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Unpaid care work: calculating its value to the South African economy.

Nokukholwa Ruth Nkwanyana

209503020

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Supervisor: Dr Ralitza Dobreva

Co-Supervisor: Ms. Janet Bruce-Brand

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Student name: Nokukholwa Nkwanyana

Student no: 209503020

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Ralitza Dobreva

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ABSTRACT

All households partake in unpaid care work (UPCW) of varying degrees. This work falls outside of the production possibilities frontier because there is no payment for the products made or services rendered within the unpaid care work category of time use. Systematically does not get accounted in the UN System of National Accounts framework, and therefore, not included in the computation of the GDP index. Consequently, this sector is invisible thereby making it hard for governments to develop and implement policies to support those who engage in it most.

This study investigates how unpaid care work contributes to the South African economy. A quantitative approach using a non-experimental research strategy is used to estimate the imputed value of the unpaid care work as a share of GDP without attempting to determine possible causality or correlation between the variables. First, aggregate annual time use for UPCW activity is calculated. Then, the market equivalent wage is estimated for each of the respective UPCW activities. Then, obtaining a product of these produces the imputed value. The imputed value is measured against the GDP figures to estimate unpaid care work's potential share to GDP.

Three datasets: the 2010 Time Use Survey (TUS), the 2010 Quarterly Labour Force Survey (QLFS) and the 2010 Quarterly Gross Domestic Product (QGDP) data are used. The TUS produces the time estimates measuring how much time is spent on paid and unpaid work activities and the QLFS is used to estimate the market-related wages payable for activities of paid work similar to unpaid work. Lastly, the QGDP data is used to compare the contribution of unpaid care work to the South African gross domestic product (GDP). The results of four valuation methods inform that unpaid care work contributed 36.83% using the Economy Wide Mean Wage, 3.87% for Men and 6.89% for Women using the Opportunity Cost method, 25.82% using the Generalist and 26.47% using the Specialist wage methods to the South African real GDP of 2010. The monetary value of the unpaid care work sector for the year 2010, was R 3.97 1.463 trillion using the Economy Wide Mean wage, R153.9 billion for Men and R273 billion for Women when using the Opportunity Cost method, and R1 trillion 26 billion for the Generalist wage method, as well as R1 trillion and 52 billion when using the Specialist Wage method.

Contents

1. INTRODUCTION

1.1. Background and context

According to universal guidelines, domestic unpaid work is the production of goods and services that include house chores, child minding, shopping, household management, volunteering to help others and transportation for undertaking these activities (Jackson, 1996). Historically, unpaid care work was typically considered to be work done by females (Floro and Komatsu, 2011; Jackson, 1996). In particular the fetching of water, child and elderly care, meal preparation, laundry services and the like were considered unimportant and complex to compute in the calculation of a nation's GDP, and so were excluded in the System of National Accounts (Beneria, 1999a; Waring and Steinem, 1988). The exclusion of the unpaid care work activities from the System of National Accounts consequently resulted in the systemic exclusion from being counted in the gross domestic product of the nation.

Gross Domestic Product (GDP) is understood to be recording the value of all productive activities within a nation's economy (Kishtainy and Abbot, 2012; Parkin et al., 2000). It was borne after the development of the system of national accounts (Messac, 2018) as an indicator of a nation's economic performance and citizen wellbeing (Pigou and Aslanbeigui, 2017; Xiao, 2015; Syrquin, 2011; Bleys, 2012; Messac, 2018; Ringen, 1991). But some economists disagree with it being used as a measure of wellbeing because it does not account for a number of the sectors that add to the improvement of economic welfare of the citizens of an economy (Stiglitz et al., 2009; Stiglitz et al., 2010). Moreover, GDP does not account for productive non-market activity namely: domestic work, child and elderly care. Given that omission, household economic productive activity is not counted and therefore not valued (Kishtainy and Abbot, 2012).

The genesis of this arose when two economists – James Meade and Richard Stone, developed the system of national accounts to measure and evaluate the economy shortly after the start of the second world war (Deane, 1946; Messac, 2018; Stone, 1986). They hoped that this new tool would help nations quantify their resources and productive output so that living standards can be measured and tracked for the reconstruction and growth of post-war Europe and its colonies (Messac, 2018). Phyllis Deane, who was applying this method in a few British colonies, discovered that it was erroneous to exclude unpaid household labour from GDP estimates (Messac, 2018; Black et al., 2005). She determined in her paper, that although the

households were not receiving payment for the goods produced and services rendered, essentially because these were often consumed by the households themselves, they still could be accounted for as they had market equivalents (Deane, 1946). Deane subsequently spent considerable time in rural Africa during the 1950s to come up with mechanisms in which this sector could be included in the national production figures, but her research findings were ignored (Deane, 1946; Messac, 2018; Bortis, 2010).

As this field of research was gaining momentum, in 1993, South Africa held the first workshop of its kind, discussing unpaid labour and economic policy (Mackintosh, 1993). It was found that South Africa had considerable unremunerated work and the main debate centred around three things: did this type of work matter? If it did, what was the impact of omitting it in the calculation of the nation's overall production? And lastly, what could be done in response? (Mackintosh, 1993). One of the outcomes of this discourse was the Time Use Survey of the year 2000. This was significant because, the starting point to evaluating the contribution of the unpaid care work sector into the economy, is to quantify the time spent on this type of work.

(Waring, 1988) in her book, If Women Counted, continued sounding the alarm on the invisibility of unpaid care work in the UN System of National Accounts (SNA). She went further by articulating that this systematic invisibility is due to the work predominantly being performed by females (Saunders and Dalziel, 2017; Waring, 1988). Waring (1988) was followed by a host of other economists, sociologists and researchers that investigated and sounded the alarm on the systematic omission of the enumeration of the contribution of unpaid care work (Beneria, 1999a; Bonke, 1992; Chadeau, 1992; Ironmonger, 1996; Stiglitz et al., 2010).

For the purposes of this paper, unpaid care work will be referred to as upcw for the remainder of this study.

Prior to the calculation of the value of unpaid care work and the methods thereof, accounting for the contribution of upcw in the calculation of gross domestic production remains a subject of debate. Federici (2008) argues that since this type of work adds to the accumulation of market capital, unpaid care work should be accounted for in national production. For example, men can participate in paid work because their time is freed up by the unpaid activities occurring at the household level, which is performed mostly by women. Moreover, Hronec et al. (2015)

suggests that when the economy does not account for the unpaid care work, it leads to an incomplete measurement of gross domestic product, and therefore the more accurate indication of economic welfare is unknown.

Conversely, other economists propose that since domestic production at a household level receives no remuneration from the marketplace and is independent of it, it should not be included in the calculation of national production. Because if there was payment for the domestically produced goods and activities, the payment would categorise them as economic activities – and consequently get measured and counted (Vanoli, 2005). This argument suggests that like the other economic activities that measure consumption, payments, time spent (e.g. workers' time sheets), unpaid care work should universally have similar systems for measurement so it can be acknowledged in GDP estimates (Vanoli, 2005). "Universal" indicates that all the countries should use the same statistics and measurements, for example, time use surveys. Others suggest that including unpaid care work in the calculation of GDP could distort the unemployment figures (Budlender and Brathaug, 2002). They postulate a hypothetical example that if household members who produced unpaid care to be consumed within the household, report themselves as self-employed, this could considerably diminish the unemployment figures ultimately distorting measures of economic welfare (Budlender and Brathaug, 2002). Other economists advocated against the inclusion of unpaid care work because it does not have a significant impact on inflation, deflation or other disequilibria in the economy (Messac, 2018). Their compromise for the 2008 versus the 1968 and 1993 United Nations SNA framework, was the inclusion of physical goods produced by the household but not the services rendered by the household to the household (Messac, 2018).

1.2. Problem statement

Unpaid care work which includes activities such as child minding, elderly care, care of the sick, and domestic work, to date, is excluded from the System of National Accounts (SNA), and thereby is omitted from GDP calculations. The outcome of this systemic exclusion is the undervaluation of a critical sector of the economy, and disproportionally affects those who engage in it most. Given that this sector is not acknowledged in GDP metrics, it is afforded minimal policy attention, resource allocation, and government assistance for the individuals who contribute to it most. This intrinsic oversight allows economic inequities to prevail, and limits initiatives intended to address gender disparities in labour and economic participation.

1.3. Research aims and objectives

The aim of this study is to estimate the time use of and impute the South African Rand value to unpaid care work and measure it as a portion of South Africa's Gross Domestic Product (GDP). Measuring the contribution of unpaid care work is important for increasing the visibility of this sector to the economy. Some scholars have argued that the reason this type of work is not more visible is due to it being largely performed by women. Women make up half of the population implying that a significant number of economic agents receive little to no value for their time spent contributing to the economy, possibly undervaluing the production of the economy. This highlights the need to account for this type of work and acknowledge it in macroeconomic statistics. This will not only increase its visibility, intended to improve the wellbeing of its workers, but it could arguably have positive spill overs on the economic well-being of the nation.

The research questions to be explored in this study are therefore as follows:

- How does the allocation of time use differ by gender??
    - The study seeks to explore what time use data can reveal about the gender patterns of time allocation towards unpaid care work, paid work and non-work activities for the South African economy. Moreover, to have an indication of which gender is most responsible for the contribution of the unpaid care work services to the South African GDP.
- What is the monetary value of time spent in unpaid care work activity in South Africa?
- What is the percentage contribution of the value of unpaid care work activity to the South African economy?

1.4. Significance of the study

The invisibility of care work in national economic statistics has a negative effect on those that engage in it most. In the United States, women, who typically work in the care sector, are twice as poor as men, who do not work in the care sector (Eisler, 2013). Because the value of care work is not accounted for in national economic statistics (Oosthuizen, 2018; Jackson and Chandler, 1995; Eisler, 2013), programmes regarding care and care giving have not garnered as much support in national debate and planning as much as programs related to big business (Eisler, 2013). By estimating the value of unpaid work, macroeconomic estimates will be more representative of all forms of domestic production, namely, the household, market, and government sectors. This will give visibility to how unpaid work is beneficial to the expansion

of the economy and give rise to policies targeted at improving the provision of unpaid care work (Hirway, 2015; Folbre et al., 2013; Folbre, 2015).

The Nordic countries of Sweden, Finland, Norway and Iceland exhibit democracy and equal partnership between the genders at a state and household level (Eisler, 2013). These countries often rank among the highest in measuring quality of life as well as global competitiveness (Eisler, 2013). They typically experience low rates of criminality and poverty. Females are motivated to participate in productive labour because these countries have implemented economic policies that support families, such as childcare subsidized by the government, global healthcare, family stipends for the care of children, dignified elderly care and generous parental paid leave (Eisler, 2013). The Nordic countries can attribute the improved wellbeing of their economies to their investment in care work. In comparison to other countries, a greater proportion of their GDP is devoted to programs that promote economic development, protection of the environment as well as human rights protection, not only domestically but in developing nations as well (Eisler, 2013). Overall, their focus on care and care giving has produced positive spill overs and thereby greater measurements of economic wellbeing.

On the other end, in countries where unpaid care work is not proactively acknowledged or supported, the quality of labour being produced is potentially suboptimal. The increasing burden of care work, coupled with the historic prejudices that are attached to it, exposes unpaid care workers, typically women, to the risk of having low values of human capital development that ultimately inhibits their labour force participation (Hirway, 2015). With the majority of the unpaid care work falling on the shoulders of the females in a household, this leaves very little time for investment in learning, money-generating activity, taking part in political activities, rest and other leisurely activities (UNW, 2018). In some regions of the world, female children are given less access to food, healthcare and other basic needs instrumental for human and human capital development (Eisler, 2013). This study therefore tabled that these female children grow up to become adults suffering from malnutrition, ill health and low brain development such that this impacts on the birth, growth and development of the children they raise, male and female alike (Eisler, 2013). Because of the mothers' impaired socioeconomic development, this possibly creates a cycle of lower levels of human capital development and or socioeconomic development for the female children and their future children, in that family line. Moreover, according to Akintola (2006), unpaid care workers who are vulnerable due to ill health or age – in their pre-teen years or in post-retirement, come under overwhelming mental

and physical stress as they provide care to others. This may be more detrimental in the human development of those who are younger and are yet to be part of the working age population. However, contrary to observed trends where an ageing society is expected to bring about direct costs to the government, De Vaus et al. (2003) found that the Australian population aged 55 and above, contributed $74.5 million – an equivalent of 13.55 percent contribution to the Australian GDP in the form of unpaid care work.

Estimating the contribution of unpaid care work to the economy of South Africa provides an updated outlook on the gendered patterns of unpaid care work so that the South African government can formulate policies and social strategies that will make the production of this type of work more efficient and less burdensome in time and other resources. This study also reveals the age cohorts where unpaid care work occurs the most. Given that unpaid care work will affect each age cohort differently, the policy making process would have to account for the time taxes on these cohorts and provide social safety nets that will cushion the impact of this type of work on the potential health and human capital losses. Moreover, analysing the geographical regions where unpaid care work mostly occurs, would better assist the policy makers in allocating a greater portion of resources in regions where there is more need for government social programmes. In this way, this study is intended to ultimately benefit unpaid care workers by revealing their time burden, the contributing factors to their limited labour force participation and human capital development and encouraging discussion around improving access to social programmes and creating unpaid care work support programmes intended to improve their social and economic wellbeing.

1.5. Scope of study

This research focuses on South African individuals, aged 10 years and above, who participated in and had positive non-zero minutes spent doing unpaid care work activities during the year 2010. Given that the main dataset, 2010 South Africa Time Use Survey (TUS) excludes individuals who live in worker hostels, consequently, this research by default excludes this subsection of the population sample.

1.6. Overview of the dissertation

This study employed a quantitative research approach to the examination of how South African individuals allocated their time towards unpaid care work activities, and the calculation of the value of unpaid care work to the South African economy.

The Economy-wide Mean Wage, Generalist Wage and Specialist Wage methods for calculating the value of unpaid care work were employed in this study. These are three of four methods provided within the Input Valuation Approach for imputing value to unpaid care work.

Three datasets were used to achieve that valuation, which were: 2010 Time Use Survey (TUS), 2010 Labour Market Dynamics South Africa and 2010 Quarterely Real Gross Domestic Product.

The current introductory chapter, Chapter 1, presented the research problem, aims and objectives of this study on unpaid care work, and tabled a general overview of the research methodology undertaken in this research. Chapter 2 reviews the theoretical literature underpinning this study, namely, household economic thought, the unitary versus collective household production models, the labour leisure trade-off from the perspective of two types of labour. Furthermore, this chapter tables the global, regional and local gender patterns of unpaid care work and closes of with the attributes of actors who engage most in unpaid care work. Chapter 3 presents the research methodology for estimating the time determination model as well as the methods for applying the different impute valuation methods.

Following this Chapter 4 on Data and Descriptives discuss the data sources, sampling strategy, as well as the descriptive statistics for the main study dataset used to provide the time use estimates. Thereafter, the fifth chapter on Time Determination and Regression Analysis presents the Seemingly Unrelated Regression (SUR) time determination model that captures the time trade-offs between, paid work, unpaid care work and non-work activity. Paid work, unpaid care work, and non-work will be used interchangeably with pw, upcw, and nw, respectively. Chapter 6 presents the application of each wage method used to impute the value of unpaid care work to the South African economy. It sources the minutes from the 2010 Time Use Survey dataset, comparative wages from the Labour Market Dynamics South Africa dataset, and the value of the economy using the 2010 gross domestic product (GDP) using real production and not the expenditure approach. Lastly, Chapter 7 concludes this study and presents recommendations.

2. LITERATURE REVIEW

2.1. Introduction

Economic decisions on where to work, how much to save and invest, and what education to acquire are mostly made at the family level (Canning et al., 1994). Families make decisions about consumption spending, labour force participation, education, migration, and the like, thereby making it a central decision-making unit in society. Because families are responsible for making decisions that affect the performance of economic development, understanding households is therefore crucial in the study and the administration of the economy.

This study therefore tables some of the literature that analyses economic behaviour and decision making that occurs at the household level. The literature includes two categories of theories that model household economic behaviour, these are: unitary household models and collective household models. All the models are underpinned by the Consumer Choice Theory from the Neoclassical School of Economic thought. The unitary household economic model presented is the work of Gary Becker on the New Household Economic Theory and this looks at the distribution of labour and time within a household. The study will also touch on the collective models of household economic behaviour that include: the effective cooperative models, the bargaining models as well as the non-cooperative models. The main distinction between the collective models and the unitary model is that the latter has households with two actors in the analysis thereby allowing for the differences in preferences and bargaining outcomes. Lastly, the study tables the criticisms of the neoclassical economic theories of the household by presenting the objections from feminist economics.

Following the tabling of economic literature, the study will briefly present the economic theories modelling household economic behaviour. Thereafter, the study will present the prevalence of unpaid work and the types of actors and areas most engaged in unpaid work.

