policy attention in this context include promoting greater gender equality at home and family-friendly policies at the workplace. Specific measures could include educational campaigns that involve men in unpaid care work to change norms and attitudes, expanding state provision and financing of care services, and accommodating care duties in the workplace through flexible work schedules and provision of on-site care facilities (e.g. breast-feeding rooms and subsidized day care).

In the remainder of the chapter, an analytical example is conducted and explained step-by-step by using Stata.

7.3 Analytical logic

Two key elements underpin the analytic logic of the step-by-step approach in the example which follows. These are:

7.3.1 Construction of key indicators

In this analysis, paid work is defined as work:

1. in establishments
2. in primary production, and
3. in non-establishments.

Unpaid domestic and care work includes:

1. domestic chores, e.g. cooking, cleaning, house repair
2. care of persons such as children, the sick or disabled, and elderly, and
3. community services.

The analysis focuses on activities on a weekday.

Three indicators are constructed to measure the degree to which unpaid domestic and care work interfere with paid work.

First indicator: RUPT

This is a dummy variable which assumes the value of one for individuals who perform unpaid domestic and care work between two episodes of paid work at least once during a weekday, and zero otherwise. RUPT is expected to have a negative effect on productivity and earnings because individuals who interrupt their paid work hours in order to attend to domestic chores and caregiving duties may experience higher levels of stress or fatigue or be more distracted from their paid work.

Second indicator: SWITCH

This is the number of times an individual switches between paid work and unpaid domestic and care work during a weekday. SWITCH differs from RUPT in that RUPT only captures the interruption that occurs during the paid work time on a weekday, whereas SWITCH also takes into account whether an individual performs unpaid domestic and care work right before his/her paid work starts or ends. Specifically, if a woman prepared breakfast before going to work and rushed home to make supper after the paid work was over, but did not perform any domestic work during the paid work time,

RUPT is equal to zero and SWITCH is equal to two. However, if this woman also attended to domestic chores during the work break, RUPT is equal to one, while SWITCH is equal to three. The number of times an individual shifts from one type of work to another measures the extent to which the individual struggles to meet the conflicting needs of the job and the household. Because this balancing act is tiresome and distracting, SWITCH is expected to have a negative effect on productivity and earnings.

Third indicator: SIMU

Both RUPT and SWITCH are defined according to the primary activity in an interval. The third indicator, termed SIMU, takes into account information on secondary and tertiary activities that occur within an interval.[89] SIMU is a dummy variable that takes on the value of one for individuals who perform both paid work and unpaid domestic and care work in an interval either simultaneously or sequentially. It is tiresome and a source of distraction for a person to do paid work while keeping an eye on children or to shift between paid work and domestic chores within a short period. Thus, as with RUPT and SWITCH, SIMU is expected to have a negative effect on productivity and earnings.

7.3.2 Regression analysis

This element demonstrates how to assess the earnings effect of unpaid domestic and care work for women and men using the ordinary least squares (OLS) regression approach.[90] For this purpose, we estimate the earnings equation below:

$$LN\_E_i = \beta_0 + \beta_1 II_i + \beta_2 UPH_i + X_i^{'} \gamma + u_i$$

$$LN\_E_i = \beta_0 + \beta_1 II_i + \beta_2 UPH_i + X_i^{'} \gamma + u_i$$

where LN_E is the logarithm of monthly earnings; II is one of the three interference indicators; UPH is the number of hours spent on unpaid domestic and care work during a weekday; X is a vector of covariates that includes paid work hours, education, age and its squared term, race, marital status, number of children under seven living in the household, job characteristics, and provincial dummy variables; Greek letters represent unknown parameters; u is the error term; and the subscript *i* is the index of individuals.[91]

The earnings variable LN_E is derived from a categorical measure of monthly income with 12 classes by taking the mid-point of each class. In addition to the interference indicators, the variable of unpaid domestic and care work hours is included as a determinant of the earnings. To take into account that the time spent on paid work may be correlated with both the earnings and the variables for unpaid domestic and care work, the number of hours spent on paid work on a weekday are also included as one of the covariates of the earnings equation.

The earnings equation is estimated by OLS. For the simplicity of the exercise, this example does not address the potential endogeneity of the unpaid domestic and care work variables, arising from the

90 For discussion of primary and secondary activities, or overlapping and simultaneous activities, see Annex 3.

91 OLS regression is a statistic technique for estimating the unknown parameters in a linear regression model.

92 The earnings equation is specified based on the information available in the 2010 South Africa Time-use Survey.

fact that these variables may correlate with unobserved individual characteristics that also influence the earnings or be determined by the level of earnings. Intuitively, individuals who earn higher wages have higher opportunity costs of spending time on unpaid care work. These individuals, therefore, have a stronger incentive to outsource unpaid domestic and care work to the market and spend less time on it. This reverse causality can generate a spurious negative correlation between unpaid domestic and care work and earnings or overstate the magnitude of the earnings effect of unpaid domestic and care work. For solutions to the potential endogeneity problem, see Hersch and Stratton (1997).

7.4 Step-by-step example

7.4.1 Background: 2010 South Africa Time-use Survey

The empirical execution of the methods described above uses data from the 2010 South Africa Time-use Survey.[92]

The data used in the examples are drawn from two data files: (1) tus-2010-activities-v1-20140409 and (2) tus-2010-person-v1-20140409. File (1) contains the information collected through time diaries on what each respondent did during 30-minute intervals between 4:00 am on the day preceding the interview to 4:00 am on the day of the interview. Each respondent filed one diary on a randomly assigned day of the week. For each 30-minute interval, the diary reports up to three activities performed at the same time or one after the other. File (2) provides complementary information on respondents' education, age, sex, marital status, employment status, occupation, monthly income (by a categorical measure), geographical location, relation to head of family, occupation, type of dwelling, distance to work and school, household assets and so on. The data in both files provide sampling weights that can be used to make the empirical results representative for the entire civilian population of South Africa.

The sample for analysis consists of prime-age individuals (between 21 and 49 years inclusively) who are engaged in paid work on a weekday and have a monthly income greater than zero. The diaries for weekend days are not examined due to the consideration that the work-family conflict on a weekend day is not as intense as it is on a working weekday.

The examples are executed following the procedure below using Stata. [93]

7.4.2 Derivation of dependent and independent variables of interest

Derive the variables for the amount of time spent on paid work and unpaid domestic and care work (PH and UPH) and three interference indicators (RUPT, SWITCH and SIMU) from the data file: tus-2010-activities-20140409 and next merge these variables with the file: tus-2010-person-

93 The dataset used in this chapter can be publicly and freely accessed from https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/497 (accessed on 05 April 2021). Online registration is required.

94 Stata codes below are as provided by the primary contributor of the chapter material and have been issued with limited validation.

20140409 to create the sample for analysis. `use "D:\_Data\South Africa Time-use\tus-2010-activities-v1- /// 20140409.dta"`[94], `clear`

(Users may change the names of the path and folder that contains the data file.)

Generate the variables of total paid work time (paid) and total unpaid domestic and care work time (unpaid) based on primary activities:

```
gen p=0
replace p=Fulltime if Activ<4&Act==1
bysort UQNO PERSONNO: egen paid=total(p)
gen u=0
replace u=Fulltime if (Activ==4|Activ==5|Activ==6)&Act==1
bysort UQNO PERSONNO: egen unpaid=total(u)
```

Compute time spent on household maintenance (a1), care of persons (a2) and community services (a3).

```
gen a1=0
replace a1=Fulltime if Activity_code>400&Activity_code<500&Act==1
bysort UQNO PERSONNO: egen chore=total(a1)
gen a2=0
replace a2=Fulltime if Activity_code>510&Activity_code<600&Act==1
bysort UQNO PERSONNO: egen care=total(a2)
gen a3=0
replace a3=Fulltime if Activity_code>600&Activity_code<700&Act==1
bysort UQNO PERSONNO: egen volunteer=total(a3)
```

Generate the variable SIMU which indicates whether or not a person does paid and unpaid work simultaneously.

```
drop u p
gen p=0
replace p=1 if Activ<4
gen u=0
replace u=1 if Activ==4|Activ==5|Activ==6
```

Generate a variable s to count whether a person does paid and unpaid work simultaneously in a 30-minute interval.

```
gen s=0
replace s=10 if p==1
replace s=1 if u==1
bysort UQNO PERSONNO Timeslot: egen ss=total(s)
gen simu=0
replace simu=1 if ss==11|ss==12|ss==21
```

Note: ss=11 indicates that two activities take place with one being paid work and the other unpaid paid work; ss=12 indicates that three activities take place with two being unpaid work and one paid work; ss=21 indicates that three activities take place with two being paid work and one unpaid work.

95 ESCAP observation: Users should file path and folder to where the data is saved. This action will need to be repeated whenever importing the data. Furthermore, if an error occurs regarding the /// when copying and pasting the code into Stata, users may need remove the /// to execute code without errors. This action will need to be repeated whenever the /// are present. Otherwise, running the do-file directly in Stata should produce minimal errors.

```
bysort UQNO PERSONNO: egen SIMU=max(simu)
gen t=Fulltime if simu==1
bysort UQNO PERSONNO: egen SIMUtime=total(t)
drop s ss simu t
drop if Act>1
save Act, replace
```

Before generating the variables of SWITCH and RUPT, create the indicators of what a person does in the previous timeslot and the next timeslot. The indicator of what the person does in the current timeslot is already in the file Act. First, generate the indicators of paid and unpaid work activities in the next timeslot and save them in the file Next.

```
use Act, clear
replace Timeslot=Timeslot-1
replace Timeslot=48 if Timeslot==0
gen Nextp=p
gen Nextu=u
keep UQNO PERSONNO Timeslot Nextp Nextu
save Next, replace
```

Next, generate the indicators of activities in the previous timeslot and save them in the file Last.

```
use Act, clear
replace Timeslot=Timeslot+1
replace Timeslot=1 if Timeslot==49
gen Lastp=p
gen Lastu=u
keep UQNO PERSONNO Timeslot Lastp Lastu
save Last, replace
```

Now, combine the three files for activity in the current, next and previous timeslots.

```
use Act, clear
merge 1:1 UQNO PERSONNO Timeslot using Next
drop if _merge==2
drop _merge
merge 1:1 UQNO PERSONNO Timeslot using Last
drop if _merge==2
drop _merge
save Act, replace
```

Generate the variable SWITCH—number of times switching between paid and unpaid work.

```
use Act, clear
gen switch=0
replace switch=1 if p==1&(Lastu==1|Nextu==1)
replace switch=2 if p==1&(Lastu==1&Nextu==1)
bysort UQNO PERSONNO: egen SWITCH=total(switch)
```

Generate the variable RUPT, which =1 if daily paid work is interrupted by unpaid work.

```
gen start=.
replace start=Timeslot if p==1&Lastp==0
gen end=.
replace end=Timeslot if p==1&Nextp==0
bysort UQNO PERSONNO: egen Start=min(start)
bysort UQNO PERSONNO: egen End=max(end)
gen rupt=0
replace rupt=1 if u==1&Timeslot>Start&Timeslot<End
bysort UQNO PERSONNO: egen RUPT=max(rupt)
```

Calculate the amount of unpaid domestic and care work performed during the daily paid work period.

```
gen b1=0
replace b1=a1 if rupt==1
bysort UQNO PERSONNO: egen chore1=total(b1)
gen b2=0
replace b2=a2 if rupt==1
bysort UQNO PERSONNO: egen care1=total(b2)
gen b3=0
replace b3=a3 if rupt==1
bysort UQNO PERSONNO: egen volunteer1=total(b3)
drop p u a1 a2 a3 b1 b2 b3 switch Next* Last* start end Start End rupt
```

Now, create a sample which has one observation on each activity variable for one person and save it in the file Act.

```
keep if Timeslot==1
save Act, replace
```

Merge the file Act with the file that provides information on individual characteristics.

```
use "D:\_Data\South Africa Time-use\tus-2010-person-v1- /// 20140409.dta", clear
merge 1:1 UQNO PERSONNO using Act
```

Create a sample that consists of individuals aged between 21 and 49 who perform paid work on a weekday and have positive monthly income.

```
keep if Q52DayDiary<6
ren Q117Age Age
keep if paid>0
keep if Age>20&Age<50
keep if Q46TotIncome>1 & Q46TotIncome<13
```

The sample is used for the five examples below:

EXAMPLE – 1

Compute the average hours spent on paid and unpaid domestic and care work, household maintenance, care of persons and community services, total work hours, and proportion of the individuals performing unpaid domestic and care work on a weekday by gender.

```
gen Female=Q116Gender-1
replace paid=paid/60
replace unpaid=unpaid/60
gen total=paid+unpaid
replace chore=chore/60
replace care=care/60
replace volunteer=volunteer/60
gen Participation_upw=(unpaid>0)
```

To be representative for the population, summary statistics are weighted by sampling weights provided in the dataset.

```
svyset UQNO [pweight=Weight]
svy: mean paid unpaid chore care volunteer Participation_upw ///[95] total if Female==0
svy: mean paid unpaid chore care volunteer Participation_upw /// total if Female==1
```

The output file results are then used to create the following table.

Table 7.1. Time spent on paid work and unpaid care work

	Men		Women	
	Weekday (hours)	Standard deviation	Weekday (hours)	Standard deviation
Paid work	8.49	0.07	6.97	0.08
Unpaid care work	1.03	0.03	2.82	0.05
% doing unpaid care work	64.3		88.7	
Components of unpaid care work				
Household maintenances	0.91	0.03	2.38	0.05
Care of persons	0.07	0.01	0.37	0.02
Community services	0.05	0.01	0.06	0.01
Total work time	9.52	0.07	9.79	0.06
Observations	4,436		3,899	

As indicated in Table 7.1, in South Africa, just as is in other countries, women spend less time on paid work than men do and more time on unpaid domestic and care work. Of those who participated in paid work on a weekday, 88.7% of women and 64.3% of men were engaged in unpaid domestic and care work.

96 ESCAP observation: If copying and pasting the code, the forward slashes (///) may need to be removed to execute the code fully.

EXAMPLE – 2

Compute summary statistics for RUPT by gender. The statistics include the percentage of individuals performing unpaid domestic and care work during the paid work period, the mean hours spent on unpaid domestic and care work during the paid work period, and it's the share in total unpaid domestic and care work time.

```
replace chore1=chore1/60
replace care1=care1/60
replace volunteer1=volunteer1/60
gen unpaid1=chore1+care1+volunteer1
gen percent=unpaid1/unpaid*100
svy: mean RUPT unpaid1 chore1 care1 volunteer1 if Female==0
svy: mean RUPT unpaid1 chore1 care1 volunteer1 if Female==1
svy: mean percent if Female==0
svy: mean percent if Female==1
```

The output file results are then used to create the following table.

Table 7.2. Performing unpaid care work during the paid work period on a weekday

	Men		Women	
	Mean	**Standard deviation**	**Mean**	**Standard deviation**
Percent performing unpaid care work during the paid work period (RUPT) (%)				
	10.68	0.60	17.89	0.86
Amount of time spent on unpaid care work (hours)				
Total	0.13	0.01	0.32	0.02
Household maintenances	0.11	0.01	0.26	0.02
Care of persons	0.01	0.00	0.03	0.00
Community services	0.01	0.00	0.03	0.01
Observations	4,436		3,899	
Percent in total unpaid care work time (%)	11.32	0.67	10.33	0.61
Observations	2,919		3,525	

The statistics presented in Table 7.2 show that compared with men, women have a higher likelihood of performing unpaid domestic and care work during the paid work period (10.7% versus 17.9%).

EXAMPLE – 3

Compute summary statistics for SWITCH by gender. The statistics include the mean number and the distribution of times an individual switched between paid work and unpaid domestic and care work during a weekday.

```
svy: mean SWITCH if Female==0
svy: mean SWITCH if Female==1
svy: tabulate SWITCH if Female==0
svy: tabulate SWITCH if Female==1
```

Then create Table 7.3 using the output file results.

From Table 7.3, the average number of times an individual switched between two types of work activity during a weekday is higher for women than for men (0.94 versus 0.48). For those who engaged in paid work on a weekday, about 58% of women switched from one type of work to another at least once, which is 23 percentage points higher than men at 35%.

Table 7.3. Number of times an individual switched between paid work and unpaid care work during a weekday

	Men	Women
Total number of times activity was switched		
Mean	0.481	0.935
Linearized S.D.	0.015	0.024
% of 0 time	65.07	42.12
% of 1time	25.29	34.50
% of 2 times	7.16	16.04
% of 3 times	1.75	4.20
% of >3 times	0.73	3.14
Observations	4,436	3,899

EXAMPLE – 4

Compute summary statistics for SIMU by gender. The statistics include the percentage of individuals performing both types of work simultaneously or sequentially in any 30-minute interval and the mean hours spent on unpaid domestic and care work of such nature by those individuals.

```
replace SIMUtime=SIMUtime/60

svy: tabulate SIMU if Female==0
svy: tabulate SIMU if Female==1
svy: mean SIMUtime if Female==0&SIMU>0
svy: mean SIMUtime if Female==1&SIMU>0
```

This generates the statistics in the following table.

Table 7.4. Performing both paid and unpaid work in a 30-minute interval on a weekday

	Men	Women
% (SIMU)	8.66	14.90
Observations	4,436	3,899
Time amount: mean	0.68	0.80
Linearized S.D.	0.02	0.03
Observations	386	608

Once again, findings show that women have a higher probability of performing both types of work in at least one 30-minute interval during a weekday (8.7% versus 14.9%).

EXAMPLE – 5

Estimate the earnings equation using OLS sampling weights for men and women separately. The standard errors are robust to intra-province clustering.

First, generate the explanatory variables involved in the regression.

```
gen Agesq=Age*Age
gen Married=0
replace Married=1 if Q23MaritalStatus<3
replace Q29Child06HH=0 if Q29Child06HH>9
gen Income=.
replace Income=100 if Q46TotIncome==2
replace Income=350 if Q46TotIncome==3
replace Income=750 if Q46TotIncome==4
replace Income=1250 if Q46TotIncome==5
replace Income=2000 if Q46TotIncome==6
replace Income=3000 if Q46TotIncome==7
replace Income=4000 if Q46TotIncome==8
replace Income=5250 if Q46TotIncome==9
replace Income=7000 if Q46TotIncome==10
replace Income=9500 if Q46TotIncome==11
replace Income=15000 if Q46TotIncome==12
gen logIncome=log(Income)
```

Estimate three earnings equations for men and store the results that will be presented in Table 7.5 together with the estimates for women.

```
xi: reg logIncome RUPT paid unpaid i.Q118Population Age Agesq ///[96] Married
Q29Child06HH i.Education_Status i.Q44Wrk4Whom i.Indus /// i.Occup i.Province
[pweight=Weight] if Female==0, ///
vce(cluster Province)
est store x1
xi: reg logIncome SWITCH paid unpaid i.Q118Population Age /// Agesq Married
Q29Child06HH i.Education_Status i.Q44Wrk4Whom /// i.Indus i.Occup i.Province
[pweight=Weight] if Female==0, /// vce(cluster Province)
est store x2
xi: reg logIncome SIMU paid unpaid i.Q118Population Age Agesq ///
Married Q29Child06HH i.Education_Status i.Q44Wrk4Whom i.Indus ///
i.Occup i.Province [pweight=Weight] if Female==0, ///
vce(cluster Province)
est store x3
```

Estimate three earnings equations for women and store the results.

```
xi: reg logIncome RUPT paid unpaid i.Q118Population Age Agesq /// Married
Q29Child06HH i.Education_Status i.Q44Wrk4Whom i.Indus /// i.Occup i.Province
[pweight=Weight] if Female==1, ///
vce(cluster Province)
est store x4
xi: reg logIncome SWITCH paid unpaid i.Q118Population Age ///
Agesq Married Q29Child06HH i.Education_Status i.Q44Wrk4Whom /// i.Indus i.Occup
i.Province [pweight=Weight] if Female==1, /// vce(cluster Province)
est store x5
xi: reg logIncome SIMU paid unpaid i.Q118Population Age Agesq ///
Married Q29Child06HH i.Education_Status i.Q44Wrk4Whom i.Indus ///
i.Occup i.Province [pweight=Weight] if Female==1, ///
```

97 ESCAP observation: If copying and pasting the code, the forward slashes (///) may need to be removed to execute the code fully.

```
vce(cluster Province)
est store x6
```

Present the results of six regressions in a table.

```
outreg2 [97][x1 x2 x3 x4 x5 x6] using 1.doc, /// dec(3)alpha(0.01,0.05,0.1) replace
```

The output file contains regression estimates which are presented in Table 7.5. The main coefficients of interest presented in the table are those on work interference and unpaid domestic and care work time. The estimates in the first three rows consistently show that the interference of unpaid domestic and care work has a significant negative effect on earnings only for women. Numerically, the monthly earnings of women whose paid work is interrupted by unpaid domestic and care work are 9% lower than the earnings of those whose paid work is not interrupted. Moreover, an additional switch between the two types of work decreases women's monthly earnings by 3.2%. Furthermore, compared to women who do not perform both paid work and unpaid domestic and care work in any 30-minute interval during a weekday, women who undertake both types of work earn 13% less.

As the estimates for interference indicate, the estimates of unpaid domestic and care work time also show that the amount of time spent on such activity has a significant negative earnings effect only for women. Quantitatively, an additional unpaid domestic and care work hour during a weekday decreases women's monthly earnings by 2%.