2.2. Household Economic Theories

2.2.1. General overview of household economic thought

Households are economic agents (Becker, 1976; Grant and Brue, 2007a; Parkin et al., 2008; Team, 2017; Becker, 2009b; Mattila-Wiro, 1999). This notion is evident in the functions for which they exist. Firstly, they exist so that their household members can care for each other (Becker, 1991; Browning et al., 2011; Reid, 1934). The raising of children, care for the sick and elderly exemplifies this notion. This particular function of the family is formerly known as

care work which is otherwise termed reproductive work (Mackett, 2021; Picchio, 2003; Wodon and Blackden, 2006). It is reproduction because it is the care and development of current and future generations of labour (Becker, 1991; Becker, 2009a; Braunstein and Folbre, 2001). Another household function is the division of labour between paid and unpaid work activities (Becker, 1991; Becker, 2009a; Hannan, 1982). Bringing up the question of who does what type of work in the household and for how long. Theory suggests that the joint production of household consumption, emphasises the specialisation of the work type, given the skills accrued in that work, as well as the resources the member is naturally endowed with in comparison to another (Becker, 2009b; Grant and Brue, 2007a; Hannan, 1982). Thirdly, a household exists to maximise joint consumption (Becker, 2009b; Gronau, 1997; Pollak, 2003). For example, one TV set can be enjoyed by the household during prime television, even though each member may be using it for different programming when other household members are not using it. The fourth function of the household is to pool income together (Becker, 2009b; Gronau, 1997; Pollak, 2003) so that the household may be able to meet financial obligations that allow it to optimise production and maximise consumption. Lastly, the household exists to deal with risk pooling where the household shares various risks to mitigate the impact of an adverse shock such as unemployment or illness (Browning et al., 2011; Kotlikoff and Spivak, 1981). An example of this is the hypothetical situation where a household member may go out in search of work and assume financial responsibility when a breadwinner is laid off work due to an illness.

The Neoclassical Theory of Consumer Behaviour posits that consumption is instantaneous (Becker, 2009a; Grant and Brue, 2007b). In that, the time used to consume a good or service cannot be simultaneously available for alternative use (Grant and Brue, 2007a). Therefore, Becker reconstructed Choice Theory and developed The Theory of the Allocation of Time in which the household is the focal point (Becker, 1965; Becker, 1976; Becker, 2009a; Grant and Brue, 2007b). The household is seen as a small factory that consumes and produces goods or services, making use of a combination of time and market goods (Becker, 1976; Chiappori and Lewbel, 2015; Grant and Brue, 2007a). The income necessary to procure market goods is obtained when the household employs labour time. The consumption of goods or services occurs when the household uses production and consumption time (Becker, 1965).

Herein is an example of a family member committing *production* time to make breakfast. This member makes breakfast by converting the raw material market goods, namely, bread, butter, eggs, bacon, salt, electricity, utensils, and a frying pan, to make a bacon and egg breakfast. From there, the household commits consumption time to eat the meal. From this example, the household is both a producer and a consumer of a good (breakfast) and service (cooking). This is a single example of the daily decisions and activities that households undertake regarding the production and consumption of commodities. The time to produce and consume these commodities differs. Some commodities are time-intensive with little resource requirements whereas others are material-intensive with few time requirements (Becker, 1965; Chiappori and Lewbel, 2015; Sandmo, 1993). A burger with fried chips can be a material-intensive good, whilst childminding is a time-intensive service, but both of them are produced and consumed by the household.

The implications of the notions in the Theory of the Allocation of Time are that an income increase will coerce household members to shift their consumption patterns away from time-intensive to material-intensive products. When this occurs, there will be a rise in the opportunity cost of household production and consumption time (Becker, 1965; Chiappori and Lewbel, 2015). This conditions the household to choose to procure childminding services from the market instead of performing the service itself so that it can free up time to earn more income.

Another implication of the same theory submits that should a household introduce and make use of, for example, a microwave, vacuum cleaner, water sprinkler, washing and drying machine, to reduce the time to produce the goods and services that the household uses, this will make production more efficient. As the household production time improves, because of increased productivity, the improvement frees up the time spent on household work. The increased productivity of the household ultimately enables it to commit the residual production time-use to the alternative income-earning activities (Becker, 1965).

The theory also suggests that in households where both spouses have the potential to secure high earnings in the labour market; these families are more likely to have fewer children and produce more material-intensive goods and services (Becker, 1965). Conversely, households where one spouse has a low-income earning-potential or chooses not to sell labour for income, those families may have more children and engage in the production of time-intensive goods (Becker, 1965).

The theory is deserving of merit because of its use of economic modelling and mathematical support; however, some authors in the field submit that it is flawed in that it supports a unitary model (Bergmann, 1995; Chiappori and Lewbel, 2015; Hannan, 1982). It looks at the household as one individual, and by implication, the entire household has a single utility function. This notion poses a problem as household members are each separate individuals with different preferences and utility-maximising functions (Chiappori and Lewbel, 2015).

Gary Becker also introduced a Treatise on the Family where he continued with a unitary household model that assumes a joint utility function. He premised it on the Rotten Kid Theorem that assumes that all the family members, no matter what their self-interests are, would internalize the effects of their actions on other beneficiaries, and cooperate to maximise family resources enjoyed through maximising the utility function of the head of the household – otherwise known as the altruist or benefactor (Becker, 1991; Pollak, 2002; Wittenberg, 2009; Bergstrom, 1989; Bergstrom, 1997). However other researchers proposed that multi-person households do not only engage in cooperation but at times face conflict as well, which is a more accurate representative of households in general (Manser and Brown, 1980; McElroy, 1990; McElroy and Horney, 1981; Seiz, 1995). Cooperation is understood to be a state where after household members use bargaining to determine their resource allocations , they cooperate in decision making so as to increase the number of goods and services consumed and thereby increase the household level of utility in consumption (Seiz, 1995). In contrast, conflict occurs when the interests of individuals in the family are different from one another.

Regarding cooperation and conflict in marriage, there are strong or longstanding societal norms that dictate the roles of men and women. The typical roles are breadwinner and homemaker (Becker, 2009b; Braunstein and Folbre, 2001), exemplified in Gary Becker's analysis on the altruist benefactor versus the wife and mother. These intergenerational social constructs guide which gender does what in the household and often presents these roles in a hierarchical manner where the breadwinner is of greater importance than the homemaker because of the work type that is performed (Braunstein and Folbre, 2001). Differences in productive capacities, no matter how big or small, are responsible for the allocation of time towards either market time, household production or consumption time between the spouses (Becker, 1991; Pollak, 2013; Treas and Lui, 2013). The time spent on a particular category of activity increases the person's skills set and improves their expertise in that area of work such that productivity in that work type improves relative to other activities (Becker, 1991; Pollak, 2013). Becker suggested this

to be the driving force towards specialization in most households. However, in others, one spouse may choose to engage in part time work as well (Becker, 1991).

2.2.2. Household production models

Unitary household behaviour models introduced by Gary Becker are also called the altruism models or the benevolent dictator models (Alderman et al., 1995: Pp. 3). These models follow a general demand analysis that extends the discussion to also include decisions on child care, subsistence production and education (Alderman et al., 1995). As in Consumer Theory, the household is assumed to be a rationally behaving agent, where the value of its time is determined by market mechanisms (Mattila-Wiro, 1999). It is implied that the preferences of the head of the household are representative of the entire household (Mattila-Wiro, 1999). This assumption provides ease of analysis because the possibly conflicting preferences and bargaining of the other members of the household – which would make the model more dynamic and statistically sophisticated, are not accounted for. This posits that decisions are made jointly within a household and the entire household maximises a single utility function (Alderman et al., 1995; Mattila-Wiro, 1999; Becker, 1965).

Below are the utility function and budget constraint.

$$U = U(Z_{i,}. \; . \; .Z_m) \equiv U(f_{1,}. \; . \; .f_m) \equiv U(x_{1,}. \; . \; .x_m; \; T_{1,}. \; . \; .T_m) \qquad (1)$$

subject to a budget constraint

$$g(Z_{i,}. \; . \; .Z_m) = Z \qquad (2)$$

The above equations indicate that the household is both a producer and a consumer. The household is a producer given the quantity of time use input $T_{i,}$, and a consumer given the utility maximisation U (Becker, 1965). The household combines market products x_1 and its time $T_{1,}$ through a production function f_1 to produce household goods Z_i (Becker, 1965). Huffman (2011) tables that Z_i represents food and non-food commodities procured from the market, whilst Z_2 represents the services performed by the household. It combines these commodities to maximise household utility via the utility function (1) (Becker, 1965). The utility function however is subject to a budget constraint (2) where g is the function of household expenditure and Z is the maximum on income resources (Becker, 1965). In summary, households combine goods from the market with its own time inputs to produce household goods that result in household utility (Heckman, 2015). Gary Becker's unitary

household economic theory's main contribution is the inclusion of time as a finite resource in the consumer's decision making process (Mattila-Wiro, 1999; Heckman, 2015). However, in the Beckerian household, since only one utility function is maximised by the household, there is no way of knowing how the individual preferences are combined into one utility function and thereby no clear indication of who gets what in the family (Mattila-Wiro, 1999).

In The Treatise on the Family, Becker presented three neoclassical assumptions: stable preferences, maximizing behaviour, as well as production and distribution equilibrium in a system of at least two actors who have a combined utility function (Becker, 2009b; Hannan, 1982). Given a set of parameters, this theory can answer some optimisation decisions regarding entering marriage and with whom, how market and household production will be allocated in the family, how income will be distributed between the members, how many children will be had and whether or not they will be invested in (Hannan, 1982). However they also raise concerns regarding the failure of accurately and realistically modelling family behaviour and decision making (Bergmann, 1995; Hannan, 1982). Bergmann (1995) submits that the theory is severely simplified and lacks dynamism, particularly in that it is not reflective of current society where the "Victorian" style of family proposed by Becker (Becker, 1976; Becker, 1991) is vastly challenged by families where children are growing up in single parent homes – a growing concern in South Africa.

In The Treatise on the Family, Becker championed the theory on the economic behaviour of marriage and the family. Regarding marriage, the approach submits that to obtain or improve economic wellbeing in marriage or for the family, a joint production of goods and services is maximised through a division of labour between spouses (Becker, 1976; Becker, 1991). The individual skills set of each partner, from human capital investment, as well as experience, are brought in to promote the gains from the marriage partnership (Becker, 1991; Becker, 2009a). The spouse with the higher market earning potential is assumed to engage in market work whereas, the other spouse with greater marginal productivity in non-market work, engages in household work (Becker, 1991; Becker, 2009a; Eisler, 2013). Traditionally, most married women are known to specialise in childbearing and homemaking activities (Becker, 2009a; Grant and Brue, 2007b) because of their comparative advantage in these (Becker, 2009a). Differences in productive capacities, no matter how big or small, are responsible for the allocation of time towards either market time, household production or consumption time between the spouses (Becker, 1965; Becker, 1991).

Moreover, regarding the division of labour in the household, Becker (1991) employs the theory of comparative advantage. It ultimately implies that even the smallest differences in productive capacities, would result in corresponding allocations in the division of labour between market and household work amongst spouses, regardless of them being identical to one another (Becker, 1976; Becker, 2009a; Hannan, 1982). Hence, the wife could be just as educated, just as experienced, sharing the same upbringing and economic status as the husband, however because she has the capacity to give birth and by implication, nurture the children, the homemaking activities related to household work would be her allocation of labour. The theory presents wage-earning men, the household heads, as the altruist benefactors who gain more utility from when they see their wives and children increased utility when they spare some of their income to share with them (Bergmann, 1995). However, this fails to acknowledge the wife's altruism in forgoing paid employment by becoming a homemaker so that children and the "altruist benefactor" can potentially improve their marginal productivity in paid employment and therefore ultimately secure a greater sum of full income for the family in the future.

Unlike collective household models, the unitary model disregards the individualistic utility functions as well as the inequalities amongst household members. That is why Alderman et al. (1995) propose that the unitary household model should be looked at as a "special case" or an exception from the norm, and rather have the collective household models as the main models for analysing household economic behaviour. The main distinction of collective models – also called pluralistic decision-making models (Bergstrom, 1997), is their focus on the preferences and aims of the individual household members versus the joint household decision making of unitary household models (Mattila-Wiro, 1999). There are three main types of collective household models for modelling household economic behaviour. These are: cooperative, collective bargaining, and non-cooperative models. Cooperative models put forward that households are made up of more than one household member and therefore more than one household member is used to model the household economic behaviour. These models also indicate that conflict often results due to household members having individualistic preferences and aims (Mattila-Wiro, 1999). Bargaining models suggest that there are rules or principles used by individual household members in bargaining to arrive at the most plausible household decisions (Mattila-Wiro, 1999; Alderman et al., 1995; Browning et al., 2011). Non-cooperative models on the other hand, suggest that there are separate and gender specific economies in the household and a wife's budget is separate from a husband's budget (Mattila-Wiro, 1999).

One of the main assumptions about collective household models is Pareto Efficiency. Meaning that no household member can be better off without making the other household member worse off. In the case of time allocation: no member can reallocate their time in a manner that makes him better off without making the other household member worse off. Thereby implying that to achieve or maintain optimal household welfare, a time trade-off allowing one household member to worker longer hours for pay, necessitates the other member to reduce their paid working hours to make more time to manage household activities.

Bargaining power

Another of the key tenets about collective household models is bargaining power. This bargaining power comes from the possession of or access to resources like income and education. A household member with more income for example, may have more bargaining power in household decisions allowing that member to do allocate less time on unpaid care work activities. The other household member may as a result have to allocate more time towards unpaid care work activities and have less time allocation towards leisure. In this way, it is observed that bargaining power arising from access to resources and influences the balance of activities and time allocation as well as the extent to which a member can engage in the activities that they would prefer.

Policy implications

One of the ways to assist in the impact of time burden on those more engaged in household activity time use is to use policy redress. To allow for more equitable time allocation, government could provide subsidized childcare and elderly care services as well as parental leave. Another viable route in this post COVID era, is to encourage flexible work arrangements through flexible and or remote work policies. These policies will allow households to improve their balance of time allocation between paid work, unpaid care work and non-work activities. Most important, it has the potential of improving the welfare of the household members and the household by extension.

2.3. Dichotomous versus polychotomous time trade-off in work and leisure

On the question of labour supply, neoclassical theory submits that the labour supply curve be explored for understanding the supposed mechanics. The labour supply curve is determined by the labour-leisure trade off. For the purposes of the analysis in this paper, leisure will henceforth

be referred to as non-work. Thereby, as the wage increases, for a wage-earning individual, the opportunity cost of engaging in non-work also increases (Parkin et al., 2000; Barker, 2007; project, 2019). The individual therefore reduces their time on non-work activity so that he or she may engage in more wage-earning time use (Parkin et al., 2000; Barker, 2007; project, 2019). In other words, up to a certain point, the more wages the individual receives from partaking in work-related time use, the more expensive it is to engage in non-work time use. Non-work time use in effect becomes forgone earnings. This concept explains the dichotomous trade-off between work and leisure. However, this concept essentially models one form of work: paid work. In that, paid work by definition is remunerated whereas unpaid work is not. Consequently, this concept does not account for unpaid work. Yet opportunity cost applies in all three categories of time use: paid work, unpaid work, and non-work.

In his book, Changing Times: Work and Leisure in Postindustrial Society, Gershuny (2003) submits that work is not only what one receives remuneration for. He tables that it is what one does for one's own living and the living of others (Gershuny, 2003). That is, a person's engagement in work for pay, work for household consumption and work for the consumption of members of the wider community. He proposes that paid work, unpaid work and leisure are all distinct categories of time use, and that people engage in these in a limited 24 hour cycle (Gershuny, 2003). This reveals that time is a scarce resource. When an individual uses time on one category of work, he or she trades time use on the other category of work. Essentially, when an individual distributes time towards unpaid care work, during that allocated time period, she or he has essentially forgone engaging in paid work and in non-work. Consequently, each individual is faced with a polychotomous trade-off between, paid work, unpaid work, and non-work.

2.4. Prevalence of unpaid work: global, regional, and local trends

The common finding by various authors is that the burden of upcw is heaviest among women, even though some of them also participate in the labour market (Dong and An, 2015; Giannelli et al., 2012; Krantz-Kent, 2009; Tabatabaei et al., 2013). In China, the unpaid care work time gap between male and female is 16.7 hours weekly, and is more pronounced in the remote areas than in urban areas (Dong and An, 2015). Married women with children under the age of seven have less total time in a day to allocate to other activities than do single women or men (Dong and An, 2015). Although childcare is the second most time consuming unpaid care work activity, domestic work tends to consume the bulk of the upcw time use in a 24-hour period

(Dong and An, 2015; Giannelli et al., 2012; Krantz-Kent, 2009; Tabatabaei et al., 2013). Urban housewives in Iran spend an average of 5 hours and 50 minutes daily in domestic activities (Tabatabaei et al., 2013). In China, urban females spend 22.5 hours a week, in domestic work, compared to 21.9 hours for rural females (Dong and An, 2015). In contrast, Chinese urban males spend an average of 10 hours versus rural men who spend 6.1 hours on average, weekly (Dong and An, 2015). In America, women spent 6.3 hours more in domestic work than did men (Krantz-Kent, 2009). Krantz-Kent (2009) revealed that due to historic gender roles, women were almost five times more likely to do food preparation than do men, on any given day. In the European region, women spend roughly 4 hours and 28 minutes in daily domestic work compared to an average of 2 hours and 45 minutes spent by men in the same activity (Giannelli et al., 2012). European women, as in other regions, face a heavier time burden in unpaid care work as the traditional gender norms make them responsible for the provision of domestic and childcare activities, regardless of household income, educational status, and their employment (Giannelli et al., 2012). Giannelli et al. (2012) tables that European women spend, on average, an extra hour in total work than their male counterparts. Total work in this study comprises of both paid and unpaid work.

In developing countries, Antonopoulos (2008) and Serrano (2012) find a similar pattern where women bear a greater proportion of unpaid care work irrespective of employment status and household income. In Sub-Saharan Africa, using time-use data to compare four countries – South Africa (2000), Benin (1998), Madagascar (2001) and Mauritius (2003) - Wodon and Blackden (2006) found that women spend significantly more time in unpaid care activities than do men. Wodon and Blackden (2006) revealed that the average daily time spent on domestic and care activities by women versus men, is 14.6% versus 5.7% in South Africa, 13.6% versus 4.2% in Bernin, 15.1% versus 3.7% in Madagascar, and 18.6% versus 5.3% in Mauritius. Ferrant et al. (2014) apprises that, on average, Ghanian women spend 13 hours in paid and unpaid work, irrespective of their educational status, employment status and household income level. The 13 hours of daily work are comprised of 39% paid work, 51% unpaid care work, and 10% in unpaid subsistence work (Ferrant et al., 2014). In the event that the findings of Serrano (2012) are true, African households spend 6 billion hours on unpaid care work activities. During this time, the care workers forgo paid work, recreational time and even personal development for the unpaid care work. The author puts forward that due to this trade-off between - typically, paid and unpaid work - this might be an attributing factor to the low development rate of the continent (Serrano, 2012).

Similar to the global and regional studies, the investigation of patterns in time use between productive and reproductive work in South Africa reveal that women spend more time in unpaid care (reproductive) work then men (Wodon and Blackden, 2006; Oosthuizen, 2018; Budlender and Brathaug, 2002; Akintola, 2006). On average, women spend 4 to 5 hours in reproductive work between the ages of 10 and 50, as opposed to 1.5 to 2.2 hours for men between the ages of 10 and 66 (Oosthuizen, 2018). Moreover, Razavi (2012) found that South Africa has a higher tendency of having children in households that are headed by women, mothers and grandmothers, compared to other countries in the cross-national study. This raises the concern of a double burden of work for these females as they have to do paid work to secure basic living standards, and reproductive work for their dependents. These type of women, are faced with the demands on their time and earnings in an economic environment where decent employment is scarce and family networks – that could assist with the burden of work, are weak (Razavi, 2012).

For a careful assessment of the prevalence of unpaid care work in the South African economy, measuring the time spent on paid versus unpaid care work will be necessary. To reveal the gender disparities, the analysis presents the results using a gender-disaggregated approach.

2.5. Types of actors and areas most engaged in unpaid care work

The preceding discussion revealed the gender patterns in care work. However, care work is not only manifested in gender, but also in various age cohorts. To further unpack the incidence of unpaid care work, the literature review now turns to the relationship between unpaid care work and age. Oosthuizen (2018) tables that in South Africa, upcw peaks at the ages of 20 and 30 amongst women, but peaks between the ages of 70 and 80 amongst men. This statistic on men's peak time for unpaid work is similar to the findings of De Vaus et al. (2003) in their study of senior citizens responsible for care work in Australia. Furthermore, men's unpaid care work is low during their twenties and thirties because they specialise in market work, with their paid work activities peaking after age 30 (Oosthuizen, 2018). This is an anticipated peak off activity given that the males are more likely to be husbands and or fathers during this time and are historically expected to be responsible for the provision of monetary resources through participation in economic activity. However unlike men, Oosthuizen (2018) shows that South African women's reproductive work increases at every age of their lifecycle. Care work increases from 2 hours daily at age 14, to 3 hours at age 17 for girls (Oosthuizen, 2018). Contrary to Oosthuizen (2018) findings, De Vaus et al. (2003) and Dong and An (2015) find

that females aged between 55 and 64 are most responsible for the provision of unpaid care work.

Dong and An (2015) find that the higher the educational attainment, the less likely men or women are to perform unpaid care work. Complementing this finding, Serrano (2012) tables that women in Africa, who typically have only a few years of schooling, have more than two children below the age of 10, and who receive little or no aid, are more likely to be performing a greater share of unpaid care work. A possible explanation for this phenomena is given by Antonopoulos and Hirway (2009) where they propose that those who find themselves specializing in unpaid care work are usually time poor and thereby have less residual time to allocate to their own human capital development.

Furthermore, the incidence of unpaid care work in the form of volunteering is a matter of interest as it also answers the question on who is doing unpaid care work. After harmonizing the time use statistics for South Africa and Mauritius, Wodon and Blackden (2006) found that men and women in both countries, spend, on average, 2 to 3 minutes in voluntary work outside their households. De Vaus et al. (2003) found that amongst Australian volunteers of various age cohorts, men and women aged between 55 and 64 shared a greater portion of their time partaking in voluntary unpaid care work outside of their families and households. On average, men and women aged between 55 and 64, contributed more to voluntary care work - worth $844 and $938 respectively in annual per capita amounts, than did the other age groups (De Vaus et al., 2003).

From the preceding discussion, it can be gathered that females aged between 13 and 64, males aged between 70 and 80; and the unpaid care workers with low levels of education; are the ones most responsible for unpaid care work. In this way, the study reveals the unequal time use on the different types of upcw and where most households spend the bulk of their time allocation on upcw. The expectation in this case is that domestic activities followed by childcare would be amongst the highest time burdens on unpaid care work. Moreover, it is expected that upcw will occur the most amongst those with lower levels of education and amongst women between the ages of 20 and 55.

2.6. Conclusion

This chapter discussed the unitary household theory models versus the collective household models. The former suggests that the spouse with more market earning potential will likely engage more in market work. Whereas the spouse with a higher marginal productivity in non-market work, will likely engage more in household work. These give a rational behind why one gender engages more in paid or market labour as opposed to the other gender engaging more in non-market labour. This is said to be set in motion by the differences in productive capacities - whether great or small, between the two genders in the traditional household. These differences in productive capabilities are what controls the allocation of time between work and leisure. Work and leisure being presented as paid work and unpaid care work versus non-work.

Collective models are seen to provide a more robust framework for analysing households and their time allocation between different types of time use activities. Pareto efficiency showed that no household member can reallocate his time to make himself better off without making the other household member worse off. The concept of bargaining power within households and its influence on time allocation and engaging in preferred time use activities, indicated that social policy could be the avenue through which household members could more equitably distribute their time between paid work, unpaid care work and non-work activities. This improved time use allocation has the potential of improving household wellbeing. With improved wellbeing, the household members are in a better position to be more productive in their time use. However, this is beyond the scope of this study.

3. RESEARCH METHODOLOGY

3.1. Introduction

Three research questions are explored in this study. These are, first, “How does the allocation of time use differ by gender??; second, “What is the monetary value of time spent in unpaid care work activity in South Africa?” and third, “What is the percentage contribution of the value of unpaid care work activity to the South African economy?”

The methodological approach used in this study to answer the first research question was the application of a Seemingly Unrelated Regression (SUR) model to jointly analyse the time use on pw, upcw and nw activities. This model acknowledges the interdependence of the time use activities, where a change in time spent on one activity may impact the time spent on others, given the 1440 minutes per day-time-constraint. To align with the theoretical frameworks of household economic theories, the socioeconomic variables - namely, gender, presence of young children, household size, and household income, are included to explore the factors that influence time allocation. To align with the theory of Human Capital and Specialisation, the education of the household member is also included. This speaks to investment in skills that make the person's time more productive and thereby allowing them to specialise in certain activities, increasing efficiency on those activities. The results from this analysis will provide insights into the factors that influence peoples’ time allocation to paid work, unpaid care work and non-work activity in South Africa. It will also highlight the gender differences in this time allocation. Exploring this will assist in shedding light on the burden of care, particularly those who engage in it the most. This analysis can platform the need for policy development aimed at reducing the burden of care and relieving time pressures so that individuals can increase their participation on income generating activities.

The latter part of this chapter will give the methodological approach to imputing monetary value on unpaid care work for the South African economy as well as determining the proportion of the monetary contribution of unpaid care work to the South African economy. This addresses the second research question on what the monetary value of time is spent in unpaid care work activity in South Africa. A quantitative approach using a non-experimental research strategy is used to firstly describe and summarise the data on how people spend their time on unpaid care work. Secondly, it estimates the imputed value of the upcw as a share of gross domestic product without attempting to determine possible causality or correlation between the variables. This is done by firstly calculating the aggregate annual time used for unpaid care

work activity. In the next step, the market equivalent wage is estimated for each of the respective unpaid care work activities. Following this, a product of the estimated time use, and the imputed wage produce the imputed value of unpaid care work. Finally, the imputed value is thereby measured against the national gross domestic product to estimate the potential share of unpaid care work to the nation's GDP. The research design chosen was therefore a descriptive quantitative design to allow for a comprehensive overview of time spent on unpaid care work and its interaction with paid work and non-work activities at a single point in South African history.

The key variables used in the analysis of these questions are herein explored. Paid work (pw) time-use comprises all the activities that an individual engages in for compensation. In this study, "work in establishments", "primary production", and "work in non-establishment" are the sub-categories of time-use aggregating the paid work variable. Non-work time use is comprised of "learning", "Social and cultural activities", "Mass media use", and "personal care." All these four categories of non-work time use indicate all the activities that cannot apply the third-party criterion. For example, an individual cannot outsource sleeping to someone else, therefore these time-use activities exclusively define non-work activities.

The Time Use Survey (TUS) dataset has exclusive care activities, namely, care of children, care of the elderly and care of sick persons. However, for the purposes of exploring the trichotomous nature of decision making between paid work, unpaid care work and non-work activities, this study will use the entire unpaid category of work activities. These unpaid work time use activities are inclusive of three broad subcategories comprising of all household management, care provision, and services to members of the community. Refer to Table A.1 in Appendix A for the activities that went into each of the three broad categories of time use. Table A.1 provides the proportions of participants relative to the total sample who reported spending time in different time use activities. It is presented in a gender-disaggregated manner to explore the preliminary gender patterns in time use.

Zooming in on time use activities included in household production – herein referred to as unpaid care work, Table A.2 [1]presents the description and activity code of each reported time use activity that is included in the upcw variable. Including all these time-use activities in the

[1] Refer to Appendix B

category of household production, will give a total aggregate for the unpaid care work that will ultimately be compared against the aggregates for paid work and non-work activity. As this study will look at the time allocation on these three broad categories of time use, to explore the trichotomous nature of decision making, all the time use sub-categories must be included, in order to obtain the maximum 1440 minutes of a given 24-hour day. Generating the dependent variables in this manner will allow the use of a seemingly unrelated regression (SUR) model to present the interdependence of the time use activities, where a change in time spent on one activity will impact the time spent on others, given the 1440 minutes per day time-constraint.

The SUR model is an empirical test on how individuals allocate their time across paid work, unpaid care work, and non-work activity as theorised in household decision making literature. The Treatise on the Family as well as the Unitary Household Behaviour model postulate that gender roles within households significantly influence the variations in time allocation (Investec, 2023; Becker, 1965; Becker, 1991; Mattila-Wiro, 1999). The Theory of the allocation of time provides a basis for analysing how household members balance their time between different activities based on opportunity costs (Becker, 1965; Mattila-Wiro, 1999). Implying that the decision to allocate time to one activity comes at the expense of other potential activities – an empirical application on time trade-offs. This is amplified by the Pareto Efficiency condition of collective household models wherein, a household member cannot reallocate their time use and be better off without making another household member worse off in time allocation, cet. parib. The household economic theories explored in Chapter 2 give valuable insights into the processes through which individuals in households make decisions. Moreover, one of the household functions is the division of labour between paid and unpaid care work, the latter being called reproductive work in Becker's Treatise on the Family (Becker, 1991). Members of a household not only engage in work (paid or unpaid) activities but also in non-work activities such as sleeping. The common factor regarding engagement on any of these activities is time use. As individuals make decisions based on time trade-offs, this study will explore the characteristics of those who engage in these different types of time use activities, particularly unpaid care work.

3.2. Data selection

Three datasets: 2010 Time Use Survey, 2010 Labour Market Dynamics South Africa and 2010 Quarterly Labour Force Survey that were selected based on their reliability and their

applicability to the objectives of this study. The TUS produces the time estimates measuring how much time is spent on pw, upcw and nw activities and the LMDS was used to estimate the market-related wages payable for activities of unpaid care work that are similar to those of paid work. Lastly, the quarterly GDP data was used to measure the portion that the imputed value of unpaid care work contributes to the South African gross domestic product.

Data processing and analysis was conducted using the STATA software package as this is a microeconomic study. To explore the characteristics of the main dataset, 2010 TUS, on time use, the gender patterns of upcw, the prevalence of upcw time use and the histogram of the upcw variable were explored.

3.3. Data preparation, processing and transformation methods

3.3.1. Processing TUS 2010 for estimating time use

The Time Use Survey has four datasets: (1) Activities, (2) All persons, (3) Household and (4) Person. The datasets were prepared by first renaming all variables to lowercase to mitigate data entry error and possible inconsistent coding. Thereafter, unique identifiers were generated for merging information about individuals and households into a single dataset. This dataset had (3) household, (1) activities and (2) all persons data appended to each (4) person record. Using the timeper [2]minutes aggregation method – which is the 24-Hour aggregation method, the analysis calculated total minutes for each of the 10 SNA activity types and added labelling for these. Thereafter rowtotals for paid work, unpaid care work and non-work, were generated computing totals from the respective 10 activity types. Following this, the four time-use datasets were then merged into one final dataset. All the other control variables were generated and transformed from this final merged time use survey dataset and one observation per person was kept for the regression analysis.

[2] 24-Hour minutes method allocates time spent to simultaneous activities by dividing the 30 minutes of a given timeslot by the number of simultaneous activities engaged in during that 30-minute slot. Example: if a respondent was engaged in 3 activities in one half hour slot, using the 24-Hour method allocates 10 minutes (30 minutes divided by 3 activities = 10 minutes) to each activity. This way, the minutes spent on the simultaneous activities add up to the 30 minutes slot. The 24-hour diary day will not exceed 1440 minutes (60minutes *24 hours). However, using a fulltime minutes method, allocates the full minutes spent on each of the three activities. Indicating that when adding up all the minutes spent in different activities during a given 24-hour day, the final minutes may well exceed 1440. The concern here is, everyone has 24 hours in a given day and not more. But the beauty of the full-minutes method is that when calculating minutes spent in 3 different activities done in 1 30 minutes slot gives a truer reflection of time spent on an activity. Example: 30 minutes minding young children, 30 minutes cooking and 30 minutes listening to the radio equals 90 minutes of time use.

Checks as well as summary stats were run to ensure that the minutes from the 10 activity types equal the minutes of the 3 broad categories of time use. Indeed, both had the same statistics for the number of observations, mean, standard deviation, as well as minimum and maximum.

The next step was the generation of variables indicating individual characteristics, household characteristics and broader population characteristics. Because the data collection process of the TUS required two members of the household to fill out time diaries, two observations per household were included in the study sample.

The data processing also involved the transformation of data variables. Particularly the time use survey monthly wage variable. This variable (q46TotIncome) is originally an interval variable that reports total monthly individual income as a range and not a datapoint. This categorical monthly income is transformed into a continuous variable using the midpoint approach. Although it may not capture the exact distribution within each category, it however provides a reasonable estimate of the central value.

3.3.2. Processing LMDS 2010 for estimating wages

For the 2010 Labour Market Dynamics dataset, all the variables were renamed to lowercase to ensure consistency and negate data entry errors. After this, wage estimates for each imputation method was generated. All observations of individuals aged 9 and below were dropped from the dataset to match the population sample of the TUS dataset. It was crucial to use this dataset as it has detailed information on wage data per occupation category.

3.3.3. Creation of demographic variables

Demographic, socioeconomic, geographic, and employment-related variables, were generated and used in regression analysis. Demographic variables included gender, marital status, age cohorts, and presence of children under age seven. Socioeconomic variables included household size, years of schooling, race, and household income. Household income is a derived variable after applying the midpoint formula for calculating the midpoint of income brackets, as the Time Use Survey does not include income values, but instead only income brackets. For this reason, later in the analysis, the labour market dynamics study dataset was used as a source dataset for income values. But for the preliminary analysis on the sample and its time use patterns, only time use variables were used, necessitating the employment of the midpoint formula for the income bands in the TUS dataset.

3.4. The Time Allocation Model Methodology

3.4.1. Seemingly Unrelated Regression to estimate time trade-off between paid work, unpaid care work and non-work activities

This paper fits a seemingly unrelated regression (SUR) that runs three equations, estimated jointly as a system using the same set of explanatory variables to determine time use on paid work (equation 1), unpaid care work (equation 2), and non-work (equation 3) activities (Dong and An, 2015).

This model uses Generalised Least Squares (GLS) estimation with cross equation constraints. Each equation in the SUR can be estimated individually using an Ordinary Least Squares (OLS) estimation but this approach will not be able to account for any correlations that may exist between the error terms across the system of equations (Colin and Trivedi, 2010; Katchova, 2021). Therefore, Generalised Least Squares estimation provides a better fit because it enables the model to handle correlations in residuals between the different activities. This improves the precision of the estimated coefficients compared to what an OLS estimation would provide (Colin and Trivedi, 2010; Katchova, 2021) given the interconnected nature of time-allocation decisions (Dong and An, 2015). This approach for determining time allocation, allows for the analysis of the individual, household, and regional characteristics that jointly influence time allocated to the three time-use activities. The imposed constraints allow one to understand the time trade-offs involved in paid work, unpaid care work and non-work activities, particularly in the context of gender differences (Dong and An, 2015).