Next, calculate the overall earnings effects of unpaid domestic and care work for women by multiplying the coefficients of each interference indicator and of unpaid domestic and work time by the mean value of the respective variable. The estimates show that the interference of unpaid domestic and work, measured by RUPT, SWITCH and SIMU, reduces women's earnings by 1.6, 3.0 and 1.9%, respectively, while the amount of unpaid domestic and care work time decreases women's earnings by 6.5, 5.4 and 6.8%, respectively. Adding up the effect of unpaid work time and one of the interference effects, it shows that, on average, unpaid domestic and care work decreases women's monthly earnings by 8.1, 8.4, and 8.7%. Given that the earnings gap between men and women in the sample is 18%, the effects of unpaid domestic and care work amount to 45 to 48% of the gender earnings gap.

```
save "D:\_Data\South Africa Time-use\Problem 2.dta"
```

98 ESCAP observation: If copying and pasting the code, the forward slashes (///) may need to be removed to execute the code fully. Furthermore, users may need to install "outreg2" first using Stata code: ssc install outreg2

Table 7.5. OLS estimates of the earnings equation for prime-aged men and women

	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Log income	7.74			7.56		
RUPT	-0.014			-0.092***		
	(0.047)			(0.027)		
SWITCH		-0.003			-0.032**	
		(0.022)			(0.014)	
SIMU			0.082			-0.135**
			(0.051)			(0.044)
Paid work	0.009**	0.010**	0.010**	0.018*	0.019*	0.016*
• Time	(0.004)	(0.004)	(0.004)	(0.008)	(0.008)	(0.009)
Unpaid work	-0.011	-0.011	-0.014	-0.023**	-0.019**	-0.024**
• Time	(0.017)	(0.018)	(0.017)	(0.007)	(0.008)	(0.008)
Colored	0.453***	0.453***	0.452***	0.229***	0.233***	0.239***
	(0.073)	(0.073)	(0.072)	(0.067)	(0.069)	(0.067)
Indian/Asian	0.389***	0.389***	0.391***	0.400***	0.401***	0.385***
	(0.084)	(0.083)	(0.082)	(0.050)	(0.050)	(0.046)
White	0.828***	0.828***	0.830***	0.564***	0.567***	0.567***
	(0.145)	(0.146)	(0.145)	(0.072)	(0.076)	(0.073)
Age	0.035**	0.035**	0.035**	0.059**	0.059**	0.058**
	(0.013)	(0.013)	(0.013)	(0.019)	(0.019)	(0.019)
Age^2	-0.000	-0.000	-0.000	-0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married	0.146***	0.146***	0.148***	0.110	0.112	0.114*
	(0.035)	(0.035)	(0.035)	(0.062)	(0.061)	(0.060)
Children 0-6	0.004	0.004	0.003	-0.031*	-0.030*	-0.029*
	(0.029)	(0.029)	(0.029)	(0.015)	(0.014)	(0.015)
Primary not completed	-0.034	-0.034	-0.035	-0.021	-0.017	-0.021
	(0.157)	(0.158)	(0.157)	(0.095)	(0.094)	(0.099)
Primary completed	0.010	0.010	0.009	-0.014	-0.005	-0.009
	(0.139)	(0.139)	(0.138)	(0.125)	(0.127)	(0.126)
Secondary not completed	0.209	0.209	0.210	0.165	0.172	0.168
	(0.151)	(0.151)	(0.149)	(0.118)	(0.119)	(0.122)

	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Secondary completed	0.510***	0.510***	0.512***	0.452***	0.459***	0.450**
	(0.150)	(0.151)	(0.149)	(0.131)	(0.132)	(0.134)
Tertiary	0.922***	0.922***	0.920***	0.878***	0.887***	0.876***
	(0.151)	(0.152)	(0.150)	(0.100)	(0.102)	(0.107)
Other educational category	0.362*	0.362*	0.358*	0.298	0.281	0.296
	(0.189)	(0.189)	(0.184)	(0.254)	(0.253)	(0.245)
Work for others for pay	1.642***	1.646***	1.641***	0.549***	0.520***	0.553***
	(0.239)	(0.239)	(0.224)	(0.119)	(0.125)	(0.120)
Employer	1.821***	1.825***	1.818***	0.651***	0.621***	0.658***
	(0.230)	(0.231)	(0.218)	(0.141)	(0.151)	(0.143)
Own account worker	1.167***	1.171***	1.165***	0.115	0.088	0.109
	(0.243)	(0.242)	(0.230)	(0.128)	(0.138)	(0.130)
Unpaid helper in	-	-	-	0.297	0.266	0.303
HH business				(0.216)	(0.223)	(0.207)
Industry	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
Occupation	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
Province	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
Constant	5.575***	5.574***	5.572***	5.515***	5.492***	5.543***
	(0.304)	(0.305)	(0.302)	(0.372)	(0.362)	(0.373)
R-squared	0.558	0.558	0.559	0.604	0.604	0.605
Observations	4,436	4,436	4,436	3,899	3,899	3,899

*Notes: ***, **, and * denote significance levels of 1%, 5% and 10%, respectively.*

Chapter summary

Using five examples, this chapter explained (1) how to measure the degree to which unpaid care work interferes with paid work, using time-use data on episode occurrences and sequences, and (2) how to estimate its effects on men's and women's earnings.

The results obtained from the 2010 South Africa Time-use Survey show that the timing and flexibility aspects of unpaid care work are as important for understanding gender earnings differentials as the amount of unpaid care work.

The analyses revealed the need for promoting greater gender equality at home and for family-friendly policies at the workplace. Specific measures could include educational campaigns that involve men in unpaid care work to change norms and attitudes, expanding state provision and financing of care services, and accommodating care duties in the workplace through flexible work schedules and provision of on-site care facilities (e.g. breast-feeding rooms and subsidized day care).

These policy measures are essential for achieving SDG target 5.4 of promoting shared responsibility for unpaid domestic and care work within the household, and SDG target 8.5 of achieving full and productive employment and decent work for all women and men.

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CHAPTER 8

EXPANDING UNDERSTANDINGS OF POVERTY: TIME POVERTY REVEALED BY TIME-USE DATA

CHAPTER 8: EXPANDING UNDERSTANDINGS OF POVERTY: TIME POVERTY REVEALED BY TIME-USE DATA

This chapter is an edited version of material provided by Ozge Ozay to the ESCAP Statistics Division in 2018.

Chapter overview: This chapter introduces the concept of time poverty. This can be defined as not having enough time for oneself after the time spent on paid employment and/or unpaid work are taken into account.

The chapter discusses (i) the notion of time poverty and its different measures; (ii) calculation of time poverty thresholds using time-use survey data; and (iii) assessment of the incidence of time poverty across different groups of the population.

This chapter draws on the 2014-2015 Turkish Time-use Survey. Stata is used to perform the empirical analysis in this chapter and multivariate regression analysis is used.

8.1 Chapter focus

There has long been a consensus over the importance of studying, measuring, and eradicating income poverty. By its very definition, income poverty is built on the mainstream economic definition of working in return for remuneration in the paid sphere of the economy. Time poverty, the concept of not having enough time for oneself due to working disproportionately long hours in paid employment, performing domestic chores, and/or taking care of dependents at home, has also gained recognition among researchers in the last few decades as another dimension of poverty. The concept of time poverty has the advantage of highlighting the significant amount of labour time that women spend on unpaid work activities and of recognizing its impact on their options and well-being. As such, the concept is fundamental in recognizing and acknowledging the unpaid economic activities that mainstream economics has generally ignored, which are shouldered predominantly by women.

8.1.1 Time poverty a crucial lens on gender dimensions of unpaid work

Unpaid domestic work such as washing and ironing clothes, cooking, doing the dishes, and cleaning the dwelling, as well as feeding, supervising, and caring for children, the elderly and those members of the household who cannot look after themselves are tasks to maintain the household and its members. Doing domestic/household chores and non-care domestic work/labour are used interchangeably in this chapter to refer to the activities of maintaining the household, while care labour or reproductive care work will be used interchangeably to refer to the time spent on caring for children, older persons, etc.

Research shows that women carry a disproportionate responsibility for such unpaid work, resulting in a "double burden" or "second shift as they increasingly also participate in the labour force." (Gershuny 2000; Floro and Komatsu, 2011; Hochschild and Machung 1989).

8.1.2 New insights on time poverty using time-use data

Time-poverty research has been made possible by the increased use of time-use surveys, especially in the last two decades, by countries in both the global North and the global South. One important strand of time-poverty literature focuses on the effects of time poverty on the maintenance of physical health through physical exercise, food preparation and healthy eating. Mothersbaugh et al. (1993) found that perceptions of time pressure have adverse effects on individuals' eating habits and on recommended dietary practices. Moreover, using the American Time-use Survey, Christian (2009) showed that longer commutes and the time spent in exercise and other health-related activities were negatively related. Spinney and Millward (2010) found that time poverty may be a more important barrier to physical exercise than income poverty.

The research on the gendered dimension of the relationship between time strain and well-being is mainly motivated by a growing recognition that the aforementioned unpaid work performed by women is an essential factor in their well-being. This is explored by Hunt and Annandale (1993), who show that long hours spent in domestic work is significantly associated with poorer health for women. Likewise, a key finding of the MacDonald et al. (2005) study of Canadian households is that women's longer hours of unpaid work contribute to women experiencing more stress than men, and that hours spent on eldercare and housework are particularly stressful.

In this chapter, varied definitions of time poverty are discussed, and the methods proposed for calculating the time-poverty thresholds are reviewed. It uses the 2014-2015 Turkish Time-use Survey (TTUS) (refer Section 8.4.1 for elaboration). Turkey has the highest gender-participation gap in formal labour market employment among all OECD countries (39.5 percentage point difference in 2016 between the labour force participation rate of men and women—72% for men and 32.5% for women). It therefore exemplifies one of the most severe cases of unequal division of labour at home. Turkey is third among the OECD countries in terms of the extra unpaid work time that women spend over men—224 minutes on an average day (OECD Gender Portal, 2018).

Since one of the aims of this chapter is to find out the double burden effect of adding unpaid domestic labour to paid employment, time-poverty thresholds for employed men and women of working age 15-64 are calculated. The chapter also shows how the incidence of time poverty is estimated for working-age employed women and men in Turkey. It provides Stata commands for modifying the TTUS data files in order to convert them into a form that is compatible with calculating time-poverty rates. Furthermore, it demonstrates how the estimation of these rates differ for different income groups.

8.2. Relevance

8.2.1 Linkages to the Sustainable Development Goals (SDGs)

Poverty in its most general form can be defined as the lack of resources necessary to maintain a "minimally decent life" (Blank, 2008). As such, being non-poor implies having the resources to promote one's safety, health, development, leisure, self-actualization, etc. According to this notion of poverty, it is obvious that income poverty does not capture the multidimensional aspect of being poor, since money cannot buy everything (Harvey and Mukhopadhyay 2007) and sufficient income does not ensure access to the resources guaranteeing a decent life (Williams et al. 2016). This is why most poverty indices used by international policy organizations are no longer unidimensional.

Chronic and severe time pressures have serious implications for a person's health and functioning and make the issue of time poverty a basic policy concern (Beneria et al., 2016). Any inquiry into people's welfare must involve not only asking how much people earn, but also how they use their time in order to produce and/or acquire the goods and services to meet their needs. As such, the notion of time poverty has facilitated the development of new indicators of well-being while shedding light on less recognized forms of deprivation.

This broadens the policy discourse addressing SDG 1 on ending poverty in all its forms everywhere. As Zacharias (2017) has pointed out, not incorporating time poverty into conventional poverty assessments implies either that everyone has enough time available to devote to unpaid domestic work, or that they have enough resources to compensate for time deficits by purchasing market substitutes. Zacharias (2017) also reports that once time deficits are taken into account, the adjusted poverty rate makes the "hidden poor" visible, and in some cases, this doubles the official poverty rate.

Time-poverty research is also relevant to SDG 5, achieving gender equality and empowering all women and girls, specifically target 5.4, "Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate". Uneven gendered division of labour at home becomes most visible through time-poverty research.

Finally, there is a close link between time poverty and SDG 3 on ensuring healthy lives and promoting well-being for all at all ages. SDG Target 3.4 includes a reference to the promotion of mental health and well-being. As elaborated below, this can be directly related to time pressures and stress experienced by women in particular as a result of multiple simultaneous activities and lack of leisure time.

8.2.2 Implications for domestic policy

The concept of time poverty is directly applicable to domestic policy formulation in areas ranging from national poverty reduction strategies to health, childcare provision, care of older persons and infrastructure development. Income poverty and time poverty may furthermore also be related to each other. Being both income- and time-stressed could severely trap people in lifetime income strain, or even across generations, since it impedes the possibility of upward income mobility. Gammage (2010), for example, argues that experiencing time poverty affects not only current functioning, but also the future, as it limits people's ability to rest, to enjoy recreation, and to invest in expanded opportunities by acquiring more capabilities through, for example, formal education. It could mean less access to education, decreased socialization and hence social capital (this could prove vital in the case of finding outside help for childcare in time of need), and even less access to paid work. These are all important considerations from an evidence-based and gender-responsive policy research, analysis and formulation perspective.

8.2.3 Gender implications

As noted above, research shows that women generally carry a "double burden" as a result of their increased participation in the labour force while continuing to be predominantly responsible for unpaid work at home. For example, the compilation of time-use survey results on the OECD Gender Portal shows that women are still working longer hours than men in 23 of 28 OECD countries for

which time-use surveys are available, in addition to the non-OECD countries of China, India and South Africa.[98] The decreased well-being due to this increased time commitment can be captured by time-use studies and time-poverty measures. Furthermore, as Burchardt (2008) shows, now that women are working outside the home, they are likely to accommodate to the increased demands of their time by reducing their leisure time and doing simultaneous activities, for example in the case of home-based workers (Floro and Pichetpongsa, 2010). Women therefore increase not only their total work hours, but also the incidence of work intensity (Srivastava and Floro 2017). Apart from the longer hours of combined unpaid and paid work and/or the greater work intensity experienced by women, evidence also suggests that they have a lower quality of leisure time. Using the 1992 Australian Time-use Survey, Bittman (2004) showed that men have more hours of pure leisure uncontaminated by unpaid work. He also found that men's leisure is less likely to be interrupted as compared to that of women.

8.3 Analytical logic

8.3.1 Two research strands expand the understanding of time poverty

Time poverty as a concept originated in Vickery's seminal study (1977). At the time of her writing, the minimum money threshold was based on the assumption that basic necessities, such as food and childcare, were produced within the household, hence the insight that a minimal non-poor level of consumption required resources of both money and time. This necessitated a two-dimensional poverty definition that made visible the time commitment required by the consumption threshold. Accordingly, households were considered poor if they had less than a certain combination of time and money. This produced two main strands of literature:

- one strand used time poverty to complement income or consumption poverty measures, thus producing time-adjusted income or consumption poverty thresholds;
- the other strand used stand-alone time-poverty measures focusing on the broader context of time deprivation.[99]

In order to calculate a weekly measure of the time that ought to be allocated to work and leisure, Vickery (1977) deducted from 168 hours (7x24 hours = 168 hours) the time required to maintain an individual's mental and physical well-being (necessary personal time) and the amount of time needed for the individual to contribute to maintaining the household (necessary minimal household

99 The OECD Gender Portal (2018) compiles the latest available time-use survey results for 28 countries and presents the time spent on unpaid work, paid work, personal care, and leisure on an average day by men and women in these countries. Although individual time-use survey methodologies and samples differ, the compilation shows that except for Sweden, Norway, Denmark, Netherlands and New Zealand, the summation of unpaid (domestic chores, care of dependents, voluntary activities) and paid work (employment for pay) by women outweighs that of men on an average day. The difference ranges from 91 minutes (Portugal) to -27 minutes in a day (Netherlands). Furthermore, even in these five countries time spent on unpaid work by women outweighs that of men. For more information on gender differences on time spent in paid and unpaid work, please visit the OECD data portal page, which was accessed on 05 April 2021: https://stats.oecd.org/index.aspx?queryid=54757 (time period can be changed). See the general employment data page for access to the time spent in paid and unpaid work indicator: https://www.oecd.org/gender/data/employment/ (accessed on 05 April 2021).

100 There was also a third strand (not discussed here) that investigated subjective notions of perceived time pressure based on individuals' perceptions as to whether they felt time pressured or not. Mothersbaugh et al. (1993) and Hamermesh and Lee (2007) exemplify this approach. For further information, refer to https://www.nber.org/papers/w10186 (accessed on 05 April 2021) (accessed on 05 April 2021).

maintenance). The second deduction differed according to the household composition. If the actual hours worked by the individual per week were higher than this figure, the person was deemed time poor.

The first strand of research—time poverty coupled with income poverty—followed Vickery's lead:

- Douthitt (2000) updated Vickery's poverty thresholds using the 1985 American Time-use Survey.
- Harvey and Mukhopadhyay (2007) built their analysis on Vickery's with a few differences in the calculations of necessary personal time and necessary minimal household maintenance, using the 1998 Canadian General Social Survey data.
- Bardasi and Wodon (2010) combined their definition of time poverty (working long hours) with consumption poverty in calculating time-poverty thresholds and rates for Guinean households using the 2002-2003 survey. They found that women living in rural areas were more likely to be time- and consumption-poor than men and those living in urban areas.
- Zacharias et al. (2014) also built on Vickery's notion, explicitly taking into account intra-household disparities in time allocation to develop a two-dimensional measure of poverty. They applied this model using the 2006 Turkish Time-use Survey and found that consumption-poor individuals and households encountered higher rates of time poverty.

The second strand of literature—focusing on time poverty in and of itself—measures time poverty by judging the availability of time against a threshold. Although there are some nuances in the definitions, time poverty is usually defined as working too much (in paid employment, and/or at home doing domestic chores and taking care of dependents, and sometimes voluntary activities) or as having too little free time. The nuances result from the different categorization of major time domains and the activities that are associated with them.

8.3.2 Classifying time domains

One classification of time domains that has been widely used in the literature is that of Ås (1978). A person's use of time can be classified as: contracted time, committed time, necessary time, and free time:

- Contracted time refers to paid work and travel in pursuit of work.[100] The term "contracted" refers to the obligatory nature of the time devoted to these activities.
- Committed time refers to the "amount of time dedicated to unpaid work such as housework, care of children, shopping, or provision of help to others, and associated travel" (Spinney and Millward, 2010). In other words, committed time refers to maintaining one's home and one's family.
- Necessary time is the personal time required to maintain oneself such as sleeping, bathing, eating, etc.
- Free time or discretionary time is what is left over when the total of contracted, committed and necessary time is deducted from the 24 hours (or 1,440 minutes) of the day. Free time then includes time for leisure, pursuing one's hobbies and interests, socializing, and participating in community, religious and civic events.

101 Some researchers include education in contracted time (e.g. Harvey and Mukhopadhyay, 2007).

Based on Ås's terminology (1978), researchers do not always agree on what counts as committed, contracted, necessary and free time. Nonetheless, it is possible to operationalize the concept. Some time-poverty measures are based on having too little free time. These methods deem people time poor if they have less than a stated proportion of the median free time distribution of a given population. Then, there are the methods based on working "too much". These methods treat time poverty as working more than a stated proportion of the median of some combination of the contracted and committed time distribution of a population.

8.3.3 Defining and measuring time poverty

One method based on free time was developed by Bittman (2002). This method calculates time poverty independently from income poverty and defines time poverty as having free time that is equal to or less than 50% of the median free time distribution. He found that, in Australia, the major causes of leisure time poverty are: being a woman, having family responsibilities, and longer hours of work.

Another free-time poverty threshold method proposed by Burchardt (2008) used 60% of the median of the free time as a threshold for time poverty. Kalenkoski et al. (2011) used a similar method to calculate the time-poverty thresholds for certain subgroups in the U.S. population and estimate the incidence of time poverty in those groups. These researchers defined time poverty as not having enough free time to engage in leisure or in educational and other activities that improve well-being.

Spinney and Millward (2010) focused on the combined measure of contracted and committed time and defined time poverty as 150% or more of the median of the summation of the contracted and committed time distribution. Using the 2003-2006 American Time-use Survey, they found that individuals with children have less free time and are more likely to be time poor. Bardasi and Wodon (2006) also used a combined measure of contracted and committed time. Their time-poverty thresholds corresponded to 1.5 times or twice the median of the sum of the contracted and committed time distribution. Using the 2002-2003 Guinea survey, they found that wealthier individuals are more prone to time poverty.

In Ireland, McGinnity and Russel (2007) based their time-poverty threshold on 60% of the median of what they called "uncommitted time", i.e. the time left when the sum of contracted and committed time is deducted from 24 hours. They found high workloads among the employed and those caring for younger children and adults.

For purposes of this chapter, Burchardt's above-mentioned method of calculating time poverty (2008) is used.[101] In order to find out whether the double burden is true for women in Turkey, the relevant sample is the working-age, part-time or full-time employed men and women.

102 The median of the distribution is used to follow the practice of other researchers. Also, it is known that some activities have skewed distributions (Kalenkoski et al. 2011).

8.4 Step-by-step example

8.4.1 Background: The Turkish Time-use Survey (TTUS)

This section demonstrates a hands-on example of calculating the type of time-poverty threshold developed by Burchardt (2008). It draws on the 2014-2015 Turkish Time-use Survey (TTUS).[102]

The current study sample data consist of 10,016 working male and female respondents aged 15-64 years, the amount of contracted, committed, personal and free time (as defined above) is estimated. Using the estimated time-poverty threshold, the proportion of the sampled population whose free time falls below the threshold ("time-poor") is then found. Time-poverty rates for different income groups are also estimated.

The TTUS 2014-2015 provides time-use data for 25,109 individuals aged 10 and older living in 9,073 households. Individuals reported their daily activities on two days—a week day and a weekend day—and their primary activity every 10 minutes. These activities were classified according to Eurostat activity coding list. [103]

The TTUS data set is composed of three separate data files—household, individual and diary. All three files have a variable identifying each household in the data set and can be used to merge files:

1. The household data file titled hane.dta gives information about the socioeconomic characteristics of households, e.g. type of housing, household income in five income intervals, whether or not they own the dwelling they live in, the number of TVs and other electronics the household owns.
2. The individual data file titled fert.dta has an individual identifier in addition to the household identifier to give a unique value to each member of the household. It gives information about the characteristics of the individuals surveyed, e.g. age, marital status, income, employment status, education status. Since the Turkish Statistical Institute surveyed only individuals of 10 years or older, this data set does not have information on household members younger than 10 years.
3. Lastly, the diary data file titled gunluk.dta provides information about the surveyed individual's primary activity on a weekday and a weekend day, as well as information on the order of the activity, the starting and ending time, its location, and whether the individual was alone performing the activity. It contains the individual identifier variable in addition to the household identifier. The format of the diary data file is called "long format" in Stata, because the same individual appears multiple times in the data.[104]

---

103 The dataset used in this chapter is not available publicly. For more information on accessing the data, please see https://data.tuik.gov.tr/en/display-bulletin/?bulletin=time-use-survey-2014-2015-18627 (accessed 20 October 2020). If the link is not accessible, please search for the 2014-2015 Time Use Survey data using this link https://data.tuik.gov.tr/Kategori/GetKategori?p=Employment,-Unemployment-and-Wages-108 (check "Time Use Statistics" under Sub Categories in the left pane, accessed on 05 April 2021).

104 For further information, refer to: https://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=TIMEUSE_08&StrLanguageCode=EN&IntPcKey=&StrLayoutCode=HIERARCHIC. The Harmonised European Time Use Surveys (HETUS) Guidelines (2018): https://ec.europa.eu/eurostat/documents/3859598/9710775/KS-GQ-19-003-EN-N.pdf/ee48c0bd-7287-411a-86b6-fb0f6d5068cc (accessed on 05 April 2021).

105 Stata codes are provided by the primary contributor of the chapter material and have been issued without validation as the data set is not publicly accessible.

STEP 1: Generation of subsample

For calculating the time-poverty threshold and the proportion of time-poor working-age employed women and men living in Turkey, only the diary file and the individual micro data file are needed.

Because one of the goals of this chapter is to calculate the time-poverty thresholds for working men and women of working-age (15-64) according to the method used by Burchardt (2008), a subsample needs to be generated first.

In order to select the sample of working women and men (aged 15-64 years) from the TTUS data, a fert.dta file needs to be opened first. In this file, age is categorized as discrete values between 10-19, and in intervals of four years from 20 to 80+, as 20-24, 25-29, 30-34,… 80+. In order to create a variable called age that takes the mid-value for the age intervals, the following Stata commands can be used:[105]

```
gen age=.
replace age= 22 if yas_hesaplanan== "20-24"
replace age= 27 if yas_hesaplanan== "25-29"
replace age= 32 if yas_hesaplanan== "30-34"
replace age= 42 if yas_hesaplanan== "40-44"
replace age= 52 if yas_hesaplanan== "50-54"
replace age= 62 if yas_hesaplanan== "60-64"
replace age= 72 if yas_hesaplanan== "70-74"
replace age= 37 if yas_hesaplanan== "35-39"
replace age= 47 if yas_hesaplanan== "45-49"
replace age= 57 if yas_hesaplanan== "55-59"
replace age= 67 if yas_hesaplanan== "65-69"
replace age= 77 if yas_hesaplanan== "75-79"
replace age= 80 if yas_hesaplanan== "80+"
replace age= 10 if yas_hesaplanan== "10"
replace age= 11 if yas_hesaplanan== "11"
replace age= 12 if yas_hesaplanan== "12"
replace age= 13 if yas_hesaplanan== "13"
replace age= 14 if yas_hesaplanan== "14"
replace age= 15 if yas_hesaplanan== "15"
replace age= 16 if yas_hesaplanan== "16"
replace age= 17 if yas_hesaplanan== "17"
replace age= 18 if yas_hesaplanan== "18"
replace age= 19 if yas_hesaplanan== "19"
```

In order to select the adults aged 15-64 years, the following Stata command can be used:

```
keep if age >14 & age < 65
```

In order to calculate the time-poverty thresholds for employed men and women aged 15-64, only working individuals in the data set need to be kept. The following set of commands can be utilized to generate a new variable:

```
gen LF=0
replace LF=1 if is_faaliyet_durum==1
replace LF=1 if is_faaliyet_durum==2 &  is_faaliyet_devam==1
label define LFlabel 0 "Not employed" 1 "Employed"
label values LF LFlabel
```

106 ESCAP observation: Users should change the file path and folder to where the data is saved. This action will need to be repeated whenever importing the data. Furthermore, users may need to import the "fert.dta" data first. See code: use "filepath\fert.dta"

This will create the LF variable that takes the value of 1 if the individual has worked at least one hour in the previous week of the survey or if they are temporarily absent from their workplace in the previous week, and takes a zero otherwise.

Next, in order to drop the observations of men and women that do not work, the following command can be used:

```
drop if LF==0
```

This will leave 10,016 individuals in the sample. The adult subsample data can be saved as ind.dta. This subsample is used throughout this example.[106]

STEP 2: Activity time variable creation

In order to calculate the time-poverty thresholds, the files need to be merged in a way that incorporates individual characteristics and the daily averages of primary activities. First, the gunluk.dta micro data set needs to be converted into a "wide format" so that each individual appears once in the data set. Furthermore, daily averages of the primary activities need to be calculated by combining the weekday and weekend day primary activities from the diary micro data file to come up with an "average day" for the individuals surveyed.

After opening the diary file set entitled gunluk.dta, in order to find the total time in minutes spent in the primary activity on a weekday, the data set needs to be sorted according to the household identifier (birimno), the individual identifier (fertno), and the primary activity code (birinci_faaliyet), using the following:

```
sort birimno fertno birinci_faaliyet
```

A new variable called time1 can be created now. This sums the minutes spent on the same activity in the weekday that the individual is surveyed on, since the same activity can be repeated several times during a 24-hour period:

```
by birimno fertno birinci_faaliyet: egen time1= sum (faaliyet_sure_dakika) if
gunluk_no==1
```

To do the same for a day on the weekend, the following command can be used:

```
by birimno fertno birinci_faaliyet: egen time2= sum(faaliyet_sure_dakika) if
gunluk_no==2
```

Now, the total time spent on each primary activity can be obtained for each individual on the weekday and on the weekend day on which the individual is surveyed.

Because some primary activities are performed several times in a day (e.g. eating), the previous commands will produce several totals of those primary activities that appear multiple times for each individual per day. In order to retain only one primary-activity total for each primary activity for the

107 ESCAP observation: Users may have to add the line of code to save this subsample data as ind.dta. Change the file path as necessary. See code: save "filepath\ind.dta", replace

week day and the weekend day per individual, the collapse command can be used in the following fashion:

```
collapse time1 time2, by (birimno fertno birinci_faaliyet gunluk_no)
```

This command retains one record of total time spent for each primary activity on the week day and the weekend day the individual is surveyed.

Next, the total time spent on each primary activity in a given week can be calculated by multiplying the time spent on each primary activity on a week day by five, and on a weekend by two, and then adding them together for each primary activity and each individual. The following commands can be utilized to generate these new variables:

```
gen week1= time1*5
gen week2= time2*2
```

Next, in order to retain only one observation for each primary-activity code, the following collapse command can be used:

```
collapse week1 week2, by (birimno fertno birinci_faaliyet)
```

Now, the average daily time in minutes spent for each primary activity can be found by using the following command:

```
egen weeksum= rowtotal (week1 week2)
gen day= weeksum/7
```

Next, in order to retain only the variables that will be used for merging, use the following command:

```
keep birimno fertno birinci_faaliyet day
```

The data set now is in what Stata calls a "long format", in which each individual appears multiple times. It has four variables identifying:

1. the household;
2. the person within that household (the individual);
3. the primary activity codes according to Eurostat activity coding ranging from 11 to 999 with 109 unique values;
4. and the day variable that gives the average time spent on the primary activity in a day.

The third variable can have either two or three digits; 2-digit activity codes include five activities of personal care: 11 refers to time spent in sleeping; 12 being sick in bed; 21 eating; 31 washing and dressing; 39 other or unspecified personal care. All other primary activity codes are 3-digit codes.[107]

108 Specifically, 1xx codes refer to activities associated with employment, 2xx codes refer to activities associated with studying, 3xx codes refer to activities associated with household and family care, 4xx codes refer to activities associated with voluntary work and meetings, 5xx refer to activities associated with social life and entertainment, 6xx

In order to convert this into a "wide format" in which each individual appears only once, the following command can be used:

```
reshape wide day, i( birimno fertno) j( birinci_faaliyet)
```

This command transposes the data set so that there is one record for each individual. It also drops the day variable and replaces it with a series of new variables labelled dayxx (such as day11, day12, day21, day31, and day39) and dayxxx (such as day111, day129) corresponding to the primary activity codes. The day11 variable, for example, shows the time spent on primary activity 11 for the relevant individual.

Table 8.1. What Stata reports on the reshape command

```
. reshape wide day, i( birimno fertno) j( birinci_faaliyet)
(note: j = 11 12 21 31 39 111 129 200 211 212 221 300 311 312 321 322 323 324 329 331 332 333 339 341 342 343 344 349 351 352 353 354 359
>  361 362 363 369 371 381 382 383 384 389 391 392 399 411 421 422 423 424 425 429 431 432 439 511 512 513 514 519 521 522 523 524 525 52
> 9 531 611 612 613 614 615 616 619 621 631 711 712 713 719 721 722 723 729 731 732 733 739 811 812 819 821 831 910 920 936 938 939 940 9
> 50 960 980 995 998 999)

Data                               long   ->   wide
-----------------------------------------------------------------------------
Number of obs.                   337631   ->   25109
Number of variables                   4   ->     108
j variable (106 values)birinci_faaliyet   ->   (dropped)
xij variables:
                                    day   ->   day11 day12 ... day999
-----------------------------------------------------------------------------
```

This data set is now ready to be merged with the other data set that is entitled ind.dta in Step 1.

STEP 3: Merging the data files

In order to merge the gunluk.dta file that is used in Step 2 with the ind.dta that is created in Step 1, the following command can be used while gunluk.dta is open on Stata:[108]

```
merge m:m birimno fertno using C:\Users\ozgeozay\Desktop\ind.dta
```

refer to activities associated with sports and outdoor activities, 7xx refer to activities associated with hobbies and games, 8xx refer to activities related to mass media, 9xx refer to activities related to travel.

109 ESCAP observation: Note that users need to modify the file path to the location where ind.dta is saved.

Table 8.2. What Stata produces on the merge command

Result	# of obs.	
not matched	15,093	
from master	15,093	(_merge==1)
from using	0	(_merge==2)
matched	10,016	(_merge==3)

In order to only keep the observations that are common to both of the files ind.dta and gunluk.dta, use the following command:

```
drop if _merge==1
```

The resulting file is going to be used for the calculation of time-poverty thresholds and rates. This file can be saved as master.dta.[109]

A caveat about the merged data file is briefly explained here. To enable Stata to recognize the survey data nature of this data set with individual observations representing a certain part of the population given by the sampling weights, the command svyset needs to be used. However, Stata sometimes reads numerical variables as string variables. In this case, Stata reads the sample weights for individuals as string values in the individual data set file. In order to convert this string variable into a numerical variable, the following command can be used:

```
encode faktor_fert, generate( faktor_fert1)
```

Then, svyset command can be used:

```
svyset fertno [pweight= faktor_fert1]
```

Table 8.3. What Stata presents on this command

```
. svyset fertno [pweight= faktor_fert1]

      pweight: faktor_fert1
          VCE: linearized
  Single unit: missing
     Strata 1: <one>
         SU 1: fertno
        FPC 1: <zero>
```

110 ESCAP observation: Users may have to add the line of code to save this data as master.dta. Change the file path as necessary. See code: save "filepath\master.dta", replace

STEP 4: Classification of activities

As discussed above, Ås (1978) classifies time in four broad categories: contracted time, committed time, necessary time, and free time. Following Burchardt (2008), however, the next step collapses those four categories into two categories, namely, committed and free time. Notice that Burchardt's use of committed time differs from Ås's. Ås (1978) includes domestic chores, care of dependents and other household activities in committed time, whereas Burchardt (2008) includes time spent in employment in committed time, along with time spent on domestic chores, care of dependents and other household activities and personal care. In Ås (1978), paid work is contracted time, defined as employment and travel to/from work, but Burchardt includes it in committed time. Unpaid work includes domestic tasks, childcare, unpaid care for others, informal help to other households, but excludes voluntary work for organizations. Free time is the residual after committed time (in Burchardt's sense) and is deducted from the 24 hours or 1440 minutes available in a day.

In order to calculate paid work time, the time spent on activities related to paid work needs to be added by using the following command:

```
egen paid=rowtotal (day111 day129 day910)
```

Here, day111 refers to working time during the primary and secondary job, day129 refers to other or unspecified activities related to employment, and day910 refers to travel to/from work.

The following command can be used to calculate the unpaid time:

```
egen unpaid=rowtotal ( day300 day311 day312 day321 day322 day323 day324 day329
day331 day332 day333 day339 day341 day342 day343 day344 day349 day351 day352 day353
day354 day359 day361 day362 day363 day369 day371 day381 day382 day383 day384 day389
day391 day392 day399 day421 day422 day423 day424 day425 day429 day936 day938 day939)
```

Specifically:

- day300 refers to unspecified household and family care
- day311 refers to food preparation, baking and preserving
- day312 refers to dishwashing
- day321 refers to cleaning dwelling
- day322 refers to cleaning garden
- day 323 refers to heating and water
- day324 arranging household goods and materials
- day329 refers to other or unspecified household upkeep
- day331 refers to laundry
- day332 refers to ironing
- day333 refers to handicraft and producing textiles
- day339 refers to other or unspecified making of and care for textiles
- day341 refers to gardening
- day342 refers to tending domestic animals (not agricultural activities)
- day343 refers to caring for pets (cat, dog, bird, etc.)
- day344 refers to walking the do
- day349 refers to other or unspecified gardening and pet care

- day351 refers to house construction and renovation
- day352 refers to repairs to dwelling
- day353 refers to making, repairing and maintaining house goods
- day354 refers to vehicle maintenance done by the household member
- day359 refers to other or unspecified construction and repairs
- day361 refers to shopping
- day362 refers to commercial and administrative services
- day363 refers to personal services
- day369 refers to other or unspecified shopping and services
- day371 refers to household management
- day381 refers to physical care and supervision
- day382 refers to teaching the child
- day383 refers to reading, playing and talking with child
- day384 refers to accompanying child
- day389 refers to other or unspecified childcare
- day391 refers to physical care of a dependent adult household member
- day392 refers to physical care of a dependent elderly household member
- day399 refers to help to a non-dependent adult household member
- day421 refers to construction and repairs as help
- day422 refers to help in employment and farming
- day423 refers to care of own children living in another household
- day424 refers to other childcare as help to another household
- day425 refers to help to an adult of another household
- day429 refers to other or unspecified informal help to another household

In order to find the time spent on personal care, the following command can be used:

```
egen personal= rowtotal ( day11 day12 day21 day31 day39)
```

Here, day11 refers to sleeping, day12 refers to being sick in bed, day21 refers to eating, day31 refers to washing and dressing, day39 refers to other unspecified personal care.

In order to find the total committed time, use the following command:

```
egen total=rowtotal ( paid unpaid personal)
```

To find the free time, deduct the total from the 1440 minutes available in a day:

```
gen free=1440- total
```

STEP 5: Graphical representation

This section demonstrates the construction of a Kernel density diagram of the total committed time and free time for working men and women aged 15-64.

First, create the label values for the gender variable in master.dta dataset by using the following commands:[110]

```
gen sex=cinsiyet
label define sexlabel 1 "Male" 2 "Female"
label values sex sexlabel
```

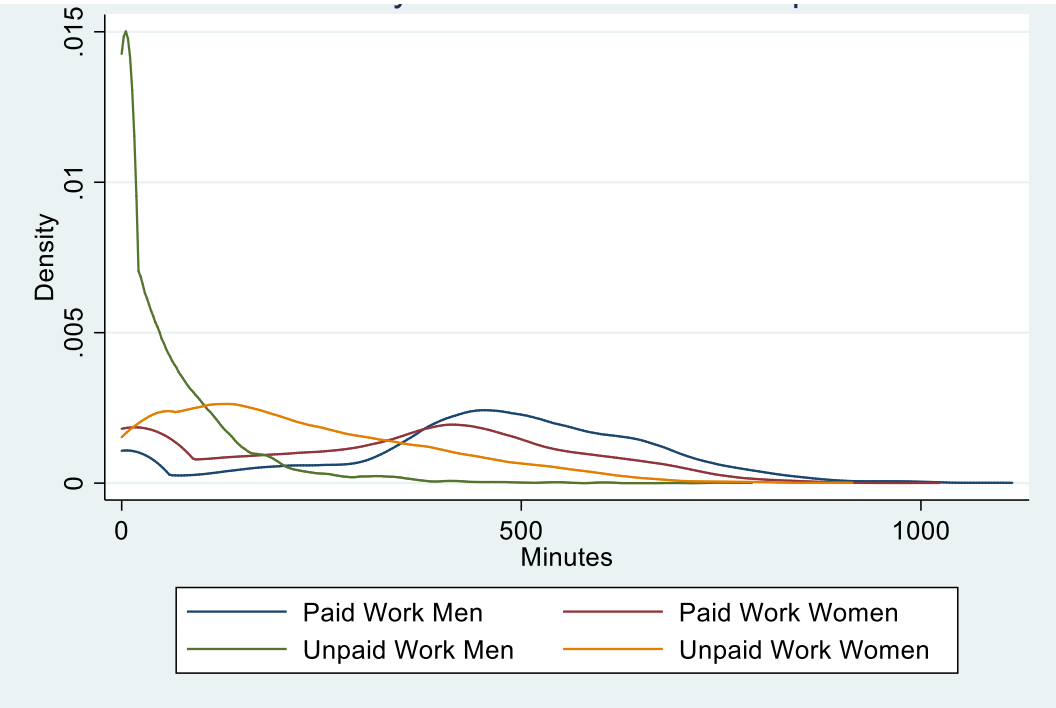
The following Stata command produces the Kernel density distribution for unpaid and paid time for working men and women of working-age:

```
twoway (kdensity paid [aw= faktor_fert1 ] if sex==1) (kdensity paid [aw=
faktor_fert1 ] if sex==2) (kdensity unpaid [aw= faktor_fert1 ] if sex==1)
(kdensity unpaid [aw= faktor_fert1 ] if sex==2), legend(order(1 "Paid Work Men" 2
"Paid Work Women" 3 "Unpaid Work Men" 4 "Unpaid Work Women")) ytitle(Density)
xtitle(Minutes) title(Kernel density estimate- Paid and Unpaid Work)
```

Once this command is executed, a new window on Stata will pop up showing the following graph:

Figure 8.1

Kernel density graph of distribution of paid work and unpaid work by sex (minutes per day)



Source: Chapter author's calculations based on time-use survey data.

The density graph shows that while women's paid work distribution mimics that of men, their unpaid work distributions differ significantly. Men's distribution of unpaid time centres around 0 minutes per day. Women's paid time per day centres to the left of 500 minutes while men's falls around 500 minutes per day. This is clearly a result of the abovementioned gendered division of labour at home.

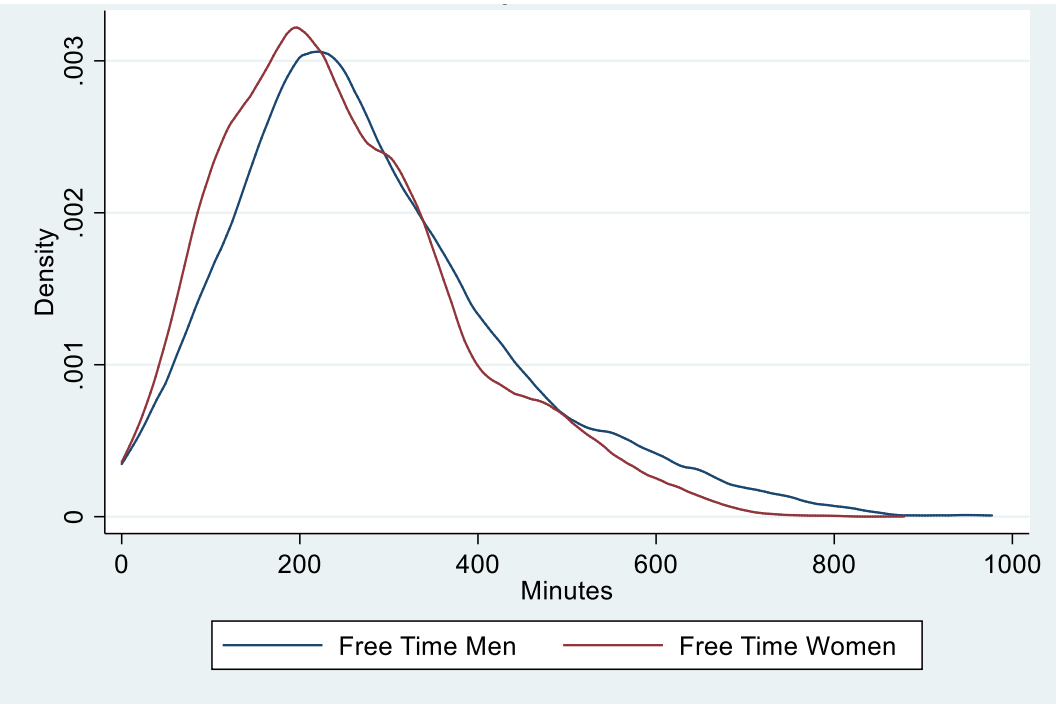
111 ESCAP observation: Users may need to import the "master.dta" data first. Please change the file path and folder to where the data is saved. See code: use "filepath\master.dta

In order to see the distribution of free time, use the following command:

```
twoway (kdensity free [aw= faktor_fert1 ] if sex==1) (kdensity free [aw=
faktor_fert1 ] if sex==2) , legend(order(1 "Free Time Men" 2 "Free Time Women" ))
ytitle(Density) xtitle(Minutes) title(Kernel density estimate- Free time)
```

This produces the following graph on Stata:

Figure 8.2
Kernel density graph of distribution of free time by sex (minutes per day)



Source: Chapter author's calculations based on time-use survey data.

This graph shows that women's free time distribution lies slightly to the left of men's and centres around 200 minutes, whereas men's centres at a point slightly to the right of 200 minutes.

STEP 6: Creation of the time poverty threshold

In order to find the time-poverty thresholds for adult men and women aged 15-64 according to the method used by Burchardt (2008), the median of the free-time distribution for men and women needs to be found first.

In order to find the median of free-time distribution, the following command can be used:

```
_pctile free [pweight=faktor_fert1], p(50)
return list
```

This should return the following line in Stata:

```
r(r1) =  245.71435546875
```

Since the median for the residual turns out to be 245.7 minutes for working-age women and men employed in Turkey, following Burchardt (2008), 60% of it (147.4 minutes) is taken to be the time-poverty threshold. Individuals whose free time on an average day is less than 147.4 minutes are deemed time poor. In order to create the time-poverty variable, use the following commands:

```
gen tpov=.
replace tpov= 1 if free < 147.4
replace tpov=0 if free >= 147.4
```

STEP 7: Estimation of time poverty rates by sex

In order to find the proportion of time-poor women and men, use the following command:

```
svy linearized : proportion  tpov, over( sex)
```

This returns the following table:

Table 8.4. What Stata produces on this command

```
Survey: Proportion estimation

Number of strata =       1       Number of obs    =      10,016
Number of PSUs   =      13       Population size  =  10,008,693
                                 Design df        =          12

      _prop_1: tpov = 0
      _prop_2: tpov = 1

        Male: sex = Male
      Female: sex = Female
```

Over	Proportion	Linearized Std. Err.	Logit [95% Conf.	Interval]
_prop_1				
Male	.8096341	.0056765	.796958	.8216959
Female	.7502295	.0190865	.7063889	.789475
_prop_2				
Male	.1903659	.0056765	.1783041	.203042
Female	.2497705	.0190865	.210525	.2936111

This shows that 19% of working men aged 15-64, and 24.9% of working women aged 15-64, are estimated to be time poor. This result supports the aforementioned hypothesis of a double burden for Turkish women, since women's time poverty rate is estimated to be almost 6 percentage points higher than that of men.