The SUR model has two restrictions imposed on it in order to reflect the interdependent nature of the activities (Dong and An, 2015). First restriction: when all the intercepts of the activities are added together, they must sum up to a total of 1440 minutes per day. Second restriction: when all the coefficients of the independent variables across each activity are added together, they must sum to 0. The restrictions are imposed to ensure that changes in one time-use activity, caused by movements in the explanatory variables, are compensated by changes in the other time-use activities (Dong and An, 2015). Moreover, on the second restriction, it is assumed that the sum of the changes in the dependent variables (j_1= paid work, j_2 = unpaid care work

and, j_3 = non-work activity) in relation to a change in the explanatory variable $\left(\frac{dM}{dX_j}\right)$ is equal to zero (Dong and An, 2015). This restriction ensures that a rise in one type of activity is compensated by a fall in at least one of the other two types.

Through this model, time allocation across different types of activities, affected by movements in explanatory variables, can be examined and the interdependence between the dependent variables can be explored. Here below is the model in equation form.

$$M_{ji} = \beta_{0j} + X_i\beta_{j\gamma} + u_{ji}$$

$$\sum_{j=1}^{3} \beta_{j0} = 1440 \ and \ \sum_{j=1}^{3} \beta_{j\gamma} = 0 \ for \ all \ \gamma = 1,2, \dots K$$

Where:

j = 1, 2, and 3 indicates paid work, unpaid care work and non-work, respectively; i represents the index for each individual observed, γ represents the index of all independent variables; M is the total number of minutes per day; M_{ji} is the number of daily minutes in activity j by individual i; X is the vector of the chosen independent variables, β_0 is the intercept term, β_{j0} is the intercept term for activity j; the vector of slope coefficients is represented by β_γ; lastly, u represents the error term.

The predicted variables ($\sum_{j=1}^{3} \beta_{j0} = 1440$) are paid work, unpaid care work and non-work activities. Predictor variables ($\sum_{j=1}^{3} \beta_{j\gamma} = 0$) are gender, urban, married / living with partner, presence of young children in the household, household size, age group (15 – 24, 25 – 34, 35 – 44, 45 – 54, 55 – 64), years of schooling, logged household income, unemployed, not economically active and province dummy variables.

3.4.2. Variable selection

Having paid work, unpaid care work and non-wok as dependent variables depicts the trichotomous nature of time use wherein individuals split their time usage between these three categories. The key dependent variable for this study, however, is unpaid care work, which is a continuous variable reporting the minutes spent doing unpaid care work activities over a 24-hour period. Paid work and non-work dependent variables also measure minutes spent on each respective activity over a 24-hour period. These, too, are continuous variables. Given that this

study used the 'timeper' minutes method, the maximum possible daily minutes spent on each activity is 1440 minutes per day. The analysis looks at daily averages of time use as the time-use diary system reports time use on each activity done in the previous 24 hours. The regression analysis also uses various demographic and economic variables, which are tabled below.

It is assumed that individuals allocate their time towards paid work activities differently based on the influences of their respective demographics and economic influences. It is expected that individuals with higher levels of educational attainment, along with better economic standing, captured through higher wages and unearned income, will allocate more time towards paid work. According to Human Capital Theory, people tend to invest in increasing educational attainment in hopes of increasing their earnings potential. As they gain more education and higher wages, they tend to allocate more time towards paid work to ensure a positive return on their investment. Even when turning to Rational Choice Theory, if indeed individuals are motivated by self-interest and thereby make decisions to maximize their utility those with higher wages are likely to allocate more time towards paid work to earn more income. This is because the higher the individual's salary the more opportunity to secure more utility.

In contrast, unpaid care work is assumed to be influenced by household composition, societal norms and demographics. The expectation is that women, especially those with young children will spend more of their collective time on unpaid care work activities. The larger the household number and the presence of elderly members in the household, the more time is likely to be allocated towards unpaid care work (King et al., 2023).

On the other hand, it is expected that more financial resources and higher educational levels are likely to afford certain individuals more time to spend on non-work activities. This is influenced by societal norms that may likely influence the availability of non-work time.

There is an expectation of gender differences in time allocation. How each gender allocates time towards the three categories of time-use is based on – among other things, societal norms. Traditional gender roles and cultural norms may influence women to allocate more time towards unpaid care work activities. However, this may be adjusted downwards through educational attainment and the economic empowerment of women. Similarly, women who live in urban environments have exposure to more educational opportunities and economic

empowerment, therefore their allocation of time towards unpaid care work activity could be lesser than their rural female counterparts.

Unpaid care work (upcw)

The upcw variable is a continuous dependent variable that captures the total minutes spent on household management, care of persons and community service time use activities in a given 24-hour day.

Paid work (pw)

The pw variable is a continuous dependent variable that represents cumulative time spent on work in establishments, primary production, and work in non-establishment, measured in minutes per 24-hour day.

Non-work (nw)

Non-work (nw) is another continuous dependent variable that measures the total number of minutes spent on all the other activities outside of paid work or unpaid care work, in a given 24-hour day. The non-work time use activities comprise learning, social and cultural activities, mass media use, and personal care.

Gender

This is a binary variable that represents two broad gender groups, as respondents' self-identification in the survey: men and women. It is included as an indicator variable and intended to capture how time allocation differs between men and women. Literature indicates that time spent on unpaid care work is disproportionately undertaken by women, whereas time use on paid work is disproportionately done by men (Becker, 1991; Becker, 2009a; Budlender and Brathaug, 2002; Chiappori and Meghir, 2015; Chiappori and Lewbel, 2015; Oosthuizen, 2018).

Marital status

This is a binary variable that indicates whether a person is "married or living with a partner", or not. It is expected that those who are married or living with partner are likely to report higher time use on unpaid care work compared to those who are single or have never married (Braunstein and Folbre, 2001; Budlender and Brathaug, 2002; Charmes, 2019; Chiappori and Meghir, 2015).

Children under 7 years of age living in the household

This is a binary variable. In the case of no children under the age of 7 being present in the household, it codes 0; it codes 1 when there is at least 1 child present in the household. It is expected that households that report at least one child under the age of 7 present in the household, are likely to record higher levels of time use on unpaid care work activity than households that have no child living within the household. This variable will help indicate how the presence of young children affects the allocation of time between the 3 time-use categories. It is expected that the presence of young children will increase unpaid care work time use, and reduce paid work and non-work activities time use (Becker, 1965; Cherchye et al., 2012; Chiappori and Meghir, 2015).

Household size

This is a continuous variable that reports the number of household members resident and living in the common dwelling (house). It is expected that initially, the more household members there are, the more minutes will be allocated to upcw (Moyser and Burlock, 2018; Antonopoulos, 2008; Huls et al., 2022). However, at larger household sizes, this study author assumes that the law of diminishing marginal returns may kick in noticeably by declining minutes spent on upcw.

Age groups

These are dummy variables for the different age cohorts: age 15 – 24, 25 – 34, 45 – 54, 55 – 64 and 65 -74 indicating the respondent's age group. 0 is assigned for observations that are not within that age cohort and 1 is assigned to observations that are within that age cohort.

Years of schooling

This is a continuous type of variable. It represents the number of years of formal education that the respondents have completed. The expectation is that the higher the respondent's education level, the less time the person will contribute towards unpaid care work. In other words, the higher the person's education level, the more likely the person is to outsource unpaid care work activity directly decreasing the person's time spent on unpaid care work.

Log of household income

The log of household income is a continuous variable and represents the natural logarithm of household income. This is the household's total income obtained from sources outside of

employment or self-employment. It is received without performing any activity. This is a necessary explanatory variable as having household income can affect an individual's participation in the labour market as well as their engagement in unpaid care work or nonwork activity. It is generated using the self-reported household monthly income bands where the midpoint of each is derived to give household income values. To normalize the data and linearize the relationship between household income and the time use spent on upcw, paid work and non-work activities, household income was transformed into log form. The expectation is that there will be a positive relationship between non-work time use and the log of household income. However, an inverse relationship is expected between the log of household income and paid work as well as unpaid care work. This percentage increase in the log of household income will result in an increase in time spent in non-work activities and a decrease in both paid and unpaid care work activities.

Urban & rural location

Both of these variables are binary variables and will be used as control variables in the time determination model to account for the geographic context of where the individual resides. This will assist in understanding the impact of the independent variables on the three different categories of time use, particularly how the effect of the independent variables differs between individuals living in urban and rural areas. It is expected that those residing in the rural parts of the country are more likely to engage in unpaid care work time use, and less likely to engage in non-work time use. On the other hand, it is expected that residents living in urban environments are likely to spend less time doing unpaid care work compared to their rural counterparts, see for instance (Charmes, 2019).

3.5. Unpaid care work valuation approach

This study thereby employs the input valuation approach focusing on the labour time spent doing unpaid care work. The time estimates are computed from total minutes and hours' that the population sample was engaged in unpaid care work activity. These estimates differ per valuation method. The valuation methods applied in this study are the Economy-wide Mean Wage, Opportunity Cost, Generalist and the Specialist wage imputation methods.

3.5.1. Estimation and valuation approaches of unpaid care work

Empirical research uses two main approaches in the calculation of the value of unpaid care work, namely the input approach and the output approach (Dong and An, 2015, Budlender and Brathaug, 2002, Antonopoulos, 2008). The output valuation method computes the value of upcw by multiplying the quantity of product or service output with its representative market price (Dong and An, 2015, Antonopoulos, 2008). In this approach, the number of goods produced or the number of times that a service is rendered in the household, is multiplied by the going or equivalent market price for the good or service.

This approach does not focus on inputs such as time or effort, but rather the resulting outcomes which are final goods or services. This approach requires that the quantity of production and consumption of the goods and services produced be measured and also expressed in terms of value addition (Dong and An, 2015, Antonopoulos, 2008). This presents severe constraints to the implementation of this method, as this type of data is not readily available in most developing countries (Dong and An, 2015, Budlender and Brathaug, 2002).

The alternative economic valuation approach is the input-based valuation approach which computes the value of production output based on the cost of unpaid labour input (Dong and An, 2015, Budlender and Brathaug, 2002). It focuses the monetary valuation on time use which is the input resource that the unpaid care workers are expending on unpaid care work activities. This approach attempts to put a value on the time or efforts of the unpaid care workers. This approach is applied through either of four valuation methods, namely: The Economy-wide Mean Wage method, the Generalist Wage method, the Specialist Replacement Cost method or the Opportunity Cost method (Dong and An, 2015, Budlender and Brathaug, 2002, Antonopoulos, 2008). The Economy-wide Mean Wage method imputes the value of unpaid care work by estimating the mean wage of all occupations across the entire economy (Budlender and Brathaug, 2004, Budlender et al., 2002, Dong and An, 2015). The Generalist Wage method imputes the value of upcw to the representative market wage for a generalist or non-specialized worker. The Specialist Replacement cost method imputes the value of upcw to the representative market wage of a specialist or professional worker providing the upcw (Jackson and Chandler, 1995). The Opportunity Cost Method is by definition, the cost of upcw as a measure of the wage the household would have earned by selling the same labour time to the market instead (Oosthuizen, 2018, Jackson and Chandler, 1995, Dong and An, 2015, Budlender and Brathaug, 2002). It is the cost of the foregone market wage for the equivalent market work.

Different authors implement these methods differently. However, this study proceeds by employing the Generalist and Specialist Wage methods of the input valuation approach.

3.5.2. Assumptions for imputing value to unpaid care work

The United Nations Statistics Division classifies time use activities according to 10 broad category types. Calculating time estimates for unpaid care work is limited to three activity types from the 10 categories of time use. These are, household maintenance, care of persons and community service, which are categories 4, 5 and 6, respectively. Whereas paid work is coded using activity categories 1 – 3, and non-work is coded using activity categories 7-10.

Water and fuel collection were kept as paid work activities and not reclassified into unpaid care work activities as employed in Budlender and Brathaug (2004). Arguably they should be reclassified because these activities do not directly contribute to economic production and are rather preparatory activities to get to the point where an individual can directly contribute to the economy through the production of a good or service. However, and due to this study's assumption that time use is a trichotomous choice between productive, reproductive and non-productive time use, these activities were maintained. They were maintained so that the total time spent in each category of time use is equal to the maximum of 1440 minutes a day. This is the application of the seemingly unrelated regression time determination model explored by Dong and An (2015). Reclassifying would have underestimated pw time use and overestimated upcw time use.

In terms of transport related activities under unpaid care work, these are maintained because when applying the third person criterion, one can hire someone else to render transportation services, e.g. hiring an uber driver. This is contrary to the way Budlender and Brathaug (2002) handled travel related to unpaid care work and paid work. In their paper they excluded travel related to unpaid care work because travel related to pw is excluded from pw estimates when calculating GDP.

3.5.3. Method for aggregating the hours spent in unpaid care work

In the case where respondents engaged in simultaneous activities, Stats SA designed the Time Use Survey (TUS) to allow up to 3 activities to be recorded in each 30 minutes time slot (Budlender and Brathaug, 2002; Stats, 2013). In the recording of the activities, the TUS does

not require the respondent to indicate whether the activity was a primary, secondary or tertiary activity, it gave all the activities equal weighting (Budlender and Brathaug, 2002; Stats, 2013).

Given that this study uses the 24-Hour aggregation method as stipulated earlier, minutes aggregation per 30 minutes time slot will be treated as thus:

- Engaged in 1 activity: full 30 minutes allocated to the activity
- Engaged in 2 activities: 15 minutes allocated to each activity
- Engaged in 3 activities: 10 minutes allocated to each activity

Using this 24-Hour aggregation method ensures that time spent in different activities in a fixed 24-hour diary day all sum to 1440 minutes. 1440 minutes is an equivalent of 24 hours. This is crucial for this study because of the exploration of the trichotomous nature of decision making. That this decision making is not a simple labour-leisure trade off – as Neoclassical economics postulates, but rather paid work and unpaid care work versus non-work trade off. Moreover, using the 24-Hour minutes aggregation method, produces estimates that are easily comparable to the findings from other countries (Budlender and Brathaug, 2002).

The drawback of this method however, is the underestimation of actual time spent on an activity (Budlender and Brathaug, 2002). Using the full-minutes aggregation method provides a fuller picture of time use on different activities. This is because the full-minutes aggregation method allocates the full duration of time spent on an activity even when that activity is being done simultaneously with another. This implies that should an individual spend time on three simultaneous activities, using the entire 30 minutes time slot, he or she can report 90 minutes in total time spent on the time use activities for the given 30 minutes diary reporting time slot. For example, an individual could be engaged in child minding, cooking and listening to the radio, from 14h00 to 14h30 and report having spent 90 minutes on these simultaneous activities for that given diary reporting time slot. This could result in the diary day minutes time-use reporting exceeding the 1440 minutes of a given 24-hour day. This indicates that the full minutes aggregation method upper bound time estimates whereas the 24-Hour aggregation method produces lower time estimates because it applies limits.

3.5.4. Method for estimating the market equivalent wage

The average hourly wages were estimated using the Labour Market Dynamics Study (LMDS) dataset for the year 2010. Due to the provision of wage data and coverage of both formal and

informal sectors, this dataset remains the most appropriate for this study in obtaining the required wage estimates. The drawback to this dataset however is that respondents, on occasion, report lower bound values of their actual wages or income (Budlender and Brathaug, 2002; Budlender and Brathaug, 2004).

When calculating the wage estimates, firstly the monthly wage was computed using question 5.4a of the LMDS questionnaire which records the monthly wage that employees get before deductions. The self-employed wages are added to the missing values using question 5.7a which records the earnings of employers and those self-employed after expenses.

Question 418 in the TUS 2010 questionnaire, records what the individuals reported as the hours usually worked. In this study, this variable is used to generate the monthly hours worked for each observation. It is multiplied by 4.3 which is an average number of weeks in a month. Upon this, the hourly wage rate is computed by dividing the estimated monthly wage over the estimated hours worked in a month. The outcome from this produces the hourly wage rate.

Thereafter the hourly wage rate is applied to each input valuation method for calculating the possible economic value of time invested in rendering unpaid care work. Prior to applying the estimated hourly wage rate, the study selected observations for the different input valuation methods.

3.6. Method for estimating the value of unpaid care work and its contribution to the South African economy

The ultimate purpose of this section is to quantify the monetary value of unpaid care work as well as to estimate the proportion of GDP that it accounts for. This requires the calculation of aggregate annual time use in each unpaid care work activity, calculation of a comparable wage rate for the unpaid care work activity, obtaining a product of these for the population sample to impute the value of unpaid care work, tabling the country's GDP figures and then finally calculating the share of the imputed value onto the GDP. The assumption is that the imputed value of unpaid care work will be positive. The process followed in the application of each imputed valuation method is outlined below.

The first step in the process of measuring the contribution of unpaid care work to GDP required the calculation of the aggregate time use spent by the target population on unpaid care work

activities. Following the work of Budlender and Brathaug (2002), this study calculated the total number of hours used in unpaid care work for the year 2010. All the daily minutes spent on an activity were multiplied by 365 days of the year. Once the estimate was obtained, it was divided over 60 in order to convert the aggregate time use from annual minutes into hours. The number of hours differed per method of valuating unpaid care work. Having estimated the annual number of hours, a product of the annual hours and the number of the target population was calculated to get the aggregate time used by the target population on unpaid care work activities.

$$\boldsymbol{T_i = \left(\frac{TDM_i * 365_{days}}{60_{minutes}} \right) * P_i} \qquad \textbf{(1)}$$

Where $\boldsymbol{T}$ is the measure of aggregate time use for the UPCW activity category, $\boldsymbol{TDM_i}$ gives the total daily minutes spent on the upcw activity category (denoted by $\boldsymbol{i}$), $\boldsymbol{P}$ gives the number of the target population.