STEP 8: Estimation of time-poverty rates by income groups

This step demonstrates the estimation of time-poverty rates for working men and women aged 15-64 in different income groups.

The income- and time-poverty relationship can be hypothesized for high-income and low-income individuals in the following way: a high income for women could mean working long hours to pursue a career while still being responsible for disproportionate amounts of unpaid work. Therefore, the time-poverty rate of high-income working women is expected to be higher than that of men. In fact, the case of high-income women with jobs located higher up the occupational hierarchy has been discussed in the context of advanced countries (Warren, 2003). It has been argued that new constraints and pressures have neutralized the benefits of increased prosperity in such advanced countries, and that people are now work rich (income rich) and time poor (McGinnity and Russel, 2007). At the other end of the income distribution, it is possible that low-income women with relatively low human capital have to work long hours to simply make a living and are also burdened with a disproportionate amount of unpaid work at home. Hence, it is expected that low-income working women would have a higher time-poverty rate than men as well.

In order to calculate the time-poverty rates for different income categories, household income information needs to be used. Therefore, the master.dta file that is used in Steps 1-6 needs to be merged with the household data file entitled hane.dta. First, the variable _merge that was created by Stata in Step 3 needs to be dropped. The following is the command for that:

```
drop _merge
```

The following command can be used to merge the master.dta file with hane.dta:[111]

```
merge m:m birimno using C:\Users\ozgeozay\Desktop\hane.dta
```

The following is what Stata presents once this command is executed:

Table 8.5. What Stata presents on this command

```
Result                           # of obs.
-----------------------------------------
not matched                         2,521
    from master                         0   (_merge==1)
    from using                      2,521   (_merge==2)

matched                            10,016   (_merge==3)
-----------------------------------------
```

In order to preserve the observations that are in the master.dta file, the observations that are associated only with hane.dta need to be dropped. To do this, use the following command:

112 ESCAP observation: Note that users need to modify the file path to the location where hane.dta is saved.

```
drop if _merge==2
```

Monthly household income in TTUS is categorized in five intervals: corresponding to 0-1080 new Turkish Lira (YTL hereafter); 1081-1550 YTL; 1551-2170 YTL; 2171-3180 YTL; and 3181 YTL or more. A new variable called income can be created that takes the midpoint of the income intervals in the following way:

```
gen income= .
replace income= 540 if gelir_ortalama_grup==1
replace income= 1315 if gelir_ortalama_grup==2
replace income= 1860 if gelir_ortalama_grup==3
replace income= 2675 if gelir_ortalama_grup==4
replace income= 3181 if gelir_ortalama_grup==5
```

In order to find the estimation of time-poor working males and females in the five income groups, use the following command:

```
svy linearized : proportion tpov, over( sex income)
```

This will return the following table:

Table 8.6. Estimation of time-poor working males and females in 5 income groups

```
Survey: Proportion estimation

Number of strata =         1        Number of obs    =       10,016
Number of PSUs   =        13        Population size  =   10,008,693
                                    Design df        =           12

      _prop_1: tpov = 0
      _prop_2: tpov = 1

         Over: sex income
    _subpop_1: Male 540
    _subpop_2: Male 1315
    _subpop_3: Male 1860
    _subpop_4: Male 2675
    _subpop_5: Male 3181
    _subpop_6: Female 540
    _subpop_7: Female 1315
    _subpop_8: Female 1860
    _subpop_9: Female 2675
   _subpop_10: Female 3181
```

Over	Proportion	Linearized Std. Err.	Logit [95% Conf.	Interval]
_prop_1				
_subpop_1	.8090731	.0062925	.7949858	.8224087
_subpop_2	.7953395	.0073734	.7788057	.8109375
_subpop_3	.7926737	.0086274	.773247	.8108432
_subpop_4	.8085203	.0291429	.7369696	.8641942
_subpop_5	.835908	.0121521	.8076887	.8607005
_subpop_6	.7425705	.0229226	.6895686	.7892882
_subpop_7	.8399255	.0173664	.7983875	.8742534
_subpop_8	.7407727	.0119988	.7137867	.7660482
_subpop_9	.7130124	.0493099	.5950828	.8076949
_subpop_10	.7387988	.0265695	.6769408	.792444
_prop_2				
_subpop_1	.1909269	.0062925	.1775913	.2050142
_subpop_2	.2046605	.0073734	.1890625	.2211943
_subpop_3	.2073263	.0086274	.1891568	.226753
_subpop_4	.1914797	.0291429	.1358058	.2630304
_subpop_5	.164092	.0121521	.1392995	.1923113
_subpop_6	.2574295	.0229226	.2107118	.3104314
_subpop_7	.1600745	.0173664	.1257466	.2016125
_subpop_8	.2592273	.0119988	.2339518	.2862133
_subpop_9	.2869876	.0493099	.1923051	.4049172
_subpop_10	.2612012	.0265695	.207556	.3230592

The same information can be presented on Excel in the following table:

Table 8.7. Time poverty by sex and income group, working males and females

Percentage Time Poor	Males	Females
First Income Group (0-1081 YTL)	0.19	0.26
Second Income Group (1081-1550 YTL)	0.20	0.16
Third Income Group (1551-2170 YTL)	0.21	0.26
Fourth Income Group (2171- 3180 YTL)	0.19	0.29
Fifth Income Group (More than 3181 YTL)	0.16	0.26

While Table 8.7 does not present a clear relationship between being time poor and belonging to any particular income group, it does however show that in the low-income category, women's time poverty rate is 7 percentage points higher than that of men. The same is true for the highest income category in which the percentage point difference is 10. This could be used to further support the double burden hypothesis of working women in Turkey. The fact that the highest percentage of time-poverty among women is estimated to be experienced by the fourth income group might imply the need for deeper analysis of income- and time-poverty, perhaps by combining time-use surveys with more detailed income surveys.

Chapter summary

Investigating time poverty has the advantage of providing insights on the unpaid labour performed predominantly by women at home. Hence, its calculation and widespread usage by policymakers is indispensable for achieving gender equality as embedded especially in SDG 5. Time poverty is beginning to be recognized as another dimension of deprivation that has important consequences for one's economic, physical, social, and psychological well-being. As such, it can broaden the policy discourse addressing SDG 1 on ending poverty in all its forms everywhere. SDG 3 on ensuring healthy lives and promoting well-being for all is also of direct relevance, particularly with respect to the link between the promotion of mental health and well-being and time pressures and stress experienced by women.

Researchers have proposed different measures of time poverty. Most of them are built on the categorization of time as contracted (paid work), committed (unpaid work), necessary or personal (sleeping, eating etc.), and free.

This chapter calculated a time-poverty threshold and estimated time-poverty rates based on the method proposed by Burchardt (2008) using the Turkish Time-use Survey of 2014-2015. The chapter demonstrated the hypothesis of a double burden experienced by working women aged 15-64 in Turkey by showing that women have higher time-poverty rates than men.

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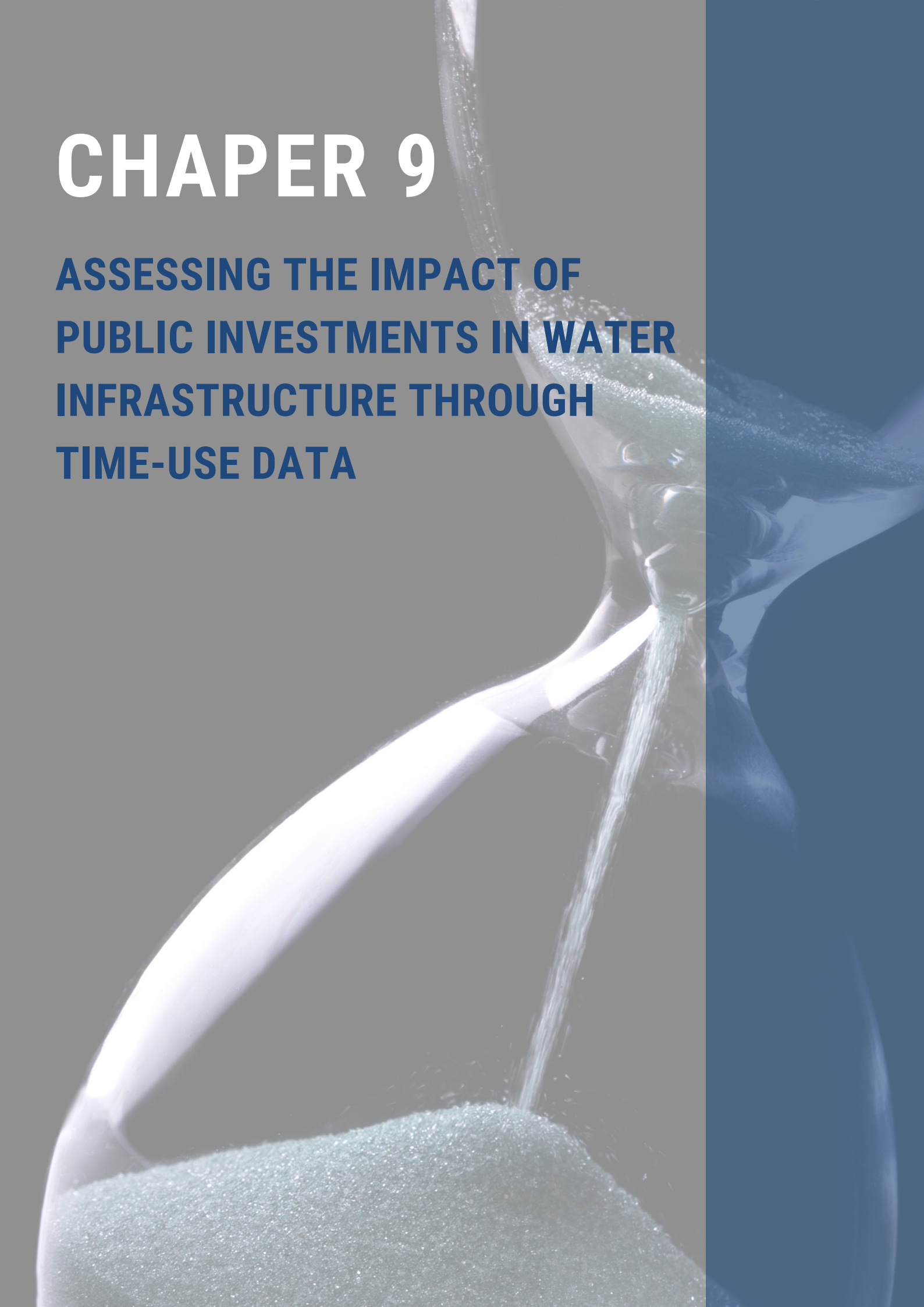

CHAPER 9

ASSESSING THE IMPACT OF PUBLIC INVESTMENTS IN WATER INFRASTRUCTURE THROUGH TIME-USE DATA

CHAPTER 9: ASSESSING THE IMPACT OF PUBLIC INVESTMENTS IN WATER INFRASTRUCTURE THROUGH TIME-USE DATA

This chapter is an edited version of material provided by Mungo Terbish and Maria S. Floro to the ESCAP Statistics Division in 2018.

Chapter overview: This chapter demonstrates the usefulness of time-use data for analysing the impact of public investments on basic infrastructure and on the benefits that are not typically captured in standard cost-benefit analyses and project evaluation appraisals.

The chapter elaborates how to (i) prepare data and select samples to support analytical work in this area; (ii) construct variables of interest namely, the number of minutes spent on unpaid household and care work on a typical workday (dependent variable), and the main explanatory variables (dummies for different types of water source); (iii) construct other controls that could affect the dependent variable; (iv) apply a Tobit regression analysis to examine the relationship between the different types of water source and the unpaid work activities performed by prime-aged male and female household members.

The chapter uses the 2011 Mongolia National Time-use Survey data as its basis. Stata is used to perform the empirical analysis in this chapter, and the Tobit regression methodology is applied. Stata do-files and R Markdown files are also available as separate attachments on the webpage for download and use.

9.1 Chapter focus

This chapter explores the effect public infrastructure investment in safe water delivery systems has on the amount of time spent by prime-aged (18-50 years old) women and men in performing household work. The study is particularly relevant to Mongolia, a landlocked country in Central Asia, that faces significant water and sanitation concerns. According to Hawkins and Seager (2010), water scarcity has affected the lives and livelihoods of many Mongolians, including those who rely directly on nomadic herding. The water supply infrastructure also has not been able to keep up with rapid urbanization. This is particularly the case with the *ger* (portable felt tents) district around Ulaanbaatar, where rural households have settled in search of work, schooling and access to services (Gawel et al. 2011).

A report by the United Nations Development Programme (UNDP) and the United Nations Capital Development Fund (UNCDF) (2011) indicates inadequate sanitation remains prevalent especially in rural areas. About 48.4% of the poor have no access to sanitation facilities, compared to 25% of the non-poor. Mongolia's poor water quality has been associated with health problems such as diarrheal diseases, which include dysentery, typhoid and Hepatitis A (34% of total infectious diseases

registered in 2008), as well as the increased risk of chronic diseases of the kidney and urinary tract infections.[112]

9.2 Relevance

9.2.1 Linkages with the Sustainable Development Goals (SDGs)

Of particular relevance to this chapter are:

- SDG 5 on achieving gender equality and empowering all women and girls. Target 5.4 includes reference to recognizing and valuing unpaid care and domestic work through the provision of public services and infrastructure.
- SDG 6 on ensuring availability and sustainable management of water and sanitation for all. The attainment of SDG 6 inter alia involves public policy interventions to develop infrastructure to deliver safe water and sanitation services. These interventions are particularly important in developing countries. The infrastructure deficit of these basic services not only adversely impacts people's health and quality of life, but also increases the time spent in unpaid work and thereby constrains labour supply, i.e. the time that could otherwise be spent on market work.
- SDG 3 on ensuring healthy lives and promoting well-being for all at all ages is also relevant in this context. SDG Target 3.3 includes reference to combating water-borne diseases, among others.

9.2.2 Domestic policy implications

The public policy implications of effective time-use statistics in this area range from enhanced health to improved employment prospects for women and school attendance for children. While directly enhancing the health status and quality of life of household members, public investment in basic infrastructure can also have indirect effects. The availability of safe drinking water and sewerage systems lowers the spread of water-borne diseases, which in turn lowers the time spent caring for sick household members. Reducing the unpaid household and care work time of those who perform these tasks enables them to spend more time in the labour market, as well as have a healthier work-life balance.

Improvements in public water infrastructure can also have positive benefits for children by freeing them up from having to help their parents to carry water, enabling them to attend school. As Chakraborty (2010) argues, school enrolments of girls and boys are likely to increase as a result of removing the need to fetch water or to collect fuel for heating and food preparation.

9.2.3 Gender implications

Although there is an extensive literature on the role of infrastructure investment in promoting development by increasing the efficiency of production and improving living standards, there is a serious gap regarding the role of public infrastructure in addressing gender inequalities. Many fiscal

113 United Nations Development Programme and United Nations Capital Development Fund (2011). Mongolia: Access to Water and Sanitation, Poverty Reduction and MDG Achievement. http://www.undp.org/content/dam/undp/library/Poverty%20Reduction/MDG%20Strategies/mongolia.pdf (accessed on 05 April 2021).

policy researchers argue that gender issues are not relevant to mainstream public infrastructure such as ports, roads and dams. Simply put, public infrastructure is perceived to be necessary in meeting everyone's needs, and hence is deemed gender-neutral. However, gender researchers refute this argument by demonstrating that such expenditure has in itself an intrinsic gender dimension (Chakraborty, 2010). The prevailing gender norms and household division of labour determine which member of the household performs the affected tasks and chores, and therefore whose unpaid work burden is reduced by better delivery of these basic services.

In developing countries, collecting water and fuel material is predominantly the job of women and older children and can be eliminated with proper water and energy policies. Time spent on domestic chores such as those mentioned above could be replaced by time spent on market work, which would give more independence and income to the women involved and more time for studies and learning for girls and boys.

9.3 Analytical logic

9.3.1 Time-use surveys put gender spotlight on water infrastructure

Time-use surveys have been invaluable in estimating the labour time contributed by household members and measuring all forms of work.[113] The information on different time allocation patterns among household members helps identify the constraints faced by individuals in developing their capabilities, including their participation in the labour market. It can also provide useful insights on important policy impacts that standard cost-benefit analyses fail to capture.

Until recently, studies on infrastructure effects have relied either on household budget surveys or on time-use modules in household integrated surveys. Examples are the Lesotho study on the effect of infrastructure on women's and men's use of time (Lawson 2008), and the Pakistan study on the relationship between access to water and the time allocation of women (Ilahi and Grimard 2000). A study by Blackden and Wodon (2006) made use of the World Bank's Living Standard Measurement Survey data to demonstrate how gender-differentiated time-use patterns are affected not only by demographic and household-level factors, but also by the ease of access to water and fuel, the availability of infrastructure, and the distance to key economic and social services such as schools, health centres, financial institutions, and markets.

Stand-alone time-use surveys, however, have the unique advantage of providing detailed time accounting that allows for comprehensive coverage of all activities, including tasks of short duration. This feature of time-use data increases the accuracy of measuring the amount of time women and men spend in unpaid work, and hence the unequal distribution of the work burden within the household.

A few studies have used time-use survey data to examine the gendered effect of public investment in infrastructure. For instance, Chakraborty's (2010) study in India found that fiscal policy interventions in public infrastructure investment affects market work, non-market work and leisure time of women and men differently. In particular, when given better infrastructure, women were

114 Global employment trends 2013: recovering from a second jobs dip. Geneva, Switzerland: International Labour Organization

found to spend less time on the unpaid work listed in the System of National Accounts (SNA), e.g. subsistence production, backyard gardening, etc. However, there was no evidence that the freed time was used for market work. In another study using the 2006 Tanzania National Time-use Survey data, Fontana and Natali (2008) found that girls were more likely than boys to undertake domestic chores such as gathering fuel, fetching water, and preparing food. Their findings also showed that urban females are the most overburdened segment of the population.

9.3.2 Examining the effect of access to safe water on unpaid household and care work

The following example of time-use data analysis of the effect of access to safe water on unpaid household and care work is based on the Terbish and Floro (2016) case study of Mongolia. First, it describes the data preparation and sample selection used in the analysis. Second, it constructs the variables of interest namely, the number of minutes spent on unpaid household and care work on a typical workday (dependent variable), and the main explanatory variables (dummies for different types of water source), as well as other controls that could affect the dependent variable. The latter include:

- sex (proxied by female dummy variable);
- interaction of sex and type of water source;
- life-cycle stage (proxied by age and age squared);
- household composition (proxied by presence of sick and disabled members);
- the number of young children aged five years and below;
- the number of children aged 6-15 years;
- and the location (proxied by rural-urban dummy).

Finally, the analysis uses a Tobit regression analysis to examine the relationship between the different types of water source and the time spent in unpaid work activities performed by prime-aged male and female household members.[114]

9.4. Step-by-step example

Background: The Mongolia National TUS, 2011

As noted earlier, the study makes use of the 2011 Mongolia National TUS data. This is the second wave of Mongolian time-use data collected by the National Statistics Office.[115]

The survey covers five geographic regions, namely Western, Steppe, Central, Eastern, and Ulaanbaatar. In each geographic region, two *aimags* (provinces) and six districts of the capital, Ulaanbaatar, were selected to participate by means of a two-stage sampling process. In the first stage, households from each region were selected by a proportional probability sampling, and 400 enumerated areas in total were randomly chosen. In the second stage, ten households were selected

115 Stata codes are as provided by the primary contributor of the chapter material and have been issued with limited validation.

116 The dataset used in this chapter can be publicly and freely accessed from http://web.nso.mn/nada/index.php/catalog/90. Online registration is required.

in each enumerated area using a systematic sampling method, yielding a total sample of 4,000 households.

The Mongolian TUS includes both household and individual modules. The household module includes demographic questions as well as dwelling characteristics such as source of drinking water, electricity, heating, and toilet facility. It is completed by a member of the household (not necessarily the household head or his/her spouse).

The individual module adopts the diary method by asking respondents to complete a time-diary for the past 24 hours. All household members 12 years and older are asked to complete the diary. It asks about activities in 10-minute intervals for 24 hours for two to three days a week. The survey categorizes the days of the week when respondents filled their diaries into three groups: Sunday, Monday, and Tuesday; Wednesday and Thursday; and Friday and Saturday.

For illustration purposes, this chapter focuses on men and women who are in the prime ages of 18 to 50 years. The sample is also restricted to the individuals who completed the diary on Wednesday and Thursday, as this group of weekdays out of the three-day groups represents a typical workday load. Those who were surveyed in this subsample group and filled the diary on these days are included in the analysis, totalling 2,767 observations.

STEP 1: Data preparation for analysis

Before performing model estimations using the data, one should prepare the raw data by cleaning, merging, and re-shaping it into the best format for answering the research question in the analysis. The following example uses both the household questionnaire and the diary. The household questionnaire provides the dwelling characteristics (used as the explanatory variables) and the household characteristics (for the control variables). The diary reveals the amount of time spent on certain activities by each household member aged 12 and older. The following details the steps needed to prepare the dataset for statistical analysis:

1. Create unique household and individual identification numbers, namely Identification Number (ID) and Province Identification Number (PID), respectively.
2. Sum up the minutes spent on the same activity throughout the same day.
3. Convert the data from "long" to "wide" format so that an individual becomes a unit variable. This is necessary because the diary data set has multiple entries for each respondent. The "wide" format contains one entry per respondent, with the total time spent by that individual on each type of activity. This allows for estimating models on the individual level.
4. Convert the missing values into zeros. This is necessary because the absence of entries is entered as a missing value during the time-use data processing.
5. Check that the total number of minutes spent on all activities throughout the day adds up to 1,440. Drop those respondents whose time-use diaries have less than 1,440 minutes.
6. Restrict the data sample selected for analysis to the individuals who completed the diary on Wednesday and Thursday, as this weekday grouping, out of the three groupings, represents a typical workday load.
7. Calculate the mean time spent on each activity during the selected two days.

```
use "TUS HD_en.dta"[116],clear
** Create a unique household ID**
drop ID
egen ID=concat(HH1 HH2 HH4)
destring ID, replace

**Create a unique personal ID**
egen PID=concat(HH1 HH2 HH4 HL1)
destring PID, replace
//[117] duplicates drop PID[118], force

**********Adding the times spent on each activity**********
keep TOTALDURATION PID DAYID DAYNUMBER ID3_ACTIVITY
collapse (sum) TOTALDURATION , by (ID3_ACTIVITY  PID DAYID DAYNUMBER)

**********Convert from long to wide format**********
rename TOTALDURATION act_
reshape wide act_, i(PID DAYID DAYNUMBER) j(ID3_ACTIVITY)

*****Convert all the missing vars into 0*****
local  activity  act_111  act_112  act_113  act_114  act_115  act_116  act_117  act_118
act_119  act_211  act_212  act_213  act_214  act_215  act_216  act_217  act_218  act_219
act_221  act_222  act_223  act_224  act_225  act_226  act_227  act_228  act_229  act_231
act_232  act_233  act_234  act_235  act_236  act_237  act_238  act_239  act_241  act_242
act_243  act_244  act_248  act_249  act_311  act_312  act_313  act_314  act_315  act_316
act_317  act_318  act_319  act_411  act_412  act_413  act_414  act_415  act_416  act_417
act_418  act_419  act_421  act_422  act_423  act_424  act_425  act_511  act_512  act_518
act_519  act_521  act_522  act_523  act_528  act_529  act_531  act_532  act_533  act_534
act_538  act_539  act_541  act_548  act_549  act_611  act_612  act_613  act_614  act_615
act_616  act_617  act_618  act_619  act_711  act_712  act_713  act_714  act_718  act_719
act_721  act_722  act_723  act_724  act_728  act_729  act_731  act_732  act_733  act_734
act_735  act_738  act_739  act_811  act_812  act_813  act_814  act_815  act_816  act_817
act_818  act_819  act_821  act_822  act_823  act_824  act_825  act_826  act_828  act_829
act_831  act_832  act_833  act_834  act_835  act_836  act_837  act_838  act_839  act_841
act_842  act_843  act_844  act_845  act_846  act_847  act_848  act_849  act_850  act_911
act_912  act_913  act_914  act_915  act_916  act_917  act_918  act_919  act_1011  act_1012
act_1013  act_1014  act_1021  act_1022  act_1023  act_1029  act_1031  act_1032  act_1033
act_1034  act_1035  act_1038  act_1039  act_1041  act_1042  act_1043  act_1044  act_1045
act_1046  act_1048  act_1049  act_2221
foreach x of local activity {
       replace `x'=0 if `x'==.
}

******Check if number of minutes add up to 1440******
egen checkmins=rsum(act_111 act_112 act_113 act_114 act_115 act_116 act_117 act_118
act_119  act_211  act_212  act_213  act_214  act_215  act_216  act_217  act_218  act_219
act_221  act_222  act_223  act_224  act_225  act_226  act_227  act_228  act_229  act_231
act_232  act_233  act_234  act_235  act_236  act_237  act_238  act_239  act_241  act_242
act_243  act_244  act_248  act_249  act_311  act_312  act_313  act_314  act_315  act_316
act_317  act_318  act_319  act_411  act_412  act_413  act_414  act_415  act_416  act_417
act_418  act_419  act_421  act_422  act_423  act_424  act_425  act_511  act_512  act_518
act_519  act_521  act_522  act_523  act_528  act_529  act_531  act_532  act_533  act_534
act_538  act_539  act_541  act_548  act_549  act_611  act_612  act_613  act_614  act_615
act_616  act_617  act_618  act_619  act_711  act_712  act_713  act_714  act_718  act_719
act_721  act_722  act_723  act_724  act_728  act_729  act_731  act_732  act_733  act_734
act_735  act_738  act_739  act_811  act_812  act_813  act_814  act_815  act_816  act_817
```

117 ESCAP observation: Users should change the file path and folder to where the data is saved. This action will need to be repeated whenever importing the data.

118 ESCAP observation: The forward slashes (//) are indicators for comments in Stata. Users may run into errors regarding the // if copy and pasting the code into Stata. If this is the case, users may have to remove the // and/or subsequent comment to execute code without errors. This action will need to be repeated whenever the // are present. Otherwise, running the do-file directly in Stata should produce minimal errors.

119 ESCAP observation: Removing duplicates at this point will only retain unique values of PID and one value of ID3_ACTIVITY and may cause a discrepancy in the subsequent lines of code. If users encounter errors with the codes, this current line should be removed. The removal of duplicate PID occurs at the end of Step 1.

```
act_818 act_819 act_821 act_822 act_823 act_824 act_825 act_826 act_828 act_829
act_831 act_832 act_833 act_834 act_835 act_836 act_837 act_838 act_839 act_841
act_842 act_843 act_844 act_845 act_846 act_847 act_848 act_849 act_850 act_911
act_912 act_913 act_914 act_915 act_916 act_917 act_918 act_919 act_1011 act_1012
act_1013 act_1014 act_1021 act_1022 act_1023 act_1029 act_1031 act_1032 act_1033
act_1034 act_1035 act_1038 act_1039 act_1041 act_1042 act_1043 act_1044 act_1045
act_1046 act_1048 act_1049 act_2221)
sum checkmins

******Keeping data for Wednesday and Thursday*********
keep if DAYID==3 | DAYID==4
keep if DAYNUMBER==2

****Take the mean of two days*****
local activity act_111 act_112 act_113 act_114 act_115 act_116 act_117 act_118
act_119 act_211 act_212 act_213 act_214 act_215 act_216 act_217 act_218 act_219
act_221 act_222 act_223 act_224 act_225 act_226 act_227 act_228 act_229 act_231
act_232 act_233 act_234 act_235 act_236 act_237 act_238 act_239 act_241 act_242
act_243 act_244 act_248 act_249 act_311 act_312 act_313 act_314 act_315 act_316
act_317 act_318 act_319 act_411 act_412 act_413 act_414 act_415 act_416 act_417
act_418 act_419 act_421 act_422 act_423 act_424 act_425 act_511 act_512 act_518
act_519 act_521 act_522 act_523 act_528 act_529 act_531 act_532 act_533 act_534
act_538 act_539 act_541 act_548 act_549 act_611 act_612 act_613 act_614 act_615
act_616 act_617 act_618 act_619 act_711 act_712 act_713 act_714 act_718 act_719
act_721 act_722 act_723 act_724 act_728 act_729 act_731 act_732 act_733 act_734
act_735 act_738 act_739 act_811 act_812 act_813 act_814 act_815 act_816 act_817
act_818 act_819 act_821 act_822 act_823 act_824 act_825 act_826 act_828 act_829
act_831 act_832 act_833 act_834 act_835 act_836 act_837 act_838 act_839 act_841
act_842 act_843 act_844 act_845 act_846 act_847 act_848 act_849 act_850 act_911
act_912 act_913 act_914 act_915 act_916 act_917 act_918 act_919 act_1011 act_1012
act_1013 act_1014 act_1021 act_1022 act_1023 act_1029 act_1031 act_1032 act_1033
act_1034 act_1035 act_1038 act_1039 act_1041 act_1042 act_1043 act_1044 act_1045
act_1046 act_1048 act_1049 act_2221
foreach x of local activity {
       egen main`x'=mean(`x'), by(PID)
}

local activity act_111 act_112 act_113 act_114 act_115 act_116 act_117 act_118
act_119 act_211 act_212 act_213 act_214 act_215 act_216 act_217 act_218 act_219
act_221 act_222 act_223 act_224 act_225 act_226 act_227 act_228 act_229 act_231
act_232 act_233 act_234 act_235 act_236 act_237 act_238 act_239 act_241 act_242
act_243 act_244 act_248 act_249 act_311 act_312 act_313 act_314 act_315 act_316
act_317 act_318 act_319 act_411 act_412 act_413 act_414 act_415 act_416 act_417
act_418 act_419 act_421 act_422 act_423 act_424 act_425 act_511 act_512 act_518
act_519 act_521 act_522 act_523 act_528 act_529 act_531 act_532 act_533 act_534
act_538 act_539 act_541 act_548 act_549 act_611 act_612 act_613 act_614 act_615
act_616 act_617 act_618 act_619 act_711 act_712 act_713 act_714 act_718 act_719
act_721 act_722 act_723 act_724 act_728 act_729 act_731 act_732 act_733 act_734
act_735 act_738 act_739 act_811 act_812 act_813 act_814 act_815 act_816 act_817
act_818 act_819 act_821 act_822 act_823 act_824 act_825 act_826 act_828 act_829
act_831 act_832 act_833 act_834 act_835 act_836 act_837 act_838 act_839 act_841
act_842 act_843 act_844 act_845 act_846 act_847 act_848 act_849 act_850 act_911
act_912 act_913 act_914 act_915 act_916 act_917 act_918 act_919 act_1011 act_1012
act_1013 act_1014 act_1021 act_1022 act_1023 act_1029 act_1031 act_1032 act_1033
act_1034 act_1035 act_1038 act_1039 act_1041 act_1042 act_1043 act_1044 act_1045
act_1046 act_1048 act_1049 act_2221
foreach x of local activity {
       drop `x'
}

*****Drop the duplicates of the PIDs to have one obs of each individual******
duplicates drop PID, force

drop checkmins
```

At this point, the dataset is saved as Mean main act.dta.

STEP 2: Creation of variables

The next set of commands labels and groups the main activities by summing the minutes spent on activities of the same kind. For example, variable mainact_11 is the total number of minutes spent on activities related to formal sector employment. Simultaneously, coding of some of the activities is modified in accordance with the ICATUS system. Table 9.1 provides a detailed list of activities included in the "Domestic Work" and "Care Work" activity categories.

Table 9.1. Activities in the 2011 Mongolia Time-use Survey classified as unpaid household and care work

I. Household maintenance, management and shopping for own household
a. Activities related to food preparation *i. Preparing meals/snacks and cleaning up after food preparation/meals/snacks*
b. Cleaning house and care of clothes *i. Hand-washing; loading/unloading washing machine* *ii. Indoor and outdoor cleaning*
c. Shopping *i. Shopping for/purchasing of goods and related activities*
d. Do it yourself *i. Improvement, maintenance and repair of dwellings personal and household goods including computers* ii. *Vehicle maintenance and minor repairs*
e. Chopping wood, collect water *i. Collect water, prepare fuel and heat the dwelling*
f. Moving *i. Prepare for moving* *ii. Carry and pack household assets to move* *iii. Moving to new place to live* *iv. Unpacking* v. *v. Other activities related to moving*
g. Other activities related to household management
II. Care for children, the sick, elderly and disabled
a. Care for pre-school age children *i. Caring for pre-school age children/physical care* *ii. Reading, playing and talking to children* iii. *Other activities related to childcare*
b. Care for school-age children *i. Caring for school age children/physical care* *ii. Assist with school work* *iii. Meet with teachers and attend parent-teachers meetings*

iv.	*iv. Other activities related to care for school age children*
c.	Care for other members of the household
i.	*Caring for dependents (children, older persons)*
ii.	*Caring for the ill*
iii.	*Caring for the disabled*
iv.	*Caring for the bedridden*
v.	*Other activities related to caring for dependent adults*

```
********** ICATUS CODING **********
  ** SNA work and related activities **

la var mainact_111 "Working time in main job"
la var mainact_112  "Working time in other jobs"
la var mainact_113  "Working time as apprentice, intern and related positions"
la var mainact_114 "Short breaks and interruption from work"
la var mainact_115 "Searching for job"
la var mainact_116  "Other breaks"
la var mainact_117 "Training and studies in relation to work"
la var mainact_118  "Other activities related to work for corporations/quasi
corporations, non-profit institutions and government "
la var mainact_119 "Travel related to work 181"
gen mainact_11= mainact_111 + mainact_112+ mainact_113+ mainact_117 + mainact_118
la var mainact_11 "Working in formal sector employment "
rename mainact_11 emp_estab

** Household and individual primary production **
la var mainact_211  "Prepare land for harvesting"
la var mainact_212  "Harvesting"
la var mainact_213  "Growing of crops and trees; kitchen gardening"
la var mainact_214  "Guard the agricultural land"
la var mainact_215  "Gathering the crop "
la var mainact_216  "Primary processing of the crop such as cleaning, grinding,
and sorting"
la var mainact_217  "Purchase and sales related to agriculture"
la var mainact_218 "Other activities related to agriculture"
la var mainact_219 "Travel related to agriculture"

** Change the coding into ICATUS system **
gen mainact_12 = mainact_211 + mainact_212 + mainact_213 + mainact_214 +
mainact_215 + mainact_216 + mainact_217+ mainact_218
la var mainact_12  "Work in primary production activities"
rename mainact_12 prim_prod

** Animal husbandry **
la var mainact_221 "Grazing cattle and other livestock"
la var mainact_222 "Fodder and water the livestock, clean the yard"
la var mainact_223 "Train, treat, clean the livestock"
la var mainact_224 "Prepare winterfeed for the livestock"
la var mainact_225 "Care for the young animals"
la var mainact_226 "Build the yard for the livestock"
la var mainact_227 "Purchases and sales related to farming"
la var mainact_228 "Other activities related to farming"
la var mainact_229 "Travel related to farming"
gen mainact_22 = mainact_221 + mainact_222 + mainact_223 + mainact_224 +
mainact_225 + mainact_226 + mainact_227+ mainact_228
la var mainact_22  "Work in animal husbandry"
rename mainact_22 anim_husbandry

** Preparing and making dairy products and farm products **
la var mainact_231 "Milk livestock"
la var mainact_232 "Shear wool of sheep and goats "
la var mainact_233 "Butchering"
la var mainact_234 "Prepare dairy products"
```

```
la var mainact_235 "Make home accessories and household utensils"
la var mainact_236 "Make other goods originated from farming"
la var mainact_237 "Sales of goods of farming origin"
la var mainact_238 "Other activities related to goods of farming origin"
la var mainact_239 "Travel related to farming"
gen mainact_23 = mainact_231 + mainact_232 + mainact_233 + mainact_234 +
mainact_235 + mainact_236+ mainact_237+ mainact_238
la var mainact_23  "Work in production of dairy and farm products"
rename mainact_23 dairy_prod

** Other activities related to primary production **
la var mainact_241 "Forestry, hunting, fishing, collecting nuts and berries,
mushrooms, and prepare woodstock"
la var mainact_242 "Mining, exploration, and other "
la var mainact_243 "Purchase and sales of goods related to the hunting and
gathering"
la var mainact_244 "Carving, make wooden articles"
la var mainact_248 "Other activities related to primary processing"
la var mainact_249 "Travel related to forestry, hunting, fishing, etc"
gen other_prim_prod =mainact_241+ mainact_242+ mainact_243+ mainact_244+
mainact_248

** Household and individual trade, service related activities and production **

la var mainact_311  "Processing and selling of food products 131"
la var mainact_312  "Making herbal and medicinal preparations 137"
la var mainact_313  "Making and selling textiles, wearing apparel, leather and
associated products 133"
la var mainact_314  "Construction and repair of buildings, roads, dams and other
structures 142"
la var mainact_315  "Budgeting, organizing, planning 252 "
la var mainact_316  "Vending and trading on the streets and markets"
la var mainact_317  "Providing repair, installation and maintenance services 152"
la var mainact_318 "Other activities related to trading, manufacturing"
la var mainact_319 "Travel related to trading and manufacturing"

** ICATUS 13 + construction **
gen mainact_13 = mainact_311 + mainact_312 + mainact_313 + mainact_314  +
mainact_316+ mainact_317+ mainact_318
la var mainact_13  "Work for household for income"
rename mainact_13 income_service

** Domestic services for own final use within household**
la var mainact_411  "Preparing meals/snacks and cleaning up after food
preparation/meals/snacks 211 and 213"
la var mainact_412  "Hand-washing; loading/unloading washing machine 241"
la var mainact_413  "221 and 222 Indoor and outdoor cleaning"
la var mainact_414  "271 Shopping for/purchasing of goods and related activities"
la var mainact_415  "231 232 Improvement, maintenance and repair of dwellings
personal and household goods including computers"
la var mainact_416  "233 Vehicle maintenance and minor repairs"
la var mainact_417  "225 Collect water, prepare fuel and heat the dwelling"
la var mainact_418  "255 Other activities related to hh management"
la var mainact_419  "280 Travel related to unpaid domestic services for own final
use within household"

** Domestic service including 21, 22, 23, 24, 25, 27, 28 **
gen mainact_21_22_23_25  = mainact_315 + mainact_411 + mainact_412 + mainact_413
+ mainact_414  + mainact_415+ mainact_416 + mainact_417+ mainact_418
la var mainact_21_22_23_25  "Unpaid domestic services"

** Packing and moving **
la var mainact_421 "Prepare for moving"
la var mainact_422 "Carry and pack household assets to move"
la var mainact_423 "254 Moving to new place to live"
la var mainact_424 "Unpacking"
la var mainact_425 "Other activities related to moving"
gen mainact_42= mainact_421+mainact_422+ mainact_423+ mainact_424
la var mainact_42 "Moving"
rename mainact_42 moving
```

```
** Care for pre-school age children **
la var mainact_511  "311 Caring for pre-school age children/physical care"
la var mainact_512  "313 Reading, playing and talking to children"
la var mainact_518  "315 Other activities related to childcare "
la var mainact_519  "380 Travel related to unpaid caregiving services to
household members"

** 31_1_1 refers to preschool children **
gen mainact_31_1= mainact_511+mainact_512+ mainact_518
la var mainact_31_1 "Care for preschool children"
rename mainact_31_1 care_presch

** Care for school age children **
la var mainact_521  "311 Caring for school age children/physical care"
la var mainact_522  "312 Assist with school work"
la var mainact_523  "Meet with teachers and attend parent-teachers meetings"
la var mainact_528  "315 Other activities related to care for school age
children"
la var mainact_529  "380 Travel related to care for school age children such as
take them to school"

** 31_1_2 refers to school children **
gen mainact_31_2= mainact_521+mainact_522+ mainact_523+ mainact_528
la var mainact_31_2 "Care for school children"
rename mainact_31_2 care_sch

** Care for other members of the household **
la var mainact_531 "321 Caring for dependents adults/physical care"
la var mainact_532 "321 Caring for the ill"
la var mainact_533 "321 Caring for the disabled"
la var mainact_534 "321 Caring for the bedridden"
la var mainact_538 "Other activities related to caring for dependent adults"
la var mainact_539 "Travel related to caring for household members"
gen mainact_32= mainact_531+mainact_532+ mainact_533+ mainact_534+ mainact_538
la var mainact_32 "Care for other members of the hh"
rename mainact_32 care_elderly

** Attending guests **
la var mainact_541 "Hosting guests and serving them"
la var mainact_548 "Other activities related to Hosting guests"
la var mainact_549 "Travel related to Hosting guests"

** Community services **
la var mainact_611  "413 Construction, renovation and repairs of dwellings and
other structures as help to other households"
la var mainact_612  "620 Participating in community cultural/social events"
la var mainact_613  "Participate in community services organized by work"
la var mainact_614  "434 Organize and participate in community services directed
towards an individual"
la var mainact_615  "Attendance of social meetings"
la var mainact_616  "630 Involvement in civic and related responsibilities"
la var mainact_617  "434 Organizing and working in organized unpaid volunteer
services providing assistance to families and individuals"
la var mainact_618  "435 Other activities related to organized unpaid volunteer
services "
la var mainact_619  "480 Travel related to community services and help to other
households"

gen mainact_41_43= mainact_611+mainact_612+ mainact_613+ mainact_614+
mainact_615+ mainact_616+ mainact_617+ mainact_618
la var mainact_41_43 "Community service"
rename mainact_41_43 comm_serv

** Learning **
la var mainact_711  "511 School/university attendance"
la var mainact_712  "512 Breaks/waiting at place of general education"
la var mainact_713  "513 Self-study for distance education course work "
la var mainact_714  "Participate in out-of-school activities"
la var mainact_718  "514 Other activities related to general education "
la var mainact_719  "580 Travel related to learning"
gen mainact_51= mainact_711+mainact_712+ mainact_713+ mainact_714+ mainact_718
```

```
la var mainact_51 "Learning"
rename mainact_51 learn_sch

** Extra-curricular activities **
la var mainact_721  "520 Homework, course review, research and activities related
to general education"
la var mainact_722  "530 Additional study, non-formal education and courses
during free time"
la var mainact_723  "Attend tutor courses"
la var mainact_724  "Purchase school supplies and books"
la var mainact_728  "590 Other activities related to learning "
la var mainact_729  "Travel related to out-of-school activities"
gen mainact_54= mainact_721+mainact_722+ mainact_723+ mainact_724+ mainact_728
la var mainact_54 "Extra-curricular activities"
rename mainact_54 learn_extra

** Non-school related courses **
la var mainact_731 "Language courses"
la var mainact_732 "Computer courses"
la var mainact_733 "Driving lessons"
la var mainact_734 "Technical and vocational training"
la var mainact_735 "722 Technical hobbies and related courses"
la var mainact_738 "Other activities related to extra courses"
la var mainact_739 "Travel related to extra courses"
gen mainact_53= mainact_731+mainact_732+ mainact_733+ mainact_734+ mainact_735+
mainact_738
la var mainact_53 "Extra courses"
rename mainact_53 learn_courses

** Socializing, community participation and religious practice **
la var mainact_811  "Talking on the phone"
la var mainact_812  "Participating in hh and out-of-hh events"
la var mainact_813  "641 Private prayer, meditation and other spiritual
activities"
la var mainact_814  "620 Participating in community cultural/social events"
la var mainact_815  "611 Talking, conversing"
la var mainact_816  "612 Socializing activities such visiting others"
la var mainact_817  "Participating in meetings/reunions"
la var mainact_818  "619 Other activities related to socializing and
communication "
la var mainact_819  "680 Travel related to socializing, community participation
and religious practice"
gen mainact_61= mainact_812+ mainact_813+ mainact_814+ mainact_816+ mainact_817+
mainact_818
la var mainact_61 "Socializing"
gen communic= mainact_811+ mainact_815
la var communic "Communicating others"

** Attending performing arts **
la var mainact_821  "721 Visual, literary and performing arts (as hobby): cinema"
la var mainact_822  "721 Visual, literary and performing arts (as hobby): opera,
ballet comedy"
la var mainact_823  "721 Visual, literary and performing arts (as hobby):
museums, galleries"
la var mainact_824  "713 Attendance at sports events"
la var mainact_825  "711 Attendance at organized/mass cultural events"
la var mainact_826  "Attend anniversaries of organizations"
la var mainact_828  "315 Other activities related to attending performances"
la var mainact_829  "Travel related to attending performances"
gen mainact_71= mainact_821+mainact_822+ mainact_823+ mainact_824+ mainact_825+
mainact_826+ mainact_828
la var mainact_71 "Performing arts"

** Sport activities **
la var mainact_831 "Walking, running"
la var mainact_832 "Camping, alpinism"
la var mainact_833 "732  Exercising"
la var mainact_834 "731 Participating in sports "
la var mainact_835 "Horse-back riding, Camel riding, traveling by car"
la var mainact_836 "Biking, skiing, sledging"
la var mainact_837 "713 Attendance at sports events and organizing"
```

```
la var mainact_838 "Other activities related to sports"
la var mainact_839 "Travel related to sports"

gen mainact_73= mainact_831+mainact_832+ mainact_833+ mainact_834+ mainact_835+
mainact_836+ mainact_837+ mainact_838
la var mainact_73 "Sports participation"

** Hobby, games, and other pastime activities **
la var mainact_841 "741 Reading: a book"
la var mainact_842 "723 Playing games and other pastimes and related courses"
la var mainact_843 "Crafting, creating art pieces"
la var mainact_844 "Technical and vocational training"
la var mainact_845 "Go to bar and karaoke"
la var mainact_846 "Go dancing and disco"
la var mainact_847 "851 Doing nothing; resting, relaxing"
la var mainact_848 "Hunting, fishing, gather berries, mushrooms"
la var mainact_849 "724 Other activities related to hobbies, games and other
pastimes"
la var mainact_850 "Travel related to hobbies, games and other pastimes"
gen mainact_72= mainact_841+mainact_842+ mainact_843+ mainact_844+ mainact_845+
mainact_846+ mainact_847+mainact_848+ mainact_849
la var mainact_72 "Hobbies, games, and pastime"

** Using mass media **
la var mainact_911  "741 Reading: newspaper"
la var mainact_912  "741 Reading: a book"
la var mainact_913  "742 Watching/listening to television and video"
la var mainact_914  "743 Listening to radio and audio devices"
la var mainact_915  "714 Visiting library"
la var mainact_916  "Browse internet"
la var mainact_917  "Make video"
la var mainact_918  "745 Other activities related to mass media "
la var mainact_919  "Travel related to using mass media"
gen mainact_74= mainact_911+mainact_912+ mainact_913+ mainact_914+ mainact_915+
mainact_916+ mainact_917+ mainact_918
la var mainact_74 "Using mass media"
gen active = mainact_61+ mainact_71+ mainact_72+ mainact_73
gen passive = communic+ mainact_74

** Sleep and rest **
la var mainact_1011  "811 Night sleep/essential sleep"
la var mainact_1012  "851 Doing nothing; resting, relaxing"
la var mainact_1013  "Waking up and getting up"
la var mainact_1014  "Make bed"
gen mainact_81= mainact_1011+mainact_1012+ mainact_1013+ mainact_1014
la var mainact_81 "Sleep and rest"
rename mainact_81 sleep

** Eating **
la var mainact_1021  "821 Eating meals/snack"
la var mainact_1022  "Eating outside home"
la var mainact_1023  "Eat/dine in restaurant/cafe"
la var mainact_1029  "Travel to eat"

gen mainact_82= mainact_1021+mainact_1022+ mainact_1023
la var mainact_82 "Eating and drinking"

** Personal hygiene and care **
la var mainact_1031 "Put on/change clothes"
la var mainact_1032 "831 Personal hygiene and care"
la var mainact_1033 "Applying makeup"
la var mainact_1034 "841 Receiving personal care from others: hairdresser, sauna,
massage "
la var mainact_1035 "841 Receiving personal care from others"
la var mainact_1038 "833 Other activities related to personal hygiene and care "
la var mainact_1039 "Travel related to personal hygiene and care"
gen mainact_83= mainact_1031+mainact_1032+ mainact_1033+ mainact_1034+
mainact_1035+ mainact_1038
la var mainact_83 "Personal hygiene and care"
rename mainact_83 selfcare
```

```
** Health related activities **
la var mainact_1041 "832 Health/medical care to oneself"
la var mainact_1042 "842 Receiving health/medical care from others"
la var mainact_1043 "Purchase medical supply"
la var mainact_1044 "731 Participating in sports "
la var mainact_1045 "Stay ill"
la var mainact_1046 "Stay in a medical facility to receive care"
la var mainact_1048 "843 Other activities related to receiving health/medical"
la var mainact_1049 "880 Travel related to receiving health/medical"
gen mainact_84= mainact_1041+mainact_1042+ mainact_1043+ mainact_1044+
mainact_1045+ mainact_1046+ mainact_1048
la var mainact_84 "Health related activities"
la var mainact_2221 "Collect animal dung"
```