The total relevant population is restricted to persons 10 years and older because the time use survey respondents that kept time use diaries were 10 years and older. This may likely underestimate the true value of labour time because the time invested by persons younger than 10 years is unaccounted given the design of the 2010 TUS.

For the estimation of wages relevant to each of the unpaid care work valuation methods, the amount of time spent in unpaid care work activity was multiplied by the appropriate average wage rate. The wage rates were market determined and sourced from the LMDS dataset. Paid occupations from the LMDS most similar to the elected non-SNA production activities were used in this step.

$$\boldsymbol{W_i = T_i * w_i} \qquad \textbf{(2)}$$

Where $\boldsymbol{W}$ is the wage for the relevant upcw activity, $\boldsymbol{T}$ denotes the total annual hours spent on the upcw activity category, $\boldsymbol{w}$ represents the market wage rate, and $\boldsymbol{i}$ represents the intended unpaid care work category.

The total hours spent by the population sample - estimated in the first step, are multiplied by the estimated mean wage rate according to the process of each of the wage valuation methods.

Once the total annual hours (***T)*** were estimated, and the corresponding wages (***W)*** were estimated, a product of these was calculated and the total value (***V***) of unpaid care work labour time was obtained. The following equation was taken from the Ghazi Tabatabaei et al. (2013) study on the monetary value of female unpaid labour delivered by urban housewives living in Iran.

$$\boldsymbol{V = T_i * W_i * P_i} \qquad \textbf{(3)}$$

Where $\boldsymbol{V}$ denotes the estimated value of upcw, $\boldsymbol{T_i}$ represents the total annual hours, $\boldsymbol{W_i}$ represents the appropriate wage, $\boldsymbol{P_i}$ refers to the target population, and $\boldsymbol{i}$ represents the appropriate upcw activity.

Subsequent to the imputation of value onto unpaid care work, the analysis measured the share of upcw as a proportion of the South African GDP. This was achieved through dividing the estimated value of the unpaid care work (***V***) over the 2010 annual GDP amount and multiplying the outcome by 100 to get a percentage share of GDP.

$$\boldsymbol{upcwGDPshare_i = \frac{V}{GDP_{2010}} * 100} \qquad \textbf{(4)}$$

Where $\boldsymbol{upcwGDPshare_i}$ is the share of GDP that the value of unpaid care work contributes, $\boldsymbol{V}$ denotes the imputed value of upcw, $\mathbf{100}$ is applied to give the share in percentage form, and $\boldsymbol{i}$ represents the targeted upcw.

The South African GDP data used to compute this statistic is the real GDP (rGDP) data using the real production and not the expenditure approach. Real GDP from quarter 1 to quarter 4 was summed up and divided by 4 to get the annual 2010 value. This value came to R 3,973,801,836,544, which is R3.97 trillion.

3.6.1. Economy Wide Mean Wage Valuation Method

To derive the mean minutes spent doing unpaid care work using the Economy Wide Mean Wage method, required a count of all non-SNA activities from categories 4 to 6. It must be taken into account that when it came to simultaneous activities, the 24-hour method was used to ensure that each day did not exceed 1440 minutes. Weighted averages of per person daily minutes were calculated for men and women, separately. A non-gender disaggregated

combined per person weighted mean minutes per day was also computed. The weighted individual mean minutes per gender were each multiplied by 365 days of a year, and then divided by 60, to obtain the average annual hours spent in unpaid care work activity per individual. The process of obtaining average annual hours in unpaid care work activity was replicated for all the methods except for the Specialist Wage method. It should be noted that all weighted mean minutes estimates for all valuation methods are obtained only through the time use survey dataset.

The LMDS dataset is the source for the target population which is the weighted number of persons 10 years and older. To ensure comparability with the TUS dataset, all observations of persons under the age of 10 were excluded. The LMDS dataset was used for the target population estimates because the hourly wage rates were sourced from this dataset, preventing aggregate distortions. Using LMDS data for the target population thereby ensured consistency. Moreover, the LMDS dataset, unlike the TUS dataset, had a larger sample for respondents (272 830 v 39 018) and households (30 000 v 11 312). Therefore, a weighted average of 40 570 251 total respondents, 19 543 191 males, and 21 027 060 females were estimated using the LMDS dataset. These figures will be applied across all labour time valuation methods presented herein.

To obtain the total hours per year, a product of the target population and the average annual hours per person was computed. The total hours per year were obtained for each gender and for both genders combined. To derive the Economy Wide Mean Wage hourly rate, the general hourly wage per person first needed to be estimated using the LMDS dataset. The general hourly wage per person was derived by first obtaining the monthly[3] wage (q54a_monthly) for each person employed, then generating the monthly hours usually worked by obtaining a product of hours worked (hrswrk) multiplied by 4.3[4] which is an approximate of hours per month, then lastly, the general hourly wage rate is given by monthly wage divided by monthly hours worked.

$$hourly\ wage = \frac{monthly\ wage\ /\ earnings\ from\ self\ employment}{monthly\ hours\ ^{5}usually\ worked}$$

[3] or earnings from self-employment (q57a_monthly) if no monthly wage.
[4] This is the average of 52 weeks ÷ 12 months, giving 4.3
[5] $monthly\ hours\ usually\ worked = usual\ hours\ worked \times 4.3$

This hourly wage was applied across all employed individuals in non-SNA occupations with survey weights to obtain the combined, as well as the gender disaggregated wages per hour. Thereafter, the wages per hour were multiplied with the annual hours to obtain the total wages per year, for each gender. The gender disaggregated total wages per year were added together to obtain the combined total wages per year for the Economy Wide Mean Wage method.

To obtain the unpaid care work sector contribution to GDP using the Economy Wide Mean Wage method, the total wages per year were divided by the 2010 real GDP value of R 3.97 trillion or R 3 973 801 836 544.

The drawback for this method, however, is that South Africa has historically high levels of unemployment. This means that the mean wage rate will be artificially high and give a skewed representation of the earnings reality of the South African population. A median wage would likely render a relatively truer representation of the South African population's earnings status. However, to be able to compare the results from this study to others, the mean wage instead of the median wage is maintained.

3.6.2. Opportunity Cost Valuation Method

Due to the high unemployment rate as well as large income inequalities experienced in the country, the version of the Opportunity Cost method applied herein, is the one introduced by Budlender and Brathaug (2002) and adapted by Dong and An (2015). This version uses the *average earnings rate* by level of schooling and disaggregated by gender, instead of using the opportunity cost of the forgone market equivalent work of the individual (Budlender and Brathaug, 2002). Educational attainment herein is a proxy for work experience. This method reflects the forgone earnings of men and women of different educational levels, had they sold their time to the labour market.

Using the 2010 TUS dataset, a sample of those aged 10 years and older was classified according to their highest level of education: *No schooling, Incomplete primary, Incomplete secondary, and Matric plus*. This was further stratified according to gender. The weighted minutes of all non-SNA productive activities, categories 4 to 6 were counted, using the 24 hours minutes aggregation method, and were averaged across the different levels of educational attainment, for both genders. The conversion from minutes to average annual hours follows the process tabled above. Taking the survey weighted mean hourly wage of persons with a specific level of

educational attainment, applying the general hourly wage on it, and stratifying by gender, derived the opportunity cost hourly wage rates. In this method, to obtain the total wages per year for each level of educational achievement, the average annual hours were multiplied by the differentiated opportunity cost hourly wages. For the calculation of the unpaid care work sector contribution to GDP, a sum total of the total wages per year for each category of educational achievement was divided into the 2010 real GDP value of R 3.97 trillion.

3.6.3. Generalist Wage Valuation Method

The source for unpaid care work average daily minutes using the Generalist Valuation Method was the 2010 TUS dataset specifically for persons 10 years and older. Similarly, minutes spent on non-SNA productive activities were derived for specific categories of unpaid care work in the application of the Generalist Wage Method. This method uses time use observations broadly reflecting paid occupations that resemble domestic workers, cleaners and helpers. The *activity_code* variable was recoded to include specific activities as seen below in Table 3.1 to generate the generalist wage selection variable.

Table 3.1: 2010 TUS observations selected for the Generalist Wage variable

TUS Activity Code	Occupation
440, 450, 470, 490	Housekeeper and related
410	Cooks
620	Waitrons
511-512, 531-532, 580	Personal care of children
671, 672, 673, 674	Institution-based personal carers
540 561-562	Home-based personal carers
550, 590	Personal care workers
420, 250, 236, 491	Domestic helpers & cleaners
615, 674	Helpers & cleaners in establishments
430	Hand-launderers & pressers

Source: 2010 S.A. Time Use Survey dataset.

The Labour Market Dynamics South Africa dataset provides the comparable paid occupations that match the Time Use Survey dataset. The q42occupation variable from this dataset was

recoded to produce the Generalist Wage selection variable. Dummy variables including *generalist_all, generalist_men and generalist_women* were generated to stratify generalist minutes by gender and to have the combined minutes. The Generalist men and women dummy variables were used to identify the men and women who actually engaged in these generalist work roles. All unpaid care work categories outside of the selection were excluded, thereby containing the following 10 categories of generalist occupation activities as observed in Table 3.2.

Table 3.2: Observations selected for the calculation of Generalist wage using LMDS.

Code	Occupation	Male	Female	Total
5121	Housekeeper & related	72	110	182
5122	Cooks	247	1 051	1 298
5123	Waitrons	226	390	616
5131	Personal care of children	8	365	373
5132	Institution-based personal carers	53	265	318
5133	Home-based personal carers	9	128	137
5139	Personal care workers	30	136	166
9131	Domestic helpers & cleaners	274	6 457	6 731
9132	Helpers & cleaners in establishments	742	2 224	2 966
9133	Hand-launderers & pressers	20	90	110
	Total	**1681**	**11 216**	**12 897**

Source: 2010 LMDS dataset.

Table 3.2 presents the LMDS occupations chosen for estimating the value of unpaid care work using the Generalist Wage Method. The first column of the table contains the occupational codes used by Stats SA in various surveys and censuses. Along with the occupation codes, Table 3.2 includes the number of male and female observations for each Generalist type occupation in the labour market dynamics study. The most represented occupational category for the generalist selection is the "Domestic helpers and cleaners" category with 52.19% representation. This is a little over half the population sub-sample, whereas, in the year 2002 it was close to two-thirds (64%) as determined by Budlender and Brathaug (2004). Due to the limited number of observations and the fact that men represented only 14.99% of the total respondents, the wage calculations were not gender disaggregated for this analysis.

This table shows significant gender disparity across all occupations related with domestic and care work. Similar to the Budlender et al. (2002) study, domestic helpers and cleaners had the largest representation amongst the elected occupations. And women made up 96% of those employed in these occupations. Given this outcome, this analysis follows Budlender et al. (2002) in that, a single combined mean daily Generalist minutes was derived. It must be duly noted that the nursing type occupations (codes 3231 and 3232) were not included as these would likely inflate the generalist wage – giving an unrealistically higher mean wage for generalist occupation types.

To derive the Generalist method minutes, a survey weighted mean on the *generalist_all* variable was computed. The average hours per year were derived by multiplying the Generalist mean minutes by 365 and then divided by 60. The Generalist hourly wage was derived by applying the general hourly wage computed earlier, onto the survey weighted LMDS Generalist selection observations. To estimate the total wages per year, a product of the annual hours and the Generalist hourly wage was computed. The total wages per year were then divided into the 2010 real GDP to obtain the contribution of the unpaid care work sector using the Generalist Wage method.

3.6.4. Specialist Wage Valuation Method

For the specialist wage estimation method, the SNA production occupations that most resembled the non-SNA production activities were elected. The time-use activity codes and the specialized occupational categories of the LMDS for the Specialist Replacement Wage method were elected as observed in Table 3.3.

Table 3.3: Non-SNA production activities and their market equivalents for application of Specialist Wage valuation method

Activity Code	Activity	Activity Code	Occupation equated with
TUS Classification		**LMDS Classification**	
410 620	Cooking-related Community organised work	5122 5123	Cooks and waitrons
420 440 450 490 615	Cleaning-related Shopping Household management Miscellaneous housework Cleaning of classrooms	5121 9131 9132	Paid domestic workers, housekeepers, and cleaners in establishments
430	Care of textiles, etc	9133	Hand launderers
460	Do-it-yourself home improvements	7331 7332	Work of craftspersons
470 511 – 512 531 – 532 550 561 – 562 590 671 – 674	Pet care Physical care of household children Accompanying household children Accompanying household adults Supervising household children Miscellaneous care of household persons Care of non-household persons	5131 - 5133	Child carers, institution-and-home-based personal carers, general personal care workers
540	Physical care of household sick, aged and elderly	3231	Nursing associate professionals
521 – 522	Teaching household children	2320 2331	Primary and secondary teachers
610	Community organised construction	9313	Construction labourers
630 650 660 690	Volunteering for an organization Participation in meetings Involvement in civic responsibilities Miscellaneous community services.	9120	Unskilled (elementary) workers

Source: 2010 S.A. Time Use Survey dataset and 2010 LMDS dataset.

The Specialist Wage average daily minutes are derived differently from the preceding unpaid care work valuation methods. This method stratifies unpaid care work by activity and maps

these to the corresponding paid occupations, refer to above Table 3.3. The TUS dataset is used to compute the mean daily minutes spent on each of the 9 categories of unpaid care work activity that match the corresponding LMDS occupations. The mean daily minutes per upcw category, per individual, summing to no more than 1440 minutes using the 24-hour aggregation method, were computed. They were derived as per below:

$$General\ domestic\ (hrs/yr) = \frac{304\ minutes}{60} \times 365$$

Thereafter, the annual hours per person were multiplied by the target[6] population of those aged 10 years plus. The general LMDS hourly wage computed in section 3.7.1, was survey weighted across each specialist occupation category to derive the Specialist hourly wage. A product of the Specialist hourly wage and the total annual hours was computed to obtain the total annual wage for each category of unpaid care work. The total annual wage values of all nine categories of unpaid care work were summed up to derive the imputed value of unpaid care work using the Specialist method. This value was then divided into the 2010 real GDP value and multiplied by 100 to get the percentage contribution of the unpaid care work sector to the South African GDP using the Specialist Wage method.

3.7. Limitations

The application of the SUR model may give way to limitations for this study. For one, time-use data is prone to reporting inaccuracies, which may be amplified across equations due to the model's interdependent structure. Measurement error sensitivity could influence the robustness of the estimates. Moreover, due to the cross-sectional nature of the data, some unobserved factors such as cultural norms or family dynamics that influence time allocation, may not be accounted for. This may lead to omitted variable bias.

With regards to estimating the value of unpaid care work, using different methods to impute a monetary value yields different results. Each result is given by the choice of valuation method. Furthermore, it is posited that unpaid care work is largely done by women, and valuation methods often apply market wages that undervalue female-dominated sectors. This can perpetuate gender bias by assigning a lower economic value to traditionally feminine occupations.

[6] A product of the proportion representation of each upcw activity and target population of 40 570 251 persons was computed.

3.8. Conclusion

This chapter presented the methodology for jointly estimating pw, upcw, and nw activities through a Seemingly Unrelated Regression model. This estimation was employed to indicate the trichotomous nature of time use, showing the time trade-offs in decision making. There is an expectation that women will have a larger sum of the time use on unpaid care work activity. That means that women will forgo time use on paid work activity or non-work activity as they engage more in unpaid care work time use. Should that be the case, that would mean lower values in either paid work time use or non-work time use in the SUR. On the other hand, it is expected that men will have a larger sum in paid work time use than women. Should that be the result, then time spent in unpaid care work activity and or non-work activity will likely be lower than the time men spent in paid work activity.

The inherent limitations in both the SUR model and the valuation methods suggest that while this study provides insights into the economic contributions of unpaid care work, caution is needed when interpreting these findings. The potential omitted variable bias and measurement inaccuracies, emphasise the need for further research and methodological advancements in this field.

Future studies could benefit from refined valuation methods that produce more uniform results thereby improving the accuracy and robustness of the estimates. This could potentially lead to more visibility for the contribution of unpaid care work to a country's economy, and by extension, those who engage in it most.

The research methodology provided a strategy for using and analysing the data to answer three research questions. These are, first, “How does the allocation of time use differ by gender??; second, “What is the monetary value of time spent in unpaid care work activity in South Africa?” and third, “What is the percentage contribution of the value of unpaid care work activity to the South African economy?” The first is answered through the application of the SUR model along with descriptive statistics to analyse the gender patterns in time use and whether there are variations in time use patterns attributable to socioeconomic influences. The second question was proposed to be answered through the estimation of the total sample’s annual non-zero time spent in unpaid care work activity, multiplied by the estimated wage rate per hour, the number of people who engaged in it, to impute the monetary value of upcw

activity. Lastly, the contribution of unpaid care work sector to the South African economy is estimated as a percentage calculation after obtaining the value of unpaid care work using the chosen methods: Economy Wide, Generalist and Specialist Valuation Methods.