Then, activities are grouped into a broader set of activities such as **Paid work, Farming and husbandry, Domestic work, Care work, Leisure, Personal care, Social activities**, and **Learning**. These groups are key variables in the model estimation, as they are employed as dependent variables.

```
gen PaidWork = emp_estab + prim_prod + income_service
gen FarmingHusbandry=anim_husbandry + dairy_prod
gen DomesticWork = mainact_21_22_23_25 + moving
gen CareWork = care_presch + care_sch + care_elderly
gen Leisure = mainact_71 + mainact_72 + mainact_74
gen PersonalCare = sleep + mainact_82 + selfcare + mainact_84
gen Social = mainact_61 + comm_serv
gen Learning=learn_sch + learn_courses + learn_extra
save "HD_sorted.dta",replace
```

Note that some activity episodes recorded by the diary method may involve at least one other simultaneous activity being done alongside the primary or main activity. Terbish and Floro (2016) show that secondary work activities in the 2011 Mongolia TUS data increase the total working time in household work by about 15% for women and 5.7% for men. The amount done by women (88 minutes per day on average) is one-third more than that done by men (66 minutes per day on average). This gender imbalance is also true for care work: 11.7% of women and 4.4% of men participate in care work. For those involved in care work, women spend an average of 132 minutes daily while men spend an average of 73 minutes on care work.

Next, create the main explanatory variables of interest using the household characteristics dataset. Before creating the explanatory variables, it is necessary to create the same unique household and personal identification numbers as done with the HD_en.dta to match the processed diary dataset.

```
use "TUS HL_en.dta", clear
** Create a unique household ID**
egen ID=concat(HH1 HH2 HH4)
destring ID, replace
**Create a unique personal ID**
egen PID=concat(HH1 HH2 HH4 HL1)
destring PID, replace
duplicates drop PID, force
```

For each infrastructure type of water source - in-house pipe, public water kiosk or public piped water, well/spring, and surface water - binary variables are created based on the dwelling characteristics of respondents to indicate the source used, instead of using a categorical variable.

```
*Source of water*
gen piped_dw=0
replace piped_dw=1 if WS1==11
gen piped_pub=0
replace piped_pub=1 if WS1==12 | WS1==15 | WS1==16
gen well_spring=0
replace well_spring=1 if WS1==13 | WS1==14
gen surface=0
replace surface = 1 if WS1==17
```

The presence of a young child or children has a tremendous effect on the household members' time allocation. Hence, create control variables for the presence of children of aged 0-5, teenagers aged 6-15, and any sick and/or disabled members.

Create binary variables for each of the nine regions to control for the geographical location. Then, control for the urban and rural location using a binary variable called urban.

For the individual characteristics of the respondents, use age and age^2 to account for the life cycle. The variable female is binary with value 1 for female respondents and 0 otherwise.

Stata commands to identify household composition:

```
** Children 0-5 years old **
egen temp05 = count(PID) if HL6<=5, by(ID)
egen nchild05 = min(temp05), by(ID)
la var nchild05 "no. children aged 0-5"
replace nchild05=0 if nchild05==.

** Children 6-15 years old **
egen temp615 = count(PID) if HL6>5 & HL6<=15, by(ID)
egen nchild615 = min(temp615), by(ID)
la var nchild615 "no. children aged 6-14"
replace nchild615=0 if nchild615==.

** total number of children under age 16 (15 or younger)
gen nchild=nchild05+nchild615
replace nchild=0 if nchild==.

** Adults 61+ years old
egen temp60up = count(PID) if HL6>60 , by(ID)
egen mem60up = min(temp60up), by(ID)
la var mem60up "members aged 60 and above"
replace mem60up=0 if mem60up==.

** Presence of sick or disabled household member **
egen tempsickdis=count(PID) if HE2==1 | HE3==1
egen sickdis=min(tempsickdis), by(ID)
la var sickdis "sick or disabled members"
replace sickdis=0 if sickdis==.
replace sickdis=1 if sickdis==1301

** Stata commands to identify household location:
rename HH4 province
replace province =0 if province ==11
replace province =1 if province ==21
replace province =2 if province ==22
replace province =3 if province ==45
replace province =4 if province ==48
replace province =5 if province ==65
replace province =6 if province ==67
replace province =7 if province ==83
replace province =8 if province ==85

**Urban location**
gen urban=0
```

```
replace urban=1 if HH3==1

**Personal characteristics:
rename HL6 age
gen age2=age^2

gen female=0
replace female=1 if HL4==2
**Then save the cleaned and processed household characteristics dataset:
save "HL_sorted.dta",replace
```

STEP 3: Merging of household-level and individual-level variables

After re-opening the diary dataset, merge it with the household characteristics dataset and save the merged dataset that has all the variables necessary for the analysis under HDHL_sorted.dta.

```
use "HD_sorted.dta"
merge 1:1 PID using "HL_sorted.dta"
drop if _merge==2
drop if _merge==1
drop _merge
save "HDHL_sorted.dta", replace
```

It should be possible to check the number of observations that are dropped when running drop if _merge == 2 and drop if _merge == 1. This can verify whether Stata has run the command correctly.

STEP 4: Obtaining descriptive statistics

An important part of any data analysis is getting well acquainted with the dataset. This usually involves constructing tables and graphs to see variations in the values and the frequency of these values, identify outliers and missing variables, and examine the reasons for this. These simple tools aid the researcher to pose the right questions, identify potential obstacles, and prepare the data set for the actual estimations.

Given that time-use survey data analysis employs observations of several members from the same household, the issue arises of double counting the household characteristics. Hence, use the Stata commands preserve…restore that allow the household ID duplicates to be dropped in order to estimate the characteristics on the household level, and then restore them.

```
preserve
duplicates drop ID, force
count if nchild05>0
count if nchild615>0
count if mem60up>0
sum nchild HHSize
tab sickdis
tab urban
restore

preserve
duplicates drop ID, force
local table1 piped_dw piped_pub well_spring surface
```

```
foreach x of local table1 {
       tab `x',m
}
restore
```

Table 9.2 shows the distribution of the sample households by type, composition, location, and dwelling characteristics. Roughly a third (34.8%) of the households have young children (aged 0-5 years), and around half (47.13%) have school-aged children. This indicates the importance of childcare for many of the households. About 15% have elderly members (aged 60 years and older), and a quarter (26.85%) of the respondents reside in households with a sick or disabled member. The majority (64%) of the households live in the rural areas, and roughly a third of the population resides in an urban setting.

The household sample is nearly evenly distributed across the four types of water source. About one-fifth of the respondents have piped-in water while the majority make use of public water kiosks. The proportion of households who use surface water (31%) is higher than the proportion of those who obtain their water from a well or spring (22%).

Table 9.2. Selected characteristics of sample households

	Number of Households	Percentage of Total
Household type		
Household Composition		
• Households with children 0–5 years old	460	34.80
• Households with children 6–15 years old	623	47.13
• Households with elderly (60 and above)	202	15.28
• Households with sick or disabled member	355	26.85
• Mean household size	2.54	
• Mean number of children	1.2	
Rural-Urban Location		
• Urban	479	36.23
• Rural	843	63.77
• TOTAL	1,322	100.00
Dwelling characteristics		
Type of water source		
• Piped into dwelling	267	20.20
• Public water kiosk	351	26.55
• Well or spring	291	22.01
• Surface water	409	30.94
• Other	4	0.29

STEP 5: Regression analysis

The final step uses the Tobit model to analyse the effect of water source type on the time spent on unpaid work (combined household maintenance and care) by women and men. Censored regression models such as Tobit generally apply when the variable to be explained is partly continuous, but has positive probability mass at one or more points. In this case, the dependent variable in the model—the number of minutes spent on unpaid domestic chores which include household work and care work—is censored and has a lower bound of 0 minutes and an upper bound of 1440 minutes per day. The main explanatory variable of interest involves a set of dichotomous dummy variables that take the value of 1 for the type of water source used by the household, and 0 otherwise. For example, if a given household gathers water from a public water kiosk, then the binary variable piped_pub takes value one while the other water source variables are zero.

The following Tobit regression model is estimated:

$$UW_{ij} = X_i\beta_i + Z_i\gamma_i + \Phi_i\alpha_i + \varepsilon_i, \qquad (1)$$

Where:

- UW_{ij} is number of minutes spent on unpaid activity j by individual *i*,
- X_i is a binary variable for each type of water source available for the individual,
- Z_i captures the individual characteristics namely:
    a) sex (with female dummy =1),
    b) life cycle stage (proxied by age and age-squared),
    c) location (with urban dummy =1),
    d) relation to household head, presence of sick or disabled,
    e) number of young children 0-5 years old,
    f) number of children aged 6-15 years old, and
- ε_i is a random error term.

Interaction variables are also included by interacting the female dummy variable with type of water source. This demonstrates the difference in the time spent by women and men on unpaid work for a given type of water source. Given that the time-use survey data was collected using a two-stage selection process, households and individuals in the same cluster are likely to share some unobserved characteristics. This makes the standard errors independent across clusters (Stata, 2013).

In the estimation, specify that the lower bound of the dependent variable is zero. Moreover, to calculate more robust standard errors to meet the assumptions of homogeneity and normality of variance of the residuals, include vce(robust).

The effects of different water sources on time spent in unpaid domestic work is estimated as follows:

```
gen femxpiped_dw = female * piped_dw
gen femxpiped_pub = female * piped_pub
gen femxwell_spring = female * well_spring
gen Unpaid = DomesticWork + CareWork

tobit Unpaid female femxpiped_dw femxpiped_pub femxwell_spring piped_dw piped_pub
well_spring age age2 urban nchild05 nchild615 sickdis i.province, ll(0) vce(robust)
```

The regression estimation is provided in Table 9.3. This indicates that women spend on average 234 minutes a day more on unpaid domestic work than men. The interaction variable coefficients indicate that women in households with piped-in water spend 113 minutes less on unpaid work than those who live in households that rely on surface water. Similarly, women who gather water from public kiosks and wells/springs spend 97 and 104 minutes, respectively, less on unpaid work than women who fetch water from surface water sources such as lakes, rivers, or ponds.

In general, access to public water kiosks and wells/springs increases men's time spent on unpaid work (60 and 67 minutes, respectively), which may be explained by higher participation of men due to greater convenience these facilities provide compared to using surface water. Residing in an urban location significantly reduces the time spent on unpaid household work, whereas having a young child in the household increases the time spent on the same activity by 51 minutes a day on average. Similarly, presence of a sick or disabled household member increases the unpaid activity time by 21 minutes a day.

Table 9.3. Tobit estimates of the effects of types of water sources on unpaid domestic work

VARIABLES	Unpaid Work	
Piped into dwelling	21.86	(14.94)
Piped into public water kiosk	59.91***	(14.15)
Well or spring	67.40***	(12.91)
Female	234.0***	(10.32)
Female x piped into dwelling	-112.7***	(16.41)
Female x public water kiosk	-96.54***	(16.23)
Female x well/spring	-104.0***	(17.46)
Age	2.429***	(0.831)
Age sq.	-0.00663	(0.0104)
Urban	-44.04***	(15.70)
Number of children under age 5	51.23***	(4.798)
Number of children of age 6-15	4.154	(3.445)
Presence of sick or disabled member	20.69***	(7.513)
Region fixed effect	Yes	
Observations	2,767	

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

For water source types, the reference category is surface water.

Chapter summary

The Mongolian time-use data provided policy makers and academics with in-depth information on the availability of public infrastructure for the urban and rural population of Mongolia and its effect on their time-use. Lack of modern water systems increases the amount of time household members spend on household work, hindering their ability to spend time on economic and other activities.

The chapter explained the structure of the dataset and the steps necessary to prepare and process it for analysis and provided an interpretation of the obtained results. The results indicated that women spend more time on unpaid household work when lacking modern sources of water than men do. Hence, these observations reveal paths toward achieving the SDGs, such as SDG 6 on ensuring availability and sustainable management of water and sanitation for all, which present positive implications beyond preventing diseases associated with an inadequate water supply (also relating to SDG 3) and obtaining food security. It also promises to empower women by giving them more time to spend on paid activities, studying, and learning new skills. This is also an important contribution to achieving the SDG 5: Achieve gender equality and empower all women and girls.

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ANNEXES

ANNEX 1:
TIME-USE SURVEYS AND STATISTICS: SELECTED READINGS, TOOLS, GUIDEBOOKS AND MANUALS

ANNEX 2:
OVERVIEW OF MAIN APPROACHES TO TIME-USE SURVEYS

ANNEX 3:
CAPTURING COMPLEXITY – SPECIAL FEATURES OF TIME-USE SURVEYS

ANNEXES

Annex 1: Selected time-use reading, tools, guidebooks and manuals

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- Section 2A.1: Introduction
- Section 2A.2: Responding to different contexts and challenges
- Section 2A.3: Methodological approaches to time-use surveys
- Section 2A.4: Activity selection
- Section 2A.5: Further key elements of Time-use design

Annex 3: Capturing complexity – special features of time-use surveys

- Section 3A.1: Overlapping or simultaneous activities
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- Section 3A.3: Bringing out the subjective aspects of everyday activity

ANNEX 1: TIME-USE SURVEYS AND STATISTICS: SELECTED READINGS, TOOLS, GUIDEBOOKS AND MANUALS[119]

The following selected resources provide further guidance to data analysts:

UNDP & ILO. 2018. Time-use surveys and statistics in Asia and the Pacific. A review of challenges and future directions.

Which countries have done it?
What were the formats used?
What were the objectives?
Background and questionnaire
Sampling
Methods for data collection
Collecting data on simultaneous activities
Context variables
Quality considerations (response rate, terminology)
Classifications

https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_630892.pdf

Data X2. 2018. Invisible no more? A methodology and policy review of how time use surveys measure unpaid work. https://data2x.org/wp-content/uploads/2019/05/Data2X-Invisible-No-More-Volume-1.pdf

Data X2. 2018. Invisible no more? Country Case Studies. https://data2x.org/wp-content/uploads/2019/05/Data2X-Invisible-No-More-Volume-2.pdf

UNECE. 2017. Guide on Valuing Unpaid Household Service Work. https://unece.org/fileadmin/DAM/stats/publications/2018/ECECESSTAT20173.pdf

UNDP. 2015. Time Use Across the World: Findings of a World Compilation of Time Use Surveys. http://www.hdr.undp.org/sites/default/files/charmes_hdr_2015_final.pdf

UNECE. 2013. Guidelines for Harmonizing Time-Use Surveys. https://unece.org/fileadmin/DAM/stats/publications/2013/TimeUseSurvey_Guidelines.pdf

120 Links last accessed on 24 March 2021.

ANNEX 2: OVERVIEW OF MAIN APPROACHES TO TIME-USE DATA COLLECTION[120]

This annex consists of edited extracts from material provided by Valeria Esquivel to the ESCAP Statistics Division in 2018.

2A.1 Introduction

Time-use surveys can provide unique insights on a range of policy areas, especially in the context of gender equality and women's empowerment. In particular, time-use data is important for monitoring SDG indicator 5.4.1 "Proportion of time spent on unpaid domestic and care work, by sex, age group and location." The selected extracts that follow present some key approaches and instruments available to measure unpaid domestic and care work, its variation over time, and its relationship with actual policies.

2A.2 Responding to different contexts and challenges

Time-use surveys collect information on how individuals allocate their time among different activities. Time-use surveys can have different objectives, but they are recognized as the primary source to accurately measure time-spent in unpaid care and domestic work.

To effectively utilize time-use surveys, the survey design and data collection methods used must be adapted to address specific challenges. In developing and transitional economies, these challenges often differ from the challenges in the developed economies where time-use methods were first practiced and refined. In developing countries, respondents in rural areas can be very different from those in urban areas. For example:

- there might be lower rates of literacy in some locations;
- there might be significant proportions of the population who speak local languages or dialects; and
- some sub-populations might not wear wrist watches, own clocks or regulate their lives by clock-time.

All these considerations will affect the design of the survey instruments and the mode of their administration. In South Africa, for example, a question was included in the time-use survey asking whether respondents had clocks to assess the possibility of analyzing time schedules in rural areas. In India, it was not possible for male interviewers to approach women respondents due to social customs that do not allow women to communicate freely with men who were strangers. This required planning for fieldwork to include both male and female interviewers.

Depending on the purposes of the time-use survey, there are often special sampling issues involved. There are the usual issues of geographical coverage, but time spent in activities often varies by day

121 Annex 2 provides an overview of approaches on time-use surveys and is not intended to be exhaustive. There might be new updates in terms of approaches, methods, concepts and definitions since the time this Annex was written. Please refer to the readings list at the end of the Annex for additional information and details.

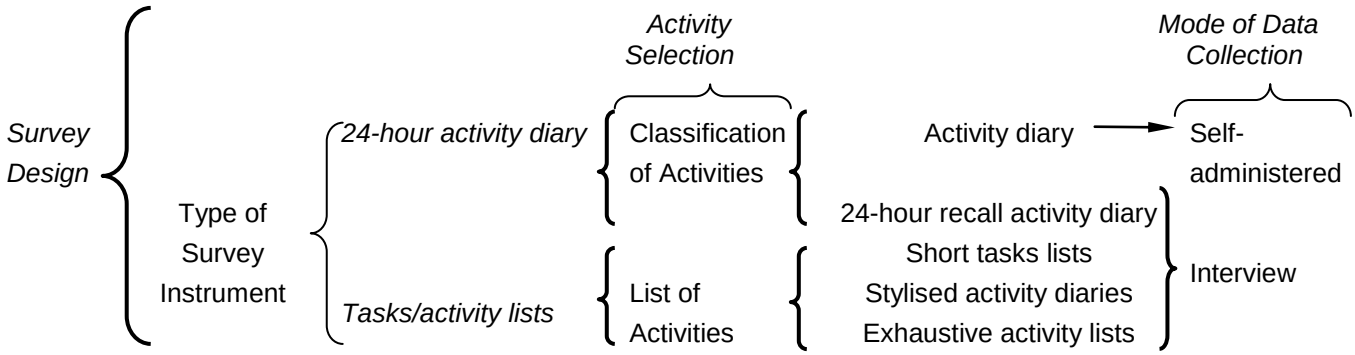
of the week, requiring the sample design to consider coverage of different days, at minimum weekdays and weekends. Many activities can also have a seasonal component, which, if relevant for the intended uses of the time-use data, would require extending the data collection to cover the whole year. In addition, if for example, the purpose of the survey is to understand childcare and other care service needs in the context of parents' employment statuses, it is crucial to ensure that the sample includes families with children and persons needing care (Addati et al., 2018).