4. DATA AND DESCRIPTIVES

4.1. Introduction

In this study three data sources were used, namely 2010 TUS, 2010 LMDS and 2010 QGDP. The data specifications as well as their processing are tabled in the subsequent discussions. The examination of the data through data descriptives revealed the behaviour of variables. Most of the analysis in the chapter was conducted using only Time Use Survey data because that is the main dataset from which time inputs are calculated. The summary statistics of the dependent variables (paid work, upcw and non-work) revealed that upcw time use was leading over paid work time use but not non-work. Section 4.2.2 presents an interesting take on the gendered differences in labour force participation, and section 4.2.4. explores the prevalence of unpaid care work activity. In the discussion it was found that contrary to expectations, there was a larger number of women active in the labour force. Although there was a lower percentage of men active in the labour force compared to women, a larger percentage of men occupied the fulltime and overtime employment compared to women. In the descriptives analysis section whilst looking at labour force participation, and the distribution of paid working hours for the South African working age population between the ages of 15 and 65, women's participation in the labour force was more dominant than that of men. This finding contrasts with existing literature, as well as the article by Dong and An (2015) which serves as the framework adapted for the South African context carried out in this study.

4.2. Data sources

Three datasets were used to obtain the statistics for unpaid care work, wages and GDP. These were, the 2010 Time Use Survey (TUS), the 2010 Labour Market Dynamics in South Africa (LMDS) and the 2010 Quarterly Gross Domestic Product.

4.2.1. Time Use Survey Data

The 2010 Time Use Survey (TUS) which is the main data source for this study, was obtained from Stats SA and is the most recent time use dataset available for South Africa. This survey measures how a person spends their time on different activities (Stats, 2013; Stats, 2014; Budlender and Brathaug, 2002; Budlender and Brathaug, 2004). This current study obtained the 2014 - version 1.2, of the published dataset. It is a general-purpose household survey with a national coverage. Households and individuals are the units of analysis.

The survey is based on a stratified two-stage design with probability proportional to size sampling of PSUs in the first stage, and systematic sampling of dwelling units in the second stage. The stratification process used a sampling frame of the 2001 Census enumeration areas (EA) (Vermaak, 2022). The study used a sampling procedure designed to make the survey representative at national, provincial and metro level as well (Phoshoko and Shandukani, 2018; Stats, 2013). The TUS 2000 sampling procedure did not allow the dataset to be representative at the metro level (Phoshoko and Shandukani, 2018). The survey was meant to be conducted again in 2016 and 2020, however that did not take place leaving the 2010 survey the latest time use survey to date for South Africa (Phoshoko and Shandukani, 2018).

The survey included interviews with adults and children from ages 10 years and older, whilst also collecting demographic data about all individuals residing in the households. It however excluded individuals living in worker hostels (Stats, 2013; Vermaak, 2022). It was conducted in the last week of October, November and December of 2010 (Vermaak, 2022). Two individuals per household were elected as survey respondents and were tasked to keep "yesterday diaries" which are time diaries. These time diaries recorded their activities for each half-hour time slot over the 24-hour period starting from 4 am the day before the interview until 4 am on the day of the interview. This was administered through face-to-face interviews using a structured questionnaire with five sections that collect detailed information on household members, demographic details of two elected household individuals, along with their economic activities, main work activities and the recorded household activities in the time diary. The data collection process involved the use of diaries divided into half-hour slots. Respondents were asked open-ended questions about their activities during these half-hour intervals. Fieldworkers then post-coded these activities based on an activity classification system. Respondents could report up to three activities for each time slot, with clarification on whether these activities occurred simultaneously or sequentially. This clarification is essential for calculating minutes spent on either upcw, pw or nw. In particular, “simultaneously” has a different minutes’ outcome when reporting and calculating minutes using the 24-Hour or the full-minutes method. The full-minutes data collection method allowed the most comprehensive log of daily activities that respondents engage in. Given that a number of unpaid care work activities can be done simultaneously with other activities, individuals can end up doing multiple parallel (secondary and tertiary) activities in one 30-minutes time slot. For the purposes of this study, the 24-hour “timeper” method for handling simultaneous activities is employed and not the full-minutes method (Budlender and Brathaug, 2002; Budlender and Brathaug, 2004).

The main purpose for using the TUS is that it gives information in minutes thereby allowing the estimation of the time an individual spends on either upcw, pw and or nw activities. When these estimates are computed and added together for a given 24-hour period (represented by 1440 minutes), the trichotomous time trade-offs between these three broad categories of time use become easier to explore and analyse. Most importantly and for the purposes of this study, it allows the estimation of the total minutes and hours spent by the sample population on unpaid care work.

4.2.2. Labour Market Dynamics Study

The 2010 Labour Market Dynamics Study (LMDS) dataset is used to proxy market related wages for unpaid care work comparable to paid work. This dataset is also from Stats SA. This is a labour force survey with individuals as the unit of analysis. The data for this dataset is sourced from all the four datasets of the Quarterly Labour Force Survey to make one LMDS dataset. This dataset has a national geographic coverage, developed using a general-purpose household survey frame. The sample size also uses 3 080 PSUs, divided into four rotation groups that also correspond to the quarters of the year. The dataset is based on a two-stage stratification design with probability proportional to size sampling of PSUs in the first stage and systematic sampling of dwelling units in the second stage.

The data for the LMDS was also collected through face-to-face interviews collecting individuals' data on their market activities, labour preferences, and demographic characteristics. The LMDS being a six-monthly rotating panel household survey is specifically designed to measure labour market dynamics in the country. Each round of the survey collects information from approximately 70,000 adults aged 15-65 years living in 30,000 households spread across the country.

Unlike the TUS, the LMDS population sample is from ages 0 and above. But for the purpose of this study, ages 9 and below were dropped from the dataset. One of the drawbacks to this dataset is that it likely provides lower estimates of the respondents' wage as respondents often report lower levels of income than what they actually earn (Dare et al., 2019). However, it is still the most appropriate dataset as it covers both formal and informal sectors along with the earnings of occupations therein. The main reason for using the LMDS dataset is that it gives wages for occupations very similar to those included in the TUS dataset.

4.2.3. Quarterly Gross Domestic Product

The final dataset is the 2010 quarterly gross domestic product (GDP) data that was sourced from the South African Reserve Bank. This dataset includes seasonally adjusted annualised quarterly real GDP data valued at constant 2010 market prices using real production and not the expenditure approach. The unit of measurement is millions of Rands. Each quarterly value of the real GDP represents an annualised GDP level for that quarter, therefore requiring that the sum of real GDP from quarter 1 to quarter 4, to be divided by 4 in order to get the annual [7]value of real GDP for the year 2010. The annual real GDP value of the South African economy for the year 2010 was, three trillion, nine hundred and seventy-three million, eight hundred and one thousand, and 75 Rands - alternatively, R3.97 trillion. Using 2010 market prices allowed for the GDP data to be comparable with the Labour Market Dynamics Study wage data as well as the Time Use Survey data of the same year.

4.3. Sampling Strategy

The target population for this study was all individuals aged 10 years and older as is typically found in the 2010 Time Use Survey. To ensure representation of the South African population, the demographic data comprised in the TUS questionnaires, namely, activities, all persons, person and household, were included in the sample. Cluster sampling was based on the enumeration areas which were demarcated into four different types of settlement areas: formal urban, informal urban, tribal areas and rural formal. Sampling weights were used so that the results could be generalised.

4.4. Descriptive statistics

4.4.1. The average time that the South African population engages in paid, unpaid care and non-work time use

The following section presents the summary statistics of the dependent variables, namely, pw, upcw and nw time use as captured in Table 4.1. This study observed that there was at least one respondent that did not do any paid work given the minimum of 0 minutes in paid work.

[7] To convert the quarterly real GDP in millions of Rands to annual GDP in millions of Rands, the following computation was made:
$Annual\ rGDP = \frac{rGDP_{2010,q1} + rGDP_{2010,q2} + rGDP_{2010,q3} + rGDP_{2010,q4}}{4} = \frac{R\ 3{,}922{,}218 + R\ 3{,}955{,}142 + R\ 3{,}990{,}353 + R\ 4{,}027{,}494}{4} = \frac{R\ 15{,}895{,}207}{4} =$ 3,973,801.75 $in\ millions\ of\ Rands$ i.e. R3.973 trillion

However, it must be noted that there was at least one respondent that spent 1365[8] minutes – which is 1 hour and 15 minutes short of a full 24-hour day, in paid work. The study also observed at least one respondent did not engage in unpaid care work time use, where at least one had spent a maximum of 1230 minutes in a given 24-hour day. However, with respect to nonwork, it was found that all the surveyed respondents engaged in non-work activity as evident with one of them using at least 75 minutes in nonwork activity in a given 24-hour period. These 75 minutes could have been used in a wide range of nonwork activity such as sleep or personal care.

On average, respondents spent 18 hours and 19 minutes of their fixed 24-hour day in nonwork activities. Although 18 hours are considerable for unproductive time use, some of the respondents could have been engaged in human capital development such as learning, sleeping, or other personal care activities as part of the 18 hours in non-work time use. Learning, sleeping, personal care, all fall within nonwork activity and in this light are deemed unproductive. For those that did engage in productive (paid) and or reproductive (unpaid care work) time use, on average, they spent 2 hours and 46 minutes in productive work, and 2 hours and 53 minutes in reproductive work per diary day, respectively.

Table 4.1: Summary statistics of the three categories of time-use in minutes per 24-hour period

Variable	Observations	Mean	Std. dev.	Min	Max
Paid work	39,018	166.3144	254.41	0	1365
Unpaid care work	39,018	173.7656	170.8414	0	1230
Non-work	39,018	1099.92	252.8017	75	1440

Source: Author's own calculations using the South Africa TUS 2010.

The standard deviation on the paid work time use is quite high, indicating variability in the average time spent in paid work in a given day. Firstly, the average time spent in paid work per day is quite low and could be as a result of high unemployment or maybe it reflects a trend[9] of

[8] To convert the 1365 minutes to hours, divide by 60 minutes to obtain the hours, and the remaining fraction must be multiplied by 60 seconds to obtain the minutes. See next: $minutes\ to\ hours\ conversion = \frac{1365}{60minutes} = 22.75$

$$22.75 - 22\ (hours) = 0.75 * 60\ seconds = 45minutes$$

[9] This cannot be determined within this study as it is a microeconomic study.

part-time work in the economy. Secondly, the high variability in paid work time use perhaps reflects a mix of full time, part-time and casual employment in the economy. Or perhaps, it indicates differences in working hours per industry or per occupation. To explore this further, the labour force participation of the South African working age population for the year 2010 is examined.

4.4.2. Labour force participation overview: by gender and geographical sector

The labour force participation rate (LFPR) indicates the economy's active labour force by measuring a proportion of the working age population that is either engaged in paid work or is unemployed (Stats, 2010). It must be noted that the LFPR herein is computed using the TUS [10] 2010 data.

The analysis on the working hours[11] relies on data procured from survey participants who held only a single job and disclosed the number of hours typically worked within a week. The initial dataset comprised responses from individuals aged 10 and up, collated over the week preceding the survey interview. The respondents encompassed a diverse employment spectrum, including employees, employers, the self-employed, and those assisting in household enterprises. This research deviates to some extent from the methodology employed by Dong and An, with a specific adjustment made to the age range of participants. While Dong and An incorporated individuals aged between 15 and 74 into their study, the present analysis constrains its scope to include only those between the ages of 15 and 65. This adjustment is informed by the South African labour market context that generally has retirement at 55, 60 or 65. This study went along with the upper end value of the retirement working age.

Table 4.2 presents labour force statistics for the South African working-age population (ages 15 to 64), disaggregated by gender and geographic sector, using the TUS 2010. It offers key

[10] This implies that the rate is calculated based on time diary data which is essentially self-reporting. For that reason, the data may suffer biases and inaccuracies, particularly in comparison to datasets like the Labour Force Survey and the National Income Dynamics Study dataset.

[11] To calculate the distribution of paid working hours, this study used the q43 hours variable that reports the number of hours spent doing paid work for a period of a week. The hours range from 0 to 112. The q43hours variable was elected as it comes from the labour force information section of the TUS questionnaire. This variable is useful for comparing the TUS statistics to other labour market statistics found in the LFS and QLFS datasets and thereby maintains consistency with wage and employment data. The downside to using q43hours is the fact that it is subject to how best the respondent recalls his or her time use. However, it is most plausible to use in this analysis because the alternative - measure of working hours, cannot be directly compared to other wage and employment statistics without careful adjustment. Moreover, the measured working hours reflects a diary day or a maximum of two diary days, and thereby fails to capture the "usual" patterns of work. In the population sample of 39058, 64.64 % (25 246 observations) report zero paid working hours. Therefore, the sub sample the study worked with is 35.36 % of the population.

insights into labour force participation rates, unemployment rates, and the distribution of paid working hours (part-time, full-time, and overtime). The working hours variable was generated as a discrete variable that has three categories: part-time, full-time and overtime working hours for those that engaged in paid work in the past seven days prior to the diary entry. The Basic Conditions for Employment Act are what informed the range in working hours for each category. [12]

Using the data from the 2010 time use survey, the labour force participation rate and the unemployment rate was computed. The strict definition was applied, limiting the labour force participation to only those who are employed, as well as those who are unemployed but still actively looking for employment. To obtain the labour force participation rate for the 2010 period, the number of those who reported as employed as well as those who reported unemployed was summed together and divided over the working age population multiplied by 100. The working age population variable was generated from the q117age variable and limited to include only the observations reported to be between 15 and 65. The LFPR resulted in 51.5% of the working age population. That is, a little over half of the working age population –that was either working or actively looking for work in 2010. The remaining 48.44% of the working age population was not participating in the labour force, perhaps due to retirement, educational pursuit, disability, household responsibilities or discouragement. Regardless of the reason, the 48.44% of the working age population not actively seeking work or employed is a significant loss in the job market and possibly had negative implications to the South African economy.

The observed labour force participation of women (44.56%) is lower than that of men (59.02%). This coincides with the findings of the Dong and An (2015) article. By the same token, the study observed that the LFPR was higher amongst men than women in all age groups. Therein, men represented a larger proportion of the labour force than women in all observed age cohorts.

[12] Parttime working hours are between 1 and 39 hours in a week. Fulltime working hours are between 40 to 45 whilst the overtime working hours are between 46 and 112. The 112 hours is not necessarily based on the labour legislature of the country, rather they are from the diary respondents reported hours on the q43hours variable. Fulltime working hours are 8 hours per 5 business days. Surprisingly, 78 people reported working 112 hours in the 7 days preceding their diary entry. Using the same parameter of 5 business days, they on average worked 22.4 [40/5=8 v 168/7=24 v 112/5=22.4] hours on each of the business day. And although that is a rather startling number of people, they only make up 0.20% of diary respondents aged 10 and above.

Table 4.2 Labour force participation, and distribution of paid working hours for South African working age population (aged 15 to 65)

	Total		All
	Men	**Women**	
Labour force participation rate (51.5%)	59.02	44.56	51.56
Age 15 – 24	27.15	21.94	24.56
Age 25 – 34	76.48	57.9	66.64
Age 35 – 44	83.91	63.81	73.43
Age 45 – 54	76.65	56.83	66.14
Age 55 – 64	49.89	29.63	38.86
Unemployment rate (16.25%)	13.90	19.19	16.25
Distribution over paid working hours (%)			
Part time (1–39 hours per week)	12.97	21.31	16.54
Fulltime (40-45 hours per week)	48.03	49.69	48.74
Overtime (≥46 hours/week)	39.00	28.99	34.71

Source: Author's own calculations using the South Africa TUS 2010.

The unemployment rate was found to be 16.25% when utilizing the TUS 2010 dataset. However according to the official South African government publication, the unemployment rate for 2010 was 24.9% (www.gov.za, 2011). This study's computed unemployment rate using the TUS 2010, deviates from the official figure by 8.65 percentage points. It must be noted that the computed TUS unemployment rate may be underestimated due to the inherent nature of the data collection process as the data collection depends on self-reported values. The unemployment rate figures are nearly gender balanced. However more women than men are found to be unemployed. This unemployment rate indicates that out of 100 people, at least 16 of them were unemployed. Although many South Africans and outside onlookers may have perceived 2010 to be a period where South Africa likely had a stronger economy due to the 2010 FIFA World Cup that boosted many economic sectors – particularly Tourism which is a labour-intensive sector, the unemployment rate signalled an economy not doing so well.

The gender disaggregated overall distribution of paid working hours revealed that women engage more in the part-time work sector. This could be due to mostly engaging in flexible or informal trading work. Men on the other hand dominate the full-time and overtime work sector. This could be due to their heavy involvement in structured employment and jobs that require or offer extended hours of participation.

4.4.3. Gender disaggregated review of time spent in the three categories of time use

The prior discussion on labour force participation shed light on the paid working hours and the labour force participation of each gender. Worthy to note, was that women did more part-time work, and men did more full-time and overtime work. The study thereby zooms in to determine how much time was spent on pw, against upcw and nw.

Table 4.3 below shows the gender disaggregated mean minutes spent in paid work, unpaid care work and nonwork activities. The gender disaggregated mean is advised because as informed by the literature, there is a discerned pattern of time-use where men devote more time on pw and women devote more time on upcw. In the same fashion as the previous section, the statistics on this section were survey adjusted.