In developing and transitional economies, scarce resources can influence survey design. Budgetary constraints can confine the time-use data collection to a module attached to an existing multipurpose household survey. This affects the information collected and the purpose the information can serve. In many Latin American countries, time-use modules have been attached to different types of household surveys, such as expenditure surveys, labor-market surveys and other regular surveys. In many cases the field operations of the parent survey could not be altered to ensure the time-use data was collected on a pre-defined day of the week, although it was possible to differentiate between weekdays and weekend days.

2A.3 Methodological approaches to time-use surveys

According to the Guide to Producing Statistics on Time-use (*Guide*, UNSD 2005: 14), a methodological approach to time-use data collection is an integrated set of basic design features or "components" which are jointly designed to meet the survey's objectives. Figure 2A.1 below lists these components, which inform the rest of this Annex.[121]

Figure 2A.1
Time-use survey design components



2A.3.1 Survey design: "Stand-alone" vs modular approaches

Stand-alone surveys

Historically, time-use surveys have been stand-alone surveys carried out by statistical offices, either on a national level or for specific areas or regions. Stand-alone time-use surveys are household surveys whose primary objective is to capture a "single subject of time-use" (*Guide*, UNSD 2005:

122 Source figure provided by Valeria Esquivel. Please also refer to the UN Guide for more information at https://unstats.un.org/unsd/publication/seriesf/seriesf_93e.pdf (accessed on 05 April 2021).

16.58): All design features and field operational procedures are fine-tuned to achieve this objective. Despite the label "stand-alone", these surveys consist of more than one survey instrument. The core instrument is typically the 24-hour activity diary and is accompanied by a questionnaire (and sometimes a household form), which gathers information about the respondent's characteristics (and those of her/his household).

Typically, these stand-alone designs go to considerable lengths to ensure representative sampling, not only by location and socio-economic characteristics, but also by natural and non-natural cycles (the seasons, the weekday/weekend differentiation) and by circumstances (bank holidays, illnesses, etc.). Although this collection might continue for almost a year in the field and is expensive, it does capture important features of time-use and is generally not conducted every year. Given the advantages of stand-alone surveys, it is not surprising that they are assumed to be the "ideal" data collection approach for time-use. Such surveys are however, resource intensive, which can pose additional challenges for many countries.

Time-use modules

The alternative to a stand-alone survey is to attach a time-use module to a multipurpose household survey examining living conditions, labour-force participation, or income and expenditure. The UN 2005 Guide to time-use research stated that, in this approach, major aspects of survey operations … are *primarily guided by the requirements of the core* [*survey*] (*Guide*, UNSD 2005: 17.60, emphasis added), which can seriously restrict the methodological design chosen to collect time-use data.[122]

The advantage of this choice is budgetary since attaching a time-use module to the hosting survey enables economies of scale. Furthermore, the information collected by other parts of the survey can enhance the time-use module's analytical uses, particularly if the two aspects are linked and the other parts provide more detailed data, e.g. on income and labour-market participation than would be typically collected by stand-alone time-use surveys.

However, it needs to be ensured that the time-use module does not impose too much additional burden on respondents. It must typically be short so as not to affect response rates. Yet, under these circumstances, the module could become so heavily restricted that the fieldwork might not be able to ensure that all the days of the week are properly represented.[123] Nonetheless, time-use modules are compatible with a range of survey designs. The UN *Guide* states that time-use modules can utilize a separate set of survey instruments that "*can be in the form of a time diary or a stylized analogue plus a background questionnaire*" (*Guide*, UNSD 2005: 17.61), or they can take the form of stylized questions on time-use integrated into the core survey questionnaire (UNSD 2005: 17.62).

123 United Nations Department of Economic and Social Affairs, Statistics Division. (2005). Guide to Producing Statistics on Time-use: Measuring Paid and Unpaid Work. New York: Accessed at https://unstats.un.org/unsd/publication/seriesf/seriesf_93e.pdf

124 Up to the early 2000s, most time-use surveys in Latin America took the form of modules attached to ongoing household surveys (Esquivel et al. 2008). Time-use modules have been included in World Bank-funded Living Conditions Surveys (Argentina 2001, Guatemala 2000, Nicaragua 1998), in Labour Force Surveys (Bolivia 2001, Costa Rica 2004, Ecuador 2003 and 2005, Mexico 1996), and in Income and Expenditure Surveys (México, 2000). Most of the more recent time-use surveys have been stand alone, though. That was the case with Brazil 2010, Mexico 2010, and Venezuela 2011-2012 (Esquivel, 2017).

2A.3.2 Types of survey instruments

There are two broad types of survey instruments for collecting time-use data:

1. a 24-hour activity diary (*Guide*, UNSD 2005: 49.211), and
2. survey instruments of (a) stylized questions or (b) tasks/activities lists.[124]

24-hour activity diaries

Activity diaries are 24-hour schedules, divided into fixed or open time slots. Fixed time slots may be 10, 15 or 30 minutes long, with room for writing up activities in each time slot. In contrast to short tasks lists and exhaustive activity lists, activity diaries follow what could be termed a bottom-up approach to time-use data collection. Instead of starting from aggregated activities and then disaggregating them further (a top-down approach), diaries collect detailed information on time-use in each time slot that is coded subsequently and only then aggregated according to the survey's activity classification.

Since activity diaries have been used to collect time-use information for about a century, there has been much research into elements of the diary design, validity and reliability.[125] For example, diary estimates have been validated by researchers "shadowing" respondents and keeping a parallel diary by comparing diary estimates with machine recordings (accelerometers) and recording activities with automatic cameras (van der Ploeg et al. 2010; Gershuny et al. 2017). There are even studies into the effect of how the diary is laid-out, particularly the number of intervals into which each hour is divided.

Time-use data collected from diaries gives a chronology of events that can be analyzed, not only by the **total time** devoted to a certain activity type, but also by the time when that activity took place. Further, they can capture simultaneous activities by asking "what else were you doing?" at any given time. Diaries may or may not include hierarchical simultaneity protocols. They can pre-establish a "main" activity and a "secondary" activity, or they can simply capture the activities without attaching any intrinsic ranking to them. Finally, the diaries can gather aspects of the context of an activity, for example:

- its location;
- mode of travel;
- other people who are present;
- devices used (mobile phone, tablet, computer, etc.);
- and sometimes, some self-rating of the experience of activity—for example, level of satisfaction, stress, or happiness.

125 The list of activity categories may consist of a small number of broad activity groups (such as paid employment, education, personal needs, domestic work, maintenance, and leisure) or it may contain a longer list of more detailed activity tasks, such as meal preparation, cooking, washing dishes, laundry, ironing, cleaning, sewing, shopping etc. (UNSD, 2005: 15.48).

126 For a summary of this testing, refer to Robinson and Godbey, 1997: 57-96.

Stylized questions and tasks/activities lists

Short tasks lists

Short tasks lists are survey instruments asking stylized questions that target specific tasks. They aim to obtain data on the time spent performing these tasks (*Guide*, UNSD 2005: 57). This data collection instrument is called "short," not so much because of the length of the list, which in some cases can be fairly long, but because the lists are never exhaustive. When measuring unpaid care and domestic work, for example, they would exclude categories like personal care (particularly sleeping time) or leisure. Consequently, they never sum to 24 hours a day.

Stylized diaries

There is a trade-off between respecting the 24-hour cap and the interests of keeping the interview short. The stylized "diary", included as a module within another survey, resorts to a short and comprehensive listing of activities, which in many cases correspond to one-digit trial in the International Classification of Activities for Time-use Statistics (ICATUS; see *Activity Selection*).[126] Respondents estimate how much time they spent on these broad activity categories during "yesterday". Although the instrument typically prompts the respondent to recognize that the activities must sum to 24 hours (by printing this total after the list of activities), it collects no information about the time of day when activities took place, unlike the stand-alone diary method. This instrument also ignores simultaneous activities and limits respondents engaged in more than one activity to choose a single "main" (primary) activity.

Exhaustive activity lists

Using short tasks lists often requires grouping activities into aggregated categories. Dissatisfaction with built-in list aggregation and the difficulties of unpacking this information, have prompted efforts to refine "task" data collection by using "exhaustive" activity lists. While exhaustive activity lists are comparable to stylized diaries with regard to their comprehensiveness (including time devoted to personal care, paid work, etc.), they also resemble short tasks lists in their emphasis on capturing unpaid care and domestic work. The 24-hour-per-day/168-hours-per-week cap is not followed, and there is no provision for capturing simultaneous activities.

2A.4 Activity selection

Activity selection is a central component of time-use survey design, since these surveys measure the time employed in performing activities (*Guide*, UNSD 2005: 5.5). In developed economies, many time-use surveys allow respondents to describe their activities in their "own words". These are then "post-classified" into a hierarchical classification by a team of coders, sometimes aided by a dictionary of keywords. An alternative method is to pre-code activities and request respondents to pick amongst a given list.

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127 Since stylized diaries do not gather information on the chronology of activities and when activities take place, they are not considered as a form of activity diarylike the 24-hour activity diary, but rather they are considered as tasks/activity lists. Refer to the discussion on activity diaries in the following section for more information.

Activity selection varies according to the objective of the time-use survey. Indeed, as the UN *Guide* has indicated, activity selection must "provide a set of activity categories that can be utilized in producing meaningful statistics on time-use. These have to be meaningful in relation to the broad range of objectives of national time-use studies" (*Guide*, UNSD 2005: 179.759).[127]

Figure 2A.1 shows that activity selection also varies depending on which time-use data collection instrument is used. The activity selection design process radically differs depending on whether the instrument is the tasks/exhaustive activity lists or activity diaries.[128]

2A.5 Further key elements of time-use design

2A.5 1 Background information

Background information is supplementary information about respondents that is collected along with the time-use information. These background characteristics of the respondents are crucial to the interpretation and analysis of time-use data. Background information refers to such things as the family, social and geographical context in which individuals live and where their activities take place. In stand-alone time-use surveys it is typically gathered by: 1) the personal questionnaire; and 2) the enumerator's household form/questionnaire. Needless to say, when the time-use module is attached to or integrated into a host household survey, the host survey provides the module's background information.

2A.5.2 Contextual variables

Contextual variables are sometimes included within the activity diary itself. The most frequent contextual variables are:

- location (the place in which the activity was undertaken);
- company (who the respondent was with);
- means of transportation;
- aim of the activity (the person(s) or institutions for whom a particular activity was being carried out); and
- whether the respondent was being paid for the particular activity.

Sometimes there are "context" columns for device use (for mediated communications), or for subjective experience (self-rated time-pressure, stress, task overload, task satisfaction or happiness).

Aside from their intrinsic value as useful information to expand the activity analysis, contextual information acts as a memory aid. It also assists post-coding by helping to distinguish activities that look the same, but might be of an entirely different nature. For example, taking care of children

128 The Guide refers to "classification of activities" and not to "activity selection" due to the fact that "it does not deal with the design of" tasks/activity list surveys (UNSD, 2005: 57.238). The selection of the activities is more general than defining a Classification of Activities, as shown in Figure 2A.1.

129 For a discussion of potential challenges to consider in the conduct of time-use surveys, refer to UNDP & ILO. (2018). Time-use surveys and statistics in Asia and the Pacific. A review of challenges and future directions, Chapter 9, page 56 (accessed on 05 April 2021): https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_630892.pdf

might be taking care of a neighbour's children for pay, which is neither unpaid care-giving work nor voluntary work but paid work.

2A.5 3 Inclusion of "probing questions"

One disadvantage of diaries, both the full-fledged and the light versions (in contrast to exhaustive task surveys), is that some activities tend to be consistently underreported. These are activities that are considered to be less important and are performed passively or routinely along with other activities, or are intimate (in which case the underreporting is conscious). Probing questions aim at recovering "forgotten" activities, or those not mentioned spontaneously, by targeting them explicitly.

Probing questions fit the interview method better than the self-administered method. They are aids to helping respondents remember events that can be entered into the diary after the spontaneous recall of events has been completed. The most frequent probing questions are related to care-giving activities and remunerated activities that might not have originally been considered paid work by the respondent.

Probing can be considered an interview technique to help respondents recall details of a chronology of events (such as dressing before leaving the house) or contextual information (such as transportation when there are changes in location).

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ANNEX 3: CAPTURING COMPLEXITY – SPECIAL FEATURES OF TIME-USE SURVEYS

This annex examines three vital aspects of the comparative advantage of time-use surveys. These are their ability to provide detailed data on (i) overlapping or simultaneous activities, particularly for women's time-use; (ii) the episodic nature of human activity (namely the mean time spent on various main activities) and (iii) subjective dimensions of human activity (e.g. levels of happiness and satisfaction).

Section 3A.1 Overlapping or simultaneous activities

This section consists of edited extracts from material provided by Maria Floro to the ESCAP Statistics Division in 2018.

3A.1.1 A growing phenomenon, particularly for women

Overlapping activities, in which secondary (and tertiary) activities are performed simultaneously with a primary or main activity, are important dimensions of time-use that have increasingly gained attention in research and the media. A number of studies on how people function, particularly in the way they spend their time and perform their work, have long recognized the fact that certain groups often engage in "overlapping" activities, or so-called "polychromic use of time" (Kaufman-Scarborough and Lindquist, 1999).[129] Hall (1959) discussed this form of activity engagement in his analysis of time-use in cultural settings and its importance, as a human activity was further highlighted by Szalai (1972). To date, a plethora of studies have acknowledged that overlapping activities is neither an isolated phenomenon nor a trivial issue. Multitasking has increasingly become a facet of modern life, especially with texting, checking emails, social media, etc. while doing something else.

But the incidence of overlapping activities has always been relevant to the way women in particular tend to use their time. The multiplicity of roles that women perform—as income earners, principal housework and childcare providers as well as community volunteers—compels them to seek ways to relieve time pressure. In some cases, this means reducing the time for leisure and/or sleep. For others however, they develop a facility to intensify their work time by performing tasks or chores while doing something else.

Research on women's work particularly in the informal sector and home-based work show the prevalence of their tendency to overlap (Roldan, 1985; Benton, 1989; Lozano, 1989; Szebo and Cebotarev, 1990; Floro and Pichetpongsa, 2010). These studies show a high incidence among women workers in Mexico, the United States, Spain and Thailand of combining market work and domestic activities such as cleaning, cooking and childcare. For instance, there are instances when women take their household responsibilities with them to work. In a Delhi study of slum dwellers, Karlekar (1982) points out that 30% of the poor women who work as street sweepers end up taking their children with them. Studies on household strategies during economic crises such as those by

130 While overlapping activities or multitasking refer to the behaviour of conducting more than one activity at the same time, the term "polychronicity" refers to the degree of preference for such behaviour (Circella et al., 2012). See also Kirchberg et al. (2015).

Beneria and Feldman (1992) and Floro et al. (2010) also indicate that prolonged multitasking or intensification of work has been an important coping mechanism during periods of falling incomes, rising prices and cuts in social services.

3A.1.2 Why should we study overlapping or simultaneous activities?

Studies indicate that there are welfare, measurement and policy consequences of overlapping activities, which make the documentation and measurement of such activities an important research priority. Three key aspects stand out on this respect:

An indicator of quality of life

Measuring the extent to which people overlap activities can convey information about their quality of life, or lack thereof, unlike standard economic indicators (Floro, 1995; Offer and Schneider, 2011). The tendency to multitask can imply potential benefits in terms of increased productivity to an individual, or it can represent the intensification of work and the lack of discretionary or "pure" leisure time (as in the case of overlap between work and leisure activities) (Bittman, 1991). Long hours of work coupled with prolonged periods of high work intensity negatively affect a person's health and well-being (Baruch et al., 1987; Adler and Benbunan-Fich, 2012; Reinecke et al., 2016; Xu et al., 2016).

Comprehensive data on economic contributions of individuals

The inclusion of secondary and tertiary activities in time-use surveys can provide a more accurate estimate of an individual's economic contribution, especially in the area of non-market production of goods and services. The non-market sector of the economy that relies heavily on unpaid labour is crucial to human development and underpins the functioning of the market economy. The omission of time-use information on secondary (and tertiary) activities is particularly problematic in the case of unpaid care, whether caring for children, older persons, ill or disabled persons, for its absence seriously underestimates the time spent on these activities.

The systematic bias created by the omission of overlapped secondary and even tertiary activities in time-use data collection has been confirmed by several studies including Ironmonger (1994, 1996), Bittman and Matheson (1996), Bittman and Pixley (1997), Robinson and Godbey (1997), Floro and Miles (2003), Mullan (2010), and Floro and Pichetpongsa (2010). For example, Bittman and Pixley (1997) have shown that nearly 75% of all time spent in childcare is spent while performing another activity. Ironmonger (2001) indicated that childcare is a constant responsibility requiring continuous physical presence with the child in a caring, minding role, even while attending to other tasks. This is often true also for caring of the disabled, the sick, and older persons. At the same time, despite the physical presence required, caregiving can permit other simultaneous activities, such as cleaning, cooking, washing clothes, tending the garden, gathering water, shopping, watching TV or even sleeping. Alternatively, these activities are closely intertwined by the frequent switching between tasks.

An indicator of the impact of economic changes on people's daily lives

A better understanding of how individuals and families organize their daily life can provide a more robust assessment of the impact of economic change on living standards and individual well-being. Individuals' and households' responses to cyclical fluctuations, particularly during periods of

economic downturns, involve coping mechanisms that affect labour force participation, household division of labour and time-use. This may include an increased search for additional sources of income, the substitution of home-produced goods and services for market purchases, and so forth. Such coping strategies affect not only the length of working hours, but also the intensity of an individual's time-use. Instead of choosing between two activities that need to be done, people may perform both simultaneously rather than singularly. Policy and academic debates on time allocation are insufficiently informed when they merely focus on the time-use trade-off among primary activities, while ignoring production accomplished as overlapped or secondary activities.

3A.1.3 Nature and consequences of multitasking

Simultaneous activities and concurrent activities

There are several aspects of multitasking or overlapping activities that require discussion. First, the manner of engagement in two or more activities depends on the time scale by which the activity is measured. Hence, a person may actually perform two or more activities either simultaneously (concurrently) or sequentially in the sense that the person switches or alternates the tasks at hand, depending on the length of the time period (Circella et al., 2012; Drago and Stewart, 2010). Time granularity and the period of observation are important time-related aspects of multitasking or overlapping activities. Juster and Stafford (1991, p.482) suggest that overlapping activities may be just frequent switches between activities, and "if the time grid were fine enough, the issue of secondary activities would then effectively disappear."

Identifying main activities and secondary activities

The question of which activity is considered to be primary and which is secondary arises if a person is doing two or more activities. This designation issue is likely to affect other decisions about the set of activities being performed. For example, if cooking is the most important activity for a mother, she may turn on the television to keep a child occupied and quiet, whereas if childminding is the more important activity, the woman may turn the stove heat to simmer level so that the cooking activity requires less attention. Deriving which activity is the 'main' one is critical, regardless of whether the survey instrument only allows for a single activity to be recorded in any given time slot, or if it reports multiple activities. In practice, several working definitions have been adopted in identifying the primary activities, including "the one you would be doing anyway", the "most important" activity, the activity that "demanded most attention," and the respondent's own identification of "main" activity.

Distinguishing pleasant and unpleasant secondary activities

Third, overlapping activities can take on multiple combinations, some of which can be pleasant and enjoyable or unpleasant and even stressful (Floro and Hungerford, 2004). For example, performing a secondary activity such as listening to the radio while cooking (primary activity) breaks the monotony of the primary task involved. On the other hand, overlapping activities may lead to increased stress or diminished quality of the output or experience, which may adversely affect the person's well-being (Floro, 1995; Kalenkoski and Foster, 2016; Reinecke et al., 2016). Studies have shown that persons who are "time squeezed" are likely to cope with time pressure by performing secondary work activities in conjunction with another (primary) activity such as childminding and cooking, or childcare and market work. Likewise, the "pure" satisfaction derived from a primary

leisure activity or the attention given to personal care may diminish when necessity dictates its combination with a secondary work activity. For example, the pleasure derived from watching sports on TV with undivided attention may be lessened when the person is also minding a young child whose interruptions are not necessarily timed during commercial breaks (refer to Section 3A.3 on bringing out the subjective aspects of everyday activity).

The impacts of multi-tasking on productivity

Finally, the way a person performs his or her work—whether fulfilling or debasing, pleasant or stressful—affects not only the quality of life of that individual but also his/her productivity. There can be greater efficiency (in terms of use of time resource allocated to task execution) and/or increased output productivity in the sense that "time is not wasted" or "time is saved" or "things get done in a shorter time". Multitasking is sometimes perceived as the solution to "time pressure" or "time squeeze". But the extent to which the individual's productivity under multitasking is higher than, equal to, or lower than his/her productivity in a monotasking condition, depends on the intensity and quality of the interactions between the activities. For example, having to look after young children while cooking or street-sweeping expends a great amount of energy and can be stressful. It is not clear if the person who is working harder for a given unit of time has necessarily increased his/her productivity, even though there has been an increase in effort as a result of undertaking two activities simultaneously. The presence of competing tasks requiring resources in the same or different domains (e.g. mental versus physical) affect the efficiency with which activities can be carried out by an individual.

On the other hand, long hours of work coupled with prolonged periods of multitasking can negatively affect not only cognitive abilities and performance, but also a person's health and well-being (Baruch et al., 1987; Reinecke et al., 2016; Johansson et al., 2016; Suziedelyte, 2016). In the case of overlapped street-sweeping and childminding activities, children are likely to be exposed for long periods to a non-stimulating and even dangerous environment. Likewise, there is a higher probability of food getting burned whenever a woman is compelled to perform both cooking and childminding simultaneously, since she has to shift frequently from one task to another.

3A.1.4 Simultaneous activities – recording and measuring

Recording secondary activities in interviews

The ability to collect reliable data on simultaneous or overlapped activities depends on the methods of data collection used (Drago and Stewart, 2010; Offer and Schneider, 2011; Kenyon, 2010). For example, it is difficult to record simultaneous activities through a telephone interview. Underreporting of secondary activities may be more likely to appear when using activity lists and stylized questions that constrain people to summarize their activities into a total of 24 hours and use of interview/recall methods. The training of interviewers is important especially in the use of the latter. Unless they are made aware of the importance of collecting data on multitasking and the various methods for helping in respondents' recall, they are likely to underreport secondary and tertiary activities or miss them altogether.