Table 4.3: Gender disaggregated average daily minutes spent in pw, upcw, and nw activities

Category of time-use	**Men**	**Women**	**Combined**
Paid work	214	130	171
Unpaid care work	97	229	165
Non-work	1129	1081	1104
Total	**1440**	**1440**	**1440**

Table 4.3 The statistics are the authors calculations. The statistics are survey adjusted and rounded up.

This table presents how much time was invested in labour to produce services that were either included (pw) or excluded (upcw) in GDP calculations as well as time spent in nonwork activities. This table supplements what was found in the labour force participation overview. Particularly, this table reveals that men engaged more in paid work and women partook more in unpaid care work time use. The data indicates that the daily averages for men were that they spent 3 hours 34 minutes [13]and 1 hour 37 minutes in paid work and unpaid care work respectively. Women, on the other hand, spent 2 hours 10 minutes and 3 hours 49 minutes per day in paid and unpaid care work, respectively. It should be acknowledged from these statistics that women tend to carry the greater total workload compared to their men counterparts, because the additional time that women allocate to unpaid care work exceeds the extra time that men dedicate to paid work.

[13] To convert minutes to hours, divide by 60. To convert seconds to minutes, multiply by 60.

4.4.4. Prevalence of unpaid care work

Conditional upon actually spending time engaging in unpaid care work activity, can this study attempt to ascertain the average time that the South African population spent on upcw time use. The prevalence of a condition in the population can have an economic impact that may impose an economic burden to that nation. In the case of unpaid care work activity, those most engaged in it and forgoing productive time use such as paid work – for example, forgo future pension payouts at retirement age and thereby have to depend on the state for pension grants. This is an economic burden to the nation, especially one that has a history of high unemployment and consequently a smaller tax base from which to fund government expenditures. Therefore, by quantifying the prevalence of unpaid care work time use, this data can nudge the government towards measures to address the adverse effects of extensive unpaid care work time use and justify for the allocation of resources towards the alleviation of these. However, should there be no political will for redress, the prevalence data can guide the research on this topic and necessitate further study of potential socioeconomic policies that can be used to lower the prevalence rates and improve the socioeconomic wellbeing of the sub-population that engages in unpaid care work activity.

The prevalence rate quantifies the portion of individuals in the population who spend time doing unpaid care work activity. The prevalence rate of unpaid care work is expressed as a percentage. Firstly, a count of the persons who engage in upcw time use, is calculated. The minimum time spent on upcw time use is set at positive values above zero, upcw >0. The number of individuals with positive non-zero values for engaging in upcw time use is thereafter divided by the total surveyed population and multiplied by 100 to get the prevalence rate.

$$upcw\ prevalence\ rate = \frac{\text{No. of individuals who spent time doing upcw}}{\text{Total surveyed population}} \text{x } 100$$

$$upcw\ prevalence\ rate = \frac{33061}{39019} \text{x } 100$$

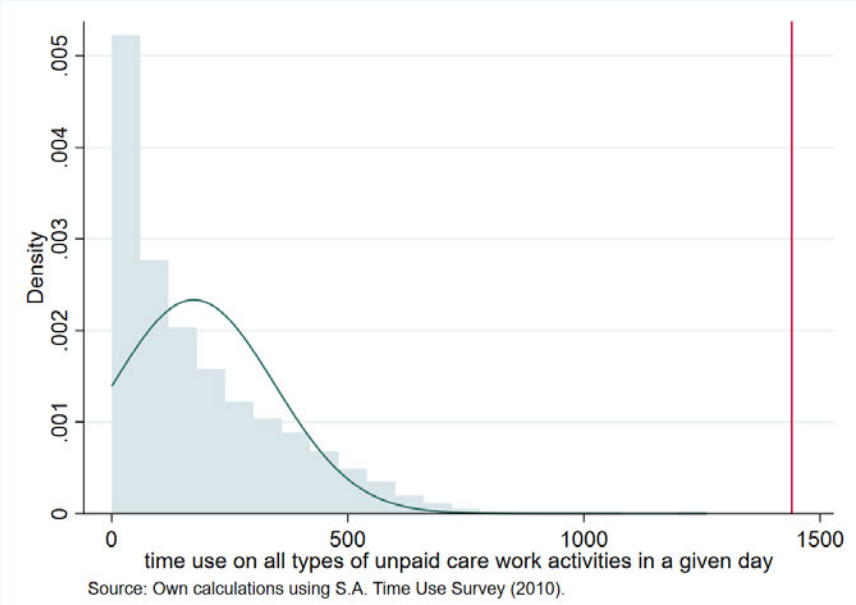
Out of a population sample of 39019, 33 061 respondents were found to have positive non-zero values of upcw time use. Measuring the prevalence rate of upcw time use results in 84.73% of the population sample that engages in this time use activity. When adjusting for survey settings it came to 83.26%. This indicates a high prevalence rate of upcw amongst the population

sample. An analysis of the survey-adjusted, gender-disaggregated mean time devoted to unpaid care work strictly amongst those who actively engages in such activities reveals that men spend an average of 130.51 minutes (i.e. 2 hours 10 minutes) per day, while women spend 249.09 minutes (i.e. 4 hours 9 minutes). These figures are conditional means and are consistent with, though distinct from, the broader estimates reported in Section 4.4.3.

4.4.5. Examining the distribution of the unpaid care work variable

Unpaid care work is the main variable of exploration and discussion for this study. A preliminary investigation on this variable showed that for positive non-zero values, average unpaid care work time use is 205.075 minutes per day, with a minimum of 7.5 minutes and a maximum of 1230 minutes on a given 24-hour day. When the analysis adjusts for survey settings, the mean daily minutes in unpaid care work for positive non-zero values was 198.177 minutes per day.

Figure 1: The distribution of unpaid care work

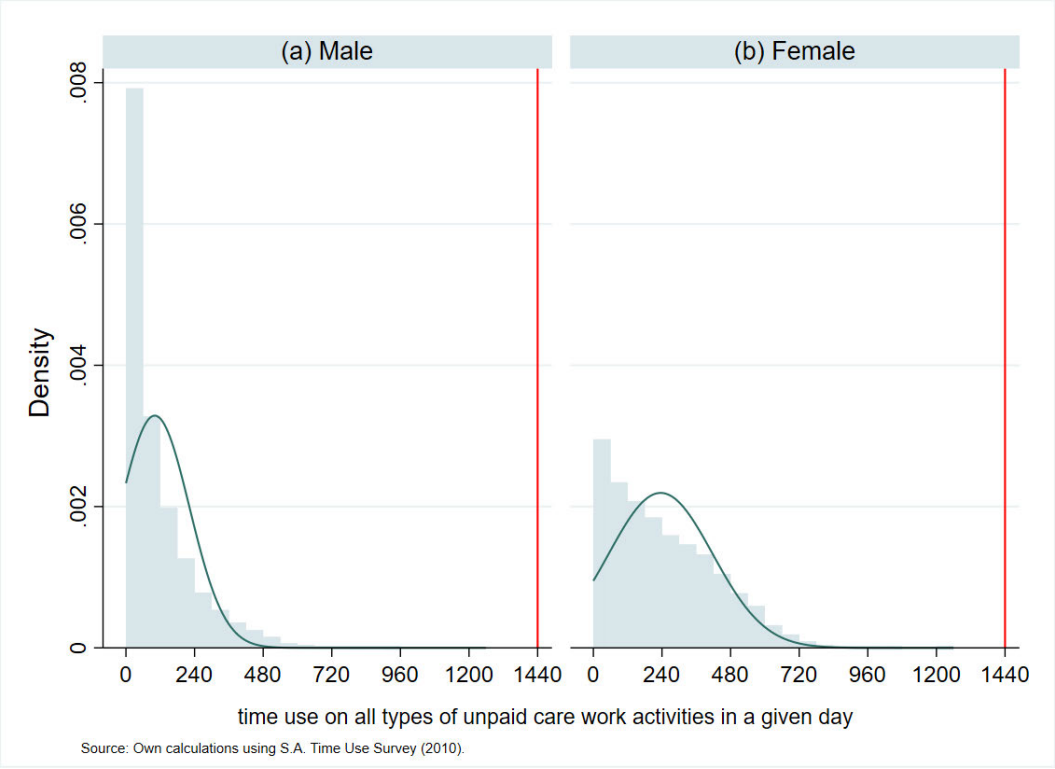


To provide insight into the distribution of unpaid care work, Figure 1 shows the distribution of time spent on unpaid care work activities in a given 24-hour period during the year 2010. The horizontal X axis displays the minutes per day spent in unpaid care work time use, ranging from 0 to 1500. The vertical Y axis displays the probability density indicating how concentrated the data is at each interval of unpaid care work time. Taller bars indicate more observations in that

time interval. The red vertical line indicates the maximum minutes which are 1440 in each 24-hour period. This line was included to highlight that the minutes allocated towards unpaid care work time use cannot exceed a given 24-hour day, whilst simultaneously providing a benchmark for interpreting significantly high values. The overlaying smooth green curve represents the density function fitted into the data. By including this theoretical normal distribution curve the observed distribution of unpaid care work can be compared to the symmetric bell-shaped curve.

Figure 1 shows that the unpaid care work distribution is right skewed with a large number of the observations censored at zero, revealing that the majority of survey respondents spent little to no time engaging in unpaid care work activities in a given 24-hour day. The shape of the density curve as well as the distribution indicates that the more time spent in unpaid care work, the frequency at which this occurred decreased. Figure 1 also communicates a wide range of the data values for unpaid care work. It indicates that as time spent in unpaid care work increased, less and less people were partaking in it. The long tail indicates outliers which are the few who spend extensive amounts of time doing unpaid care work up to the maximum recorded time of 1230 minutes in a given day.

Figure 2: The gender disaggregated distribution of unpaid care work



When considering Becker (1991) Treatise on the Family and Mattila-Wiro (1999) collective household models, men and women do not allocate time towards unpaid care work in the same measure. Figure 2 was thereby included to gain insight into how unequal the allocation of unpaid care work time use is between men and women. A gendered analysis is beneficial for the viewing of the shape and spread of time use allocation and identifying the mean levels of time spent doing unpaid care work activity between men and woman.

Figure 2 (a) shows the unpaid care work distribution for men. As expected, the distribution for men is significantly clustered around low levels of unpaid care work, particularly between the 0 to 120 minutes range. This indicates that most male respondents reported having done either no unpaid care work or up to 2 hours of unpaid care work in a given 24-hour day. In contrast, Figure 2 (b) shows the distribution for women, with fewer of them clustering in the lower levels of unpaid care work time allocation compared to men. The bell-shaped density curve is flatter for women and steeper for men, indicating that the burden of care work time use is widely spread out amongst women whilst contrarily, a small subgroup of men contributes more time towards unpaid care work activity. The red vertical line at 1440 minutes emphasises that there is a maximum of 24 hours in a given day and thereby reinforces that unpaid care work time use allocation is not the only daily time allocation as there is paid work and other non-work activities – namely sleep, that time can be allocated to. The asymmetrical distributions for both men and women in relation to the 1440 minutes constraint, highlights the time burden that unpaid care work imposes on women more than men.

4.5. Conclusion

This chapter focused on responding to the first research question, particularly the gender patterns of time use. Table 4.2 broke down labour force participation to reveal the dynamics of the South African labour force in 2010 and the distribution of paid working hours they spent in the labour market. The Time Use Survey data revealed that labour force participation rates for women were lower than those of men. Furthermore, estimated unemployment rates were generally higher for women than for men. Given that women are assumed to do less paid work then men and assumed to do more unpaid care work than men, this outcome of higher unemployment rates among women was to be expected.

Similarly, when looking at working hours, the study observed that women were more likely to be employed in part-time work, compared to men. In both full-time and overtime work, men

made up a higher proportion of the labour force than their women counterparts. These findings were supplemented by the analysis on Table 4.3 presenting the gender disaggregated average daily minutes spent in paid work, unpaid care work and non-work activities. On average, men spend 214 minutes engaged in paid work activity in a given 24-hour day, ceteris paribus. This average time spent in paid work for men is 84 minutes higher than the average for women. On the other hand, women had a 132 minutes higher average time spent in unpaid care work time use than men did. On average, women were found to spend 229 minutes on unpaid care work activity in a given 24-hour day.

From this analysis the assumption that women do more unpaid care work activity and men do more paid work activity is confirmed.

5. TIME DETERMINATION REGRESSION ANALYSIS

5.1. Introduction

Fitting a seemingly unrelated regression model - here forth to be referred to as SUR, assists in highlighting key concepts that help to explain the allocation of time towards unpaid care work activity. The SUR captures the time trade-offs and explores the gender patterned time allocation. One of the research aims of this study is explore if gender has an influence on the pattern of time use. This answers the first research question which is, "How does the allocation of time use differ by gender??" Gender patterns of time use are of interest after the body of literature tabled that women spend more time engaged in unpaid care work time use than men. This study therefore fitted a seemingly unrelated regression that runs three equations, estimated jointly as a system using the same set of explanatory variables to determine time use on paid work (equation 1), unpaid care work (equation 2), and non-work (equation 3) activities.

5.2. The time determination model

The main aim of this time determination model is to examine how time use allocation is different between genders as well as how it varies with individual characteristics. Table 5.1 presents the SUR estimates of the equation estimated separately for men and women. This is an application of the study of economics where individuals allocate limited resources to meet different needs and wants. Herein the limited resource is a given 24-hour day. The intercept terms of the Time Determination model here below must sum to 1440 minutes of a given 24-hour day for men and for women separately. Men and women are not expected to allocate their limited 1440 minutes in the same way.

The constant terms measure the mean daily minutes spent in each of the three time use categories by the reference group, which is a rural resident, of a particular gender, that is single, has no child aged 6 and under living in the household, aged between 15 to 24, is employed and lives in the Western Cape.

The intercepts reveal that women with the above characteristics, on average, allocated 167.7 minutes to unpaid care work, 315.1 minutes to paid work, and 957.2 minutes to non-work activities. In contrast, men allocated 119.0 minutes to unpaid care work, 386.1 minutes to paid work, and 934.9 minutes to non-work activities. The gender differentials suggest that, ceteris paribus, women initially allocate a greater share of their time to unpaid care work, whereas men allocate relatively more time to income-generating activities. The urban dummy variable

reveals that urban residency significantly reduces unpaid care work time-use by 21.21 minutes for women ($p<0.01$) and by 14.38 minutes for men ($p<0.01$). This means that men and women residing in urban areas spend less time in unpaid care work compared to their rural counterparts. It increases non-work time for women by 42.92 minutes ($p<0.01$), and by 31.47 minutes ($p<0.01$) for men. This suggests that men and women living in urban areas have 31.47 (men) and 42.92 (women) more minutes of non-work activity relative to their rural counterparts. The results seem to indicate that living in urban environs provides unique opportunities to reduce unpaid care work activity and increase non work activity.

Marriage or cohabitation is associated with a statistically significant increase of 62.77 minutes ($p < 0.01$) in women's unpaid care work, alongside a reduction of 10.24 minutes ($p < 0.01$) for men, relative to being single. In terms of non-work activities, women experience a decrease of 59.13 minutes ($p < 0.01$), while men experience a reduction of 17.56 minutes ($p < 0.01$), relative to their unmarried counterparts. This suggests that partnership increases women's engagement in unpaid care work activity while decreasing men's involvement in this activity. Although there is no significant impact on a woman's paid work time use, it is however a reduction possibly indicating the transfer of time from paid work to unpaid care work activity. Cohabitation has a positive impact on a man's paid work time use, as it increases it by 27.80 minutes ($p<0.01$) compared to their single or divorced male counterparts. These findings are in keeping with the concept of specialization which theorises that men tend to engage more in income generating work while women tend to engage most in household work, also an alignment with traditional gender norms.

The presence of young children significantly increases unpaid care work time for women by 49.63 minutes ($p<0.01$), and a reduction of 8.899 minutes ($p<0.01$) for men, compared to households that do not have young children present in the household. It reduces women's non-work time by 44.36 minutes ($p<0.01$), while the effect on men is statistically insignificant. This emphasizes the gendered burden of childcare on women's time allocation.

An increase in household size significantly reduces unpaid care work time for women by 15.03 minutes, $p<0.01$) and decreases it for men by 12.40 minutes, ($p<0.01$). It significantly increases non-work time for men by 13.01 minutes ($p<0.01$) and for women by 15.17 minutes ($p<0.01$). These results indicate that larger households may probably share household tasks making more time available for engaging in other time use activities.