Measuring actual time spent in each parallel activity

Once collected, the next question is how to measure the time spent in simultaneous activities. For example, should the one hour an individual spends on cleaning (primary activity) and caring for children (secondary activity) be considered one hour of cleaning plus one hour of child care? Or should the two activities be equally weighted and the time period (1 hour) split between them—30 minutes on cleaning and 30 minutes on childcare?

Three methods for measuring the time spent in simultaneous activities namely are presented: use of weights (full or deflated), use of matrix, and use of context variables.

(i) Use of weights

Some studies, such as Floro and Miles (2003), use "weights" for activities that take place simultaneously. Based on different assumptions regarding the relative attention or energy spent on the secondary (work) activity, they use two types of weights in accounting for the time spent in secondary activities:

1. primary and secondary work activities are given equal weight, when the respondent seems to give similar attention or energy to the two activities; and
2. overlapped or secondary work activities is given half the weight of the main activity, when one activity stands out as being the "main" one and requiring more attention or energy that the secondary activity.

(ii) Use of matrix with a two-dimensional measure of time

Ironmonger (2001) argues, however, that there is no need for "weights" to account for the simultaneous activities. Instead, he makes use of a two-dimensional measure of time that constrains the time spent on primary and secondary activities to 1440 minutes per day by constructing a matrix table of average time spent on "primary" activities by time spent on "secondary" activities. The use of matrix techniques facilitates the examination of primary and secondary time individually or in unison. It identifies which activities are performed simultaneously and for how long.

(iii) Use of context variables

The third approach addresses a common problem of underreporting secondary and tertiary activities in time-use surveys, especially when using the interview/recall method. It involves the use of contextual information that are collected for each activity. These context variables are useful for distinguishing different types of work and between work and leisure activities. The distinction relies on the context information collected such as the location of an activity, the other people present, the person or institution for whom the activity was done, the purpose of the activity and any remuneration that may have been received for the activity. Contextual information is therefore crucial for coding and classifying activities. For example, information on the persons or institutions for whom a particular activity was being carried out, and whether payment was involved, are important for identifying volunteer work, unpaid work within the household and unpaid work outside of the household. Other contextual information, such as subjective information regarding a person's experience while performing an activity, can be useful in constructing measures of quality of life.

Section 3A.2 Patterns in the day: episode occurrences and constructing tempograms

Unless otherwise stated, this section consists of edited extracts from material provided by Ignace Glorieux to the ESCAP Statistics Division in 2018

3A.2.1 Episode occurrences as an indicator of quality of time-use

Analysis of episode occurrences (the number of activities) is often used as an indicator of the quality of time-use, and as such, to study differences in the quality of time-use between men and women. Bittman and Wajcman (2000), for instance, used the number of different leisure activities as an indicator of fragmentation to examine the different character of the leisure of men and of women. Vandeweyer and Glorieux (2011) used the number of housework activities per hour, the number of childcare activities per hour, and the number of leisure activities per hour, to research differences in feelings of time pressure between women.

Increased feelings of time pressure are often associated with the acceleration of social life. The more one wants to do during a day with a limited number of hours, the more fragmented time-use becomes. A simple indicator to measure fragmentation is counting the number of activities or episodes recorded during one day. The fragmentation of time-use of different groups can be studied by comparing the mean number of episode occurrences of these groups (e.g. men and women, working mothers and non-working mothers, etc.).

Another indicator can be restricted to one type of activity. It is possible to study the fragmentation of housework, for example, or childcare or leisure time, by calculating the number of episodes per hour devoted to this category of activity (e.g. number of housework episodes per hour).

3A.2.2 Calculating episode occurrences

Most analyses of time-use data involve duration (how long?), participation rates (with how many?) and occurrence (how many times?). As well as these three basic dimensions of time-use, the timing and sequencing of activities are also important parameters of daily life. These parameters are not restricted to one activity or episode. Rather, they focus on when different activities occur, and hence provide insight to the patterns of daily life.

Episode occurrences are easy to calculate in this context. The only decision to make is which activities should be counted and for which period. Most simply, the number of registered episodes per day or per week can be counted. This gives some insight into the fragmentation of the time-use of a respondent or a category of respondents. The same can be done for particular categories of activities, e.g. household work, childcare or leisure time. Since not everyone is spending the same amount of time in each category of activities, it is recommended that the number of activities be standardized by dividing it by the number of hours spent on this category, which results in the number of activities per hour (e.g. number of household episodes per hour of housework). Episode occurrences as an indicator of fragmentation can be used as an independent variable in regression

analysis to study its effect on the dependent variables of subjective indicators of time pressure or well-being (refer Section 3A.3).[130]

Box 3
Presentation of episodes in time-use diary format

Edited extract from material provided by Klas Rydenstam to the ESCAP Statistics Division in 2018

The presentation of episodes in a completely filled-out diary format with open time recording (i.e. not fixed time intervals) is illustrated in Table 3A.2.1 below. Each line represents an episode, which is characterized by the content in each of the four recording domains. When there is a shift in any of the recording domains, a new episode starts. Starting and ending time represents the temporal identifiers of the episodes.

Table 3A.2.1. Presentation of episodes in content of a principal diary

Diary/ Peron id	Starting time	Ending time	Main activity	Parallel activity	Who with:				Where/ mode of transport
					Alone	Spouse	Children	Other Persons	
a	04:00	07:20	Sleep						At home
a	07:20	07:50	Shower						At home
a	07:50	08:30	Had breakfast	Read newspaper			Ch		At home
a	08:30	08:40	Walked to bus		A				By foot
a	08:40	09:00	Bus to job					OP	By bus
a	09:00	11:20	Paid work					OP	At work
a	11:20	11:50	Lunch break: meal	Talked with colleagues				OP	At work
a	11:50	12:00	Lunch break: walk	Talked with colleagues				OP	By foot
a	12:00	12:30	Lunch break: walk		A				By foot
a	12:30	16:30	Paid work					OP	At work
a	16:30	16:50	Bus to home	Read newspaper	A				By bus
a	16:50	17:00	From bus by foot		A				By foot
a	17:00	17:40	Cooked supper	Talked with children			Ch		At home
a	17:40	18:20	Had supper	Talked with family		Sp	Ch		At home
a	18:20	19:10	Dish washing	Listened to radio	A				At home
a	19:10	21:00	TV			Sp	Ch		At home
a	21:00	22:10	Took a walk	Talked with spouse		Sp			By foot
a	22:10	22:20	Shower						At home
a	22:20	04:00	Sleep						At home

The duration of episodes, which is immediately available in the above format, is the most exploited information-rich element of time-use survey. This forms the basis for calculating the most common time-use statistic, namely the **mean time** spent on various **main activities**. It is also the basis for calculating **participation rates** because it records whether any time is allocated to a particular activity in the diary. The **temporal location** of episodes shown above further provides the temporal "foot prints" of social coordination, which is critical for family association, transport and energy use, while **the frequency of**

131 The assessment of such indicators is obtained through self-reports: people are asked to evaluate their lives as a whole or some aspect of it. The questions can be relatively straightforward and a widely used one simply asks: 'Taking all things together, would you say you are: very happy, quite happy, not very happy or not at all happy'. More elaborate measures use multiple items to target a specific part of SWB (subjective well-being) and consequently render more reliable results single-item measures do (thought at an expense). Sourced from A Short Introduction to Subjective Well-being: Its Measurement, Correlates and Policy Uses. (2007). André van Hoorn, Nijmegen Center for Economics (NiCE), Radboud University Nijmegen. Based on joint work with Stefano Castriota.

episodes can also be calculated, shedding light on the degree of time fragmentation in a day, with potential implications for stress levels and health.

Sequences, or the chronological order of episodes, can also be analysed in various ways. One example is the distribution of activities, such as the activities that follow immediately after the episodes of free-time. In Sweden, there is a significant difference between women and men in such situations. Women's episodes of free-time activities are more often followed by episodes of unpaid work. On the other hand, men's episodes of free-time activities are more often followed by a meal.

3A.2.3 Tempograms: Episode sequencing and the collective rhythm of daily life

The timing of activities is usually represented graphically using tempograms that show for different times of the day (e.g. each 10 or 15 minutes from midnight till midnight) the proportions of the sample involved in a certain type of activity or in different groups of activities. Tempograms provide insight into the collective rhythm of societies and how different social groups share the same activities. Studying patterns of time-use by means of tempograms also gives insight into how activities are sequentially ordered in a given society or for certain social groups.

Tempograms summarize a lot of information. If time-use data has been collected at more than one point in a society's history, tempograms can be used to study trends in the timing (e.g. sleeping time, collective meal times), the sequencing, and the synchronization of activities.

Tempograms are useful not only for studying the timing and sequences of activities, but also for mapping locations, the presence of interaction partners, and even the subjective qualities of an activity (e.g. the meaning of activities).

Episode or activity files are the basis of tempograms. In this kind of data file, the cases are not respondents or individuals, but episodes (e.g. 10- or 15-minute slots) or activities (with the exact starting and ending time). These data files contain all the information on the sequence and the exact timing of all the activities of the respondents in the sample.

By means of these data, it is possible to calculate for a given point in time (e.g. 10 a.m. on a weekday) what everyone in the sample was doing, which can be done for different points in time for a certain period. This is the information that is used to make tempograms.

The simplest tempogram refers to one day (a weekday, a Saturday or a Sunday) and shows for every 10^{th} or 15^{th} minute of the day the proportion of the sample (or subsample) that is doing a certain activity. To generate this kind of tempogram, the computer has to calculate for every respondent for every 10^{th} (or 15^{th} minute) of the reference day, whether (1) or not (0) the respondent was engaged in the activity of interest. Using this binary variable, it is simple to calculate the proportion of the sample that was doing the activity of interest for each point in time during the day. Once these proportions are calculated, it is easy to represent them—using Excel or another spreadsheet—in a graph or tempogram.

More complex tempograms contain information of different activities. The process to generate them is the same as for a simple tempogram. Given a number of categories of activities, the SPSS software package, and perhaps other statistical software, can calculate for every point in time whether or not a respondent was doing one of these categories of activities. Using these binary

variables for each activity of interest, it is possible to calculate the proportions of the sample (or subsample) that was involved in these activities for every point in time of the period of reference.

Section 3A.3 Bringing out the subjective aspects of everyday activity

This section consists of edited extracts from material provided by William Michelson to the ESCAP Statistics Division in 2018.

3A.3.1 Setting the scene

The importance of capturing the subjective aspects of time-use was emphasized internationally by an influential report of the Commission on the Measurement of Economic Performance and Social Progress (2010). The Executive Summary produced by Joseph Stiglitz recommends that "measures of both objective and subjective well-being provide key information about people's quality of life. Statistical offices should incorporate questions to capture people's life evaluations, hedonic experiences and priorities in their own survey" (Stiglitz, J. E., Sen, A., & Juan-Paul Fitoussi, J.-P., 2010).[131]

The report observes that "research has shown that it is possible to collect meaningful and reliable data on subjective as well as objective well-being. Subjective well-being encompasses different aspects, such as cognitive evaluations of one's life, happiness, satisfaction, positive emotions such as joy and pride, and negative emotions including pain and worry, each of which should be measured separately to derive a more comprehensive appreciation of people's lives. Quantitative measures of these subjective aspects may potentially deliver not only a good measure of quality of life per se, but also a better understanding of its determinants, reaching beyond people's income and material conditions. Despite many unresolved issues, these subjective measures provide important information about quality of life. As a result, the types of questions that have proved their value within small-scale and unofficial surveys should be included in larger-scale surveys undertaken by official statistical offices (Stiglitz et al., 2010: 16).[132]

This finding was reinforced by the OECD's report on "Measuring Subjective Well-being" (OECD 2013). In Chapter 3, on "Measuring Subjective Well-being", the authors both note the valuable role of time-use surveys for measuring subjective well-being and recommend strategies that different national time-use studies have used to cope with the burden of collecting so much diverse data from many respondents.

In this context, statistical agencies in more and more countries have been paying some degree of attention to the subjective phenomena in collecting time-use data. However, perceived limitations on what researchers and administrators consider as acceptable costs to research organizations and respondents alike have led to a reluctance to obtain subjective measures pertaining to the full range of activities throughout the day.

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132 "Connected to feelings of pleasure." Cambridge English Dictionary: https://dictionary.cambridge.org/dictionary/english/hedonic.

133 Ibid.

Instead, the tendency has been to experiment with a few cost-effective techniques. These have followed two main tracks: (i) gathering data on the subjective aspects of each of the episodes of activity in a day; or (ii) sub-sampling respondents. In the latter case, the French national time-use study of 2010 asked a subsample of respondents to rate all episodes reported on a scale of pleasant to unpleasant. This approach allowed for the aggregation of hedonic subjective data into the higher day-long unit of analysis.[133]

Currently, given the pioneering efforts of prominent scholars to assess the subjective side of time-use methods and the impact of "Stiglitz" report and the collection of time-use data by national statistical agencies, the question is not whether subjective data are being collected, but rather what relationships they have with objective data, with respect to which unit(s) of analysis, and whether the coverage is significant enough to support conclusions.

3A.3.2 Range of applications

While there are a number of challenging questions that still need to be addressed concerning the gathering of subjective time-use data, a range of applications for the use of such data have emerged. Wheatley's review (2017), for example, addresses a number of applications, such as work time, household division of labour, care and voluntarism, commuting and leisure.

A few research examples from the work of Michelson are offered below to suggest the range of applications, as well as some evidence of the logic and analytical steps potentially involved. Once again, appropriate objective and subjective variables at different levels of analysis are the *sine qua non* of satisfactory inquiry.

Subjectivity at the episode level: Tension in particular activities by employed mothers/fathers

Assessing the degree of tension (on a scale of 1-7) perceived by respondents for each episode in the day made it possible to assess the extent to which employed mothers and fathers subjectively experienced various types of activities in the day in ways that were similar or different. To conduct this assessment, the mean tension reported in the time budget for each category of activity by men and by women was calculated, then graphed by gender (cf. Michelson, 1985, 1999). The data showed that employed women's days were uniquely and negatively complicated by primary responsibility for transitions (for example, from school to home) in the daily lives of their children. This demonstrated the importance of documenting subjective feelings at the episode unit of analysis. Feelings for the day as a whole, or even more generally in such variables as life satisfaction, cannot document the sources of the feelings emerging within the pursuit of everyday life.

Locating subjectivity by time of day

As also outlined in the previous section, a type of graph called a tempogram can be created to show the pattern of frequencies during a given time of day when certain components of time-use occur and compare this pattern among subgroups. Figure 3A.1 compares men and women with reference

134 For further information, refer to: Insee time-use survey source (https://www.insee.fr/en/metadonnees/source/serie/s1224); French time-use survey (https://unstats.un.org/unsd/demographic/sconcerns/tuse/Country/france/French_TUS_2010.pdf); and/or Eurostat time-use survey metadata (https://ec.europa.eu/eurostat/cache/metadata/en/tus_esms.htm).

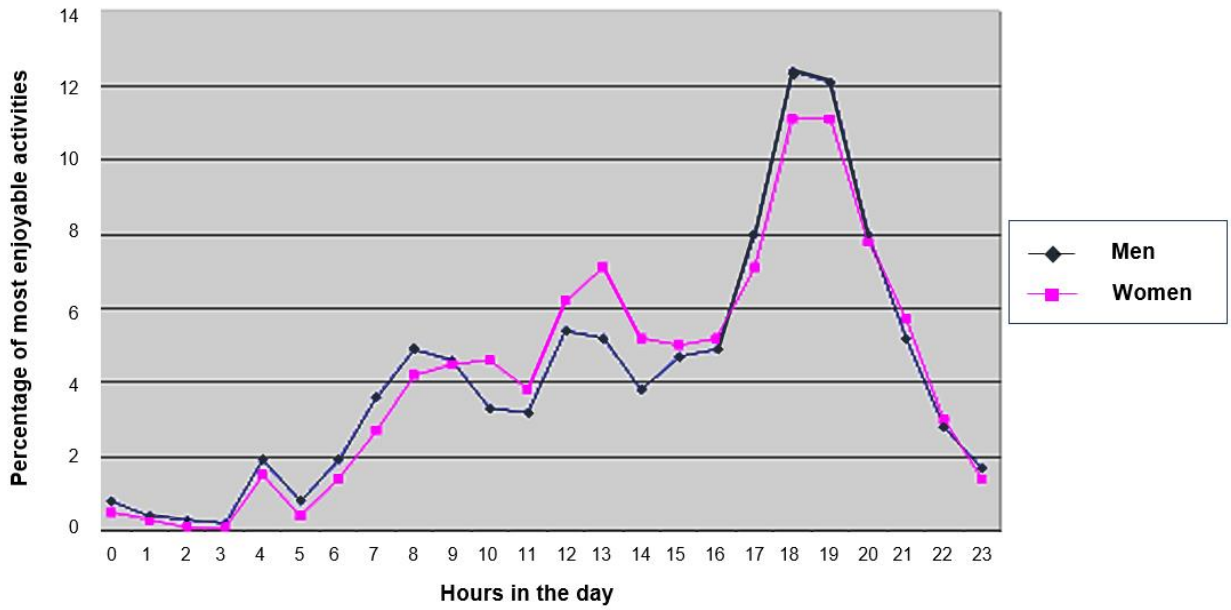
to the hour in which the activity they specified as "most enjoyable" occurred. It can be constructed through a frequency distribution on the episode identified as most enjoyable by the hour in which it started and by gender.

This tempogram shows that, while the distribution throughout the day of the most enjoyable activity is relatively similar for men and women, women are more likely than the men to experience their most enjoyable activity in the middle of the day (from 10 a.m. to 4 p.m.), while the men are more likely in the early morning and around the dinner hour. Both genders are much more likely to single out the dinner hours as the most enjoyable of the day. Clearly, this type of information is only conveyed by the episode as the unit of analysis.

Commonly used subjective variables do not all refer to the same levels of scale in people's lives. It is important to remain aware of which such variables are appropriate for the topic examined.

Figure 3A.1

Percentage distribution of hours in which most enjoyable activity of day started by gender (Canada 2005)



Source: Recreated by ESCAP based on materials submitted by William Michelson to ESCAP Statistics Division in 2018

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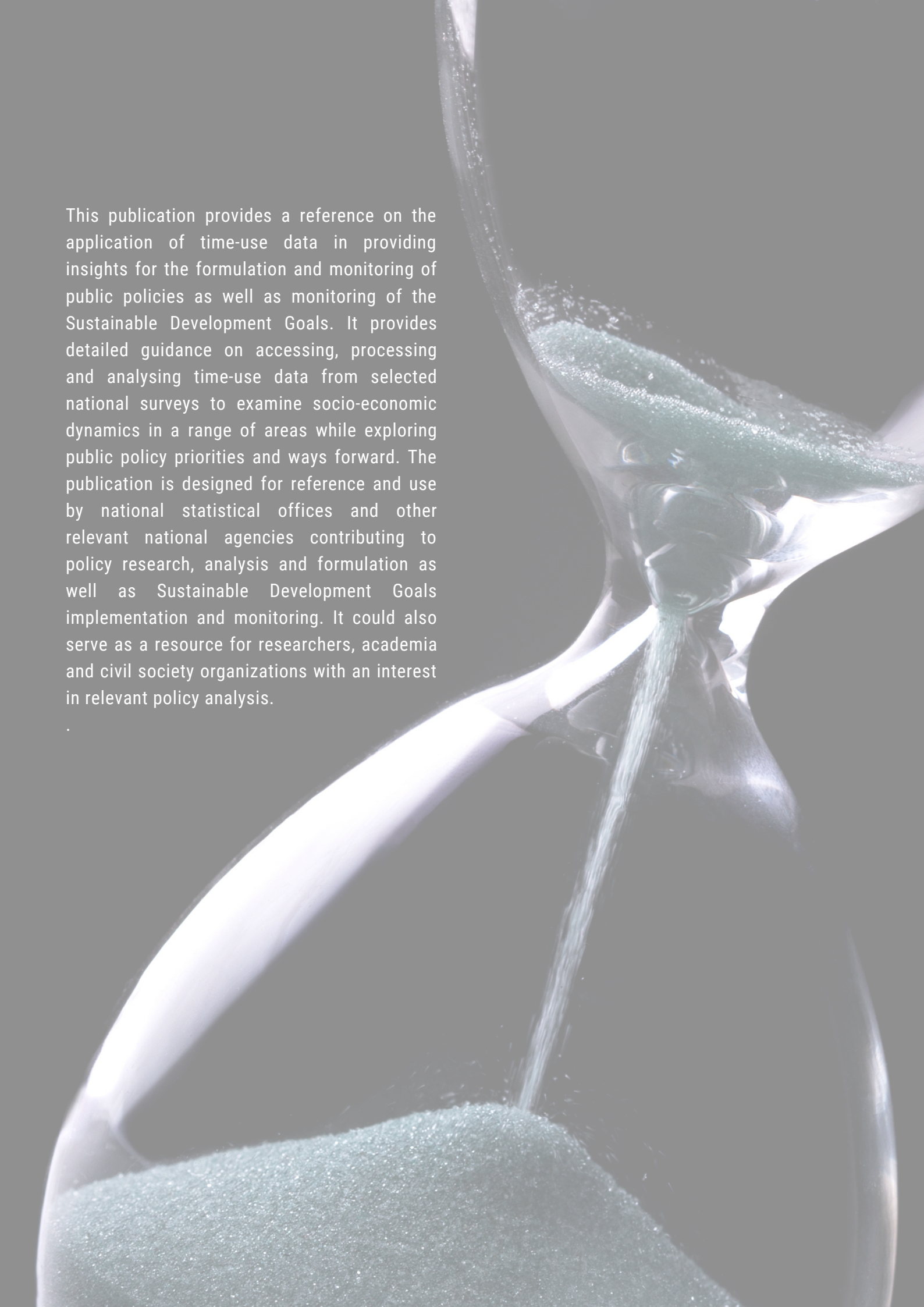

This publication provides a reference on the application of time-use data in providing insights for the formulation and monitoring of public policies as well as monitoring of the Sustainable Development Goals. It provides detailed guidance on accessing, processing and analysing time-use data from selected national surveys to examine socio-economic dynamics in a range of areas while exploring public policy priorities and ways forward. The publication is designed for reference and use by national statistical offices and other relevant national agencies contributing to policy research, analysis and formulation as well as Sustainable Development Goals implementation and monitoring. It could also serve as a resource for researchers, academia and civil society organizations with an interest in relevant policy analysis.

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