Table 5.1: SUR estimates of the predictors of time allocation by gender

	UPCW for men	Paid work for men	Non-work for men	UPCW for Women	Paid work for Women	Non-work for Women
Constant	119.0***	386.1***	934.9***	167.7***	315.1***	957.2***
	(13.63)	(26.09)	(63.10)	(14.47)	(27.34)	(72.65)
Urban	-14.38***	-17.09***	31.47***	-21.21***	-21.71***	42.92***
	(-6.28)	(-4.40)	(8.10)	(-7.21)	(-7.42)	(12.83)
Married / living with partner	-10.24***	27.80***	-17.56***	62.77***	-3.644	-59.13***
	(-4.50)	(7.21)	(-4.55)	(23.16)	(-1.35)	(-19.19)
Child under age 7 present in household	-8.899***	3.765	5.134	49.63***	-5.269*	-44.36***
	(-4.38)	(1.09)	(1.49)	(20.60)	(-2.20)	(-16.20)
Household size	-12.40***	-0.613	13.01***	-15.03***	-0.145	15.17***
	(-17.59)	(-0.51)	(10.88)	(-16.70)	(-0.16)	(14.83)
Age 25 – 34	23.33***	40.97***	-64.30***	86.92***	22.05***	-109.0***
	(8.17)	(8.47)	(-13.27)	(23.91)	(6.10)	(-26.37)
Age 35 – 44	27.63***	19.96***	-47.59***	94.08***	12.95***	-107.0***
	(8.72)	(3.72)	(-8.86)	(24.27)	(3.36)	(-24.29)
Age 45 – 54	30.35***	5.086	-35.43***	86.95***	10.58**	-97.53***
	(8.85)	(0.88)	(-6.09)	(21.61)	(2.64)	(-21.32)
Age 55 – 64	35.68***	-1.201	-34.48***	80.03***	6.841	-86.87***
	(9.47)	(-0.19)	(-5.39)	(18.80)	(1.62)	(-17.95)
Years of schooling	3.326***	-0.846	-2.481***	6.151***	-1.134***	-5.017***
	(12.07)	(-1.81)	(-5.31)	(18.46)	(-3.42)	(-13.25)
Log household income	-4.921***	4.900**	0.0218	-14.52***	7.956***	6.566***
	(-4.76)	(2.80)	(0.01)	(-10.75)	(5.93)	(4.28)
Unemployed	83.42***	-353.1***	269.7***	158.3***	-323.8***	165.5***
	(21.15)	(-52.83)	(40.31)	(30.96)	(-63.69)	(28.47)
Not economically active	60.52***	-381.4***	320.9***	122.6***	-328.1***	205.5***
	(24.57)	(-91.35)	(76.78)	(40.12)	(-108.03)	(59.18)
Eastern Cape province	-3.529	3.727	-0.198	22.88***	-1.735	-21.14***
	(-0.89)	(0.55)	(-0.03)	(4.53)	(-0.35)	(-3.68)
Northern Cape province	-15.02***	-5.614	20.63**	1.506	-14.54*	13.03
	(-3.29)	(-0.73)	(2.67)	(0.26)	(-2.49)	(1.95)
Limpopo province	-20.40***	-15.68*	36.08***	-9.088	-13.14*	22.23***
	(-4.81)	(-2.18)	(5.01)	(-1.70)	(-2.47)	(3.66)
Free State province	-10.62*	-2.025	12.64	13.03*	-14.02**	0.981
	(-2.47)	(-0.28)	(1.74)	(2.41)	(-2.61)	(0.16)
KwaZulu-Natal province	-10.50**	31.15***	-20.64**	-3.030	32.63***	-29.60***
	(-2.83)	(4.96)	(-3.28)	(-0.64)	(6.89)	(-5.46)
North West province	-16.94***	-20.57**	37.51***	-10.12	-18.70***	28.82***
	(-3.98)	(-2.85)	(5.20)	(-1.84)	(-3.42)	(4.61)
Gauteng province	-7.099	-4.019	11.12	-5.130	1.328	3.802
	(-1.87)	(-0.63)	(1.73)	(-1.03)	(0.27)	(0.67)
Mpumalanga province	-7.734	16.35*	-8.616	8.335	0.194	-8.530
	(-1.90)	(2.38)	(-1.25)	(1.59)	(0.04)	(-1.43)
R^2	0.0814	0.5040	0.4657	0.2051	0.4730	0.3822
X^2	1500.78	17207.66	14761.64	5217.81	18147.78	12509.70
P value	0.0000	0.0000	0.000	0.0000	0.0000	0.000
N	16936	16936	16936	20220	20220	20220

Note: Standard errors are below coefficient estimates. ***, **, * denote significance levels of 1%, 5% and 10% respectively. The omitted groups include those who are single, rural resident, have no children under the age of 7, and aged 15 – 24 are employed and live in Cape Town.

For those aged 25-34 – relative to those aged between 15-24, there is a significant increase in unpaid care work time for women and men, which is 86.92 minutes ($p<0.01$) and 23.33 minutes ($p<0.01$), respectively. Moreover, men aged 25-34, spend 41 minutes ($p<0.01$) more in paid

work activity compared to those aged 15-24. Similarly, women from the same age group spend more time (22.05 minutes, $p<0.01$) in paid work activity compared to the reference group. Non-work time-use significantly decreases for both women (109.0 minutes, $p<0.01$) and men (64.30 minutes, $p<0.01$). In the 35-44 age group, unpaid care work time-use significantly increases for women by 94.08 minutes ($p<0.01$) and for men by 27.63 minutes ($p<0.01$), compared to men and women in the 15-24 age cohort. Non-work time decreases significantly for both women (107.0 minutes, $p<0.01$) and men (47.59 minutes, $p<0.01$). For ages 45-54, women's unpaid care time increases by 86.95 minutes ($p<0.01$) and men's by 30.35 minutes ($p<0.01$), compared to the reference age group. There is a significant reduction in non-work time for both men and women in this age group compared to those of the reference group. For ages 55-64, time spent in unpaid care work activity increases for women by 80 minutes ($p<0.05$) and for men by 36 minutes ($p<0.01$), with no significant effect on paid work time for both genders. For the oldest age group, there is an observed reduction in paid work time use, however, it is insignificant. The observed age-specific patterns of time allocation are consistent with the standard life-cycle effect, wherein as individuals age, they devote increasing amounts of time to work activities — both household and market, while correspondingly reducing the time allocated to non-work activities.

Additional years of schooling slightly increase time spent in unpaid care work for women by 1.134 minutes ($p<0.01$) and by 3.326 minutes ($p<0.01$) for men. The impact on non-work time is also insignificant for both genders, indicating minimal influence of education on time allocation.

For men, additional years of schooling is associated with a rise in time spent doing upcw activity by 3.33 minutes ($p<001$), and a decline in non-work time use by 2.48 minutes ($p<0.01$). The reduction in paid work time-use for an additional year of schooling, although expected, is insignificant. For women, an additional year of schooling is associated with a rise in upcw activity by 6.15 minutes ($p<001$), and a decline in non-work time use by 5 minutes ($p<0.01$). The 1-minute ($p<0.01$) reduction in paid work time use for an additional year of schooling, is expected.

A one unit increase in the log of household income significantly reduces time spent in unpaid care work activity for women by 14.5 minutes ($p<0.01$) and for men by 4.92 minutes ($p<0.01$). A one unit increase in the log of household income also increases time spent in non-work

activity for women by 6.56 minutes ($p<0.01$) and increases that of men by a small but insignificant amount. These results suggest that higher income households have a unique opportunity to outsource their upcw activities significantly reducing their engagement in these activities. For women, this is more pronounced evident in the significant increases in both income generating activities and non-work activities.

Being unemployed for men is associated with 83 minutes ($p<0.01$) increase in upcw, a 353 minutes ($p<0.01$) reduction in pw, and a 270 minutes increase in nw activity relative to being employed. For women, unemployment is associated with a statistically significant increase of 158 minutes ($p < 0.01$) in unpaid care work, a reduction of 324 minutes ($p < 0.01$) in paid work, and an increase of 166 minutes in non-work activities, relative to being employed. On the other hand, being non-economically active for men is associated with a statistically significant increase of 61 minutes ($p<0.01$) in unpaid care work, a reduction of 381 minutes ($p<0.01$) in paid work, and a 321 minute increase in non-work activity, relative to being employed. Whereas being non-economically active for women is associated with a 123 minutes ($p<0.01$) increase in unpaid care work, a 328 minutes ($p<0.01$) reduction in paid work, and a 206 minutes increase in nonwork activity, relative to being employed. These study findings are to be expected as individuals who are unemployed and not economically active generally have more available time for non-work activity and unpaid care work activity.

The provinces dummy variables were included to capture the regional and institutional differences in time allocation between genders across the country. For example, being a man whilst residing in the KwaZulu-Natal province reduces unpaid care work time use by 11 minutes ($p<0.05$), increases paid work time use by 31 minutes ($p<0.01$) and reduces non-work time use by 21 minutes ($p<0.05$), relative to being a man and residing in the Western Cape province.

5.3. Post estimation efficiency test

The Breusch-Pagan test of independence was used to test whether the residuals of the paid work, unpaid care work, non-work equations in the SUR model were independent of each other. This test differs in its normal application of checking whether the homoscedasticity assumption of the Classical Linear Regression Model was violated (Colin and Trivedi, 2010). In the case of a Seemingly Unrelated Regression model application, it tests the cross-equation error correlation (Colin and Trivedi, 2010). This assesses whether the residuals of the paid work,

unpaid care work and non-work equations are correlated (Colin and Trivedi, 2010). This aids in supporting the assumption made in Chapter 2, that time use allocation is trichotomous in nature.

In the case that the Breusch Pagan test indicates significant cross-equation correlations, that will indicate that the SUR was more efficient in estimating the pw, upcw and nw equations instead of using separate OLS regressions. Given that the SUR model uses a Generalised Least Squares estimation (Colin and Trivedi, 2010), the time determination model can account for any correlations that may be present between the residuals of the pw, upcw and nw equations. This will help account for the interconnected nature of time allocation decisions faced by individuals. Table 5.2.1 through to Table 5.2.4 present the results of the Breusch-Pagan test of independence. The interpretation of the other Breusch Pagan test results follows a similar pattern and therefore and therefore only one set of results is discussed. The assumption is that the residuals are uncorrelated across equations.

Table 5.2.1: Test for cross-equation error correlation, SUR (pw and upcw, men)

Correlation matrix of residuals: Paid work and unpaid care work		
	Paid work	Unpaid care work
Paid work	1.0000	
Unpaid care work	-0.2934	1.0000
Bresch-Pagan test of independence: chi2(1) = 1457.537, Pr = 0.0000		

Table 5.2.2: Test for cross-equation error correlation, SUR (pw and nw men)

Correlation matrix of residuals: Paid work and Non-work		
	Paid work	Non-work
Paid work	1.0000	
Non-work	-0.8261	1.0000
Bresch-Pagan test of independence: chi2(1) = 11557.318, Pr = 0.0000		

Table 5.2.3: Test for cross-equation error correlation, SUR (pw and upcw, women)

Correlation matrix of residuals: Paid work and unpaid care work		
	Paid work	Non-work
Paid work	1.0000	
Non-work	-0.3502	1.0000
Bresch-Pagan test of independence: chi2(1) = 2479.179, Pr = 0.0000		

Table 5.2.4: Test for cross-equation error correlation, SUR (pw and nw, women)

Correlation matrix of residuals: Paid work and Non-work		
	Paid work	Non-work
Paid work	1.0000	
Non-work	-0.5665	1.0000
Bresch-Pagan test of independence: chi2(1) = 6489.562, Pr = 0.0000		

In Table 5.2.1, there is a negative but moderate correlation between the residuals of pw and upcw, -0.2934. The negative correlation between paid work and unpaid care work indicates that changes in the unobserved factors influencing time allocation in paid work could either increase or decrease unpaid care work. This is a meaningful result as paid work and unpaid care work compete for time allocation. The null hypothesis for the Breusch-Pagan test states that the residuals across the equations for paid work and unpaid care work are independent. With a chi-squared statistic of 1457.537, 1 degree of freedom, and a p-value of 0.0000, the null hypothesis is rejected. This indicates that the residuals between these equations are indeed correlated. This is necessary for the accuracy and integrity of the SUR model.

These test results suggest that unpaid care work, paid work and non-work time use is interdependent. Therefore, the SUR model is more efficient in modelling the time determination model.

5.4. Limitations

Results from the SUR model cannot be interpreted as causal because the model estimates correlations rather than causal effects. One of the reasons limiting causal interpretation is simultaneity and reverse causality. For example, household income likely has a bidirectional relationship with time spent in paid employment. Time spent on paid employment on the other

hand also affects changes to household income. This issue of simultaneity could result in inconsistent estimates.

Moreover, it is hereby noted that the results are specific to the cultural and regional context of this study and may not be generalizable to other settings with different societal norms and economic conditions.

5.5. Conclusion

The time determination model was applied through the seemingly unrelated regression model. It tabled how different allocate their time as well as how that varies with individual characteristics. In Table 5.1, the intercepts revealed gender differences indicating that all other things being equal, women in the reference group initially allocate a greater share of their time to unpaid care work, whereas men allocate relatively more time to income-generating activities.

Living in an urban area as opposed to a rural area, results in men and women spending less time in upcw and more time in non-work activity.

Being married or cohabiting leads to a significant increase in unpaid care work time-use for women and a decrease in the same for men. Interestingly, non-work time reduced by a greater amount 59.13 minutes for women ($p<0.01$) then men 17.56 minutes ($p<0.01$). These findings are in keeping with Becker's concept of specialization where men tend to engage more in income generating work while women tend to engage most in household work. Similarly, the presence of young children increased women's upcw time use but reduced it for men. Indicating the gendered burden of childcare on women's time allocation.

An increase in household size significantly reduces unpaid care work time for women by 15.03 minutes, $p<0.01$) and decreases it for men by 12.40 minutes, ($p<0.01$). It significantly increases non-work time for men by 13.01 minutes ($p<0.01$) and for women by 15.17 minutes ($p<0.01$). These results indicate that larger households may probably share household tasks making more time available for engaging in other time use activities.

The normal life cycle effect was observed in the gender patterns of time allocation across various age cohorts. As the age group increased, more upcw and paid work time use was

observed. Interestingly, an additional year of schooling increased upcw time use for both men and women but no significant influence on non-work time.

As the efficiency tests were conducted on the residuals, the study observed and confirmed the interdependence of time use between upcw, pw and nw activity.

The application of the SUR model was appropriate because it jointly estimates the time use allocation on pw, upcw and nw. The interdependencies through correlated error terms, such that an increase in upcw time use allocation results in a corresponding decrease in time available for pw and nw is essential for estimating the opportunity cost of time devoted to unpaid care work.

By estimating the model separately for men and women, the results clearly show that time allocation is influenced by gender. For instance, the baseline for upcw is significantly higher for women than for men (167.7 vs. 119.0 minutes), which aligns with established gender roles. Moreover, predictors such as marital status and the presence of young children have markedly different effects on time allocated to unpaid care work for men versus women. These differences reinforce the notion that gender is a critical determinant of time use and, by extension, the valuation of unpaid care work.

The application of the SUR model effectively answered the research question on, "How does the allocation of time use differ by gender??" The upcw time use data, that is ultimately used in calculating the total annual minutes of the population that devoted time to unpaid care work activity in Chapter 6, was explored through the SUR model. The SUR model revealed the gender patterns of time use, and of particular interest to this study, how time allocation towards upcw is influenced by gender and other socioeconomic influences. The model also indicated that time allocation towards upcw is not independent of affecting time allocation towards paid work or non-work activity. It showed that pw, upcw and nw time use are interdependent, meaning that more time allocated to one time use activity will effectively reduce the amount of time available to use on the other two time use activities. This is in line with a 24 hour day with a fixed daily limit of 1440 minutes. Therefore, the SUR provides a framework to understand the interdependent nature of time allocation across different activities.

Allowing efficient estimation and direct comparison of the determinants of time allocation between men and women. Thus, the application of the SUR model not only fits into the study of calculating the value of unpaid care work but also robustly addresses the objective of exploring gender differences in time allocation. This analysis laid the foundation for later estimating the economic value of unpaid care work by quantifying the time devoted to it under various conditions.

6. THE VALUE OF UPCW: APPLICATION OF VALUATION METHODS

6.1. Introduction

This chapter implements the methods discussed in Chapter 3 used in the monetary valuation of unpaid care work. The valuation approach followed in this study is the input valuation approach that imputes monetary value to labour time in household production. Herein, four methods of valuation were employed, namely, Economy-wide Mean wage method, Opportunity Cost method, Generalist wage method, and the Specialist wage method. The nature of these methods produced different value estimates as some employ gender disaggregation (e.g. Economy-wide Mean Wage and Opportunity Cost) in the methodology whereas others focus on the activity or occupation (e.g. Generalist Wage and Specialist Wage) disaggregation.

The main objective of this chapter was to estimate the total annual minutes spent in unpaid care work time use (utilising the 2010 Time Use Survey dataset), multiply these minutes by the estimated labour market equivalent hourly wage rate (obtained through the 2010 LMDS dataset), to obtain the monetary value of time spent in unpaid care work time use. The estimated monetary economic value of unpaid care work time use – according to each valuation method employed, was then divided into the 2010 real GDP to obtain the GDP share that the unpaid care work sector contributes to the South African GDP.

A brief comparison of results between the GDP shares of each of the four methods employed using the 2000 TUS dataset versus this study's use of the 2010 TUS dataset, is undertaken to conclude this chapter.

6.2. Sample

A total of 83 818 respondents from 22 484 households participated in the 2010 Time Use Survey. The values for all SNA and non-SNA time use categories were obtained from 39 019 respondents, aged 10 years and above, who were interviewed through the time diary method These individuals are representative of the South African population, spanning all nine provinces and categorised by settlement types.

In the Labour Market Dynamics Survey dataset, 161 594 individuals from 44 624 households were surveyed. To ensure the sample selection has respondents aged 10 years and above as in the TUS, all those under the age of 10 were dropped, leaving 127 543 for analysis.

6.3. Unpaid care work valuation approach

This study employed the input valuation approach focusing on the labour time spent doing unpaid care work. The time estimates were computed from total minutes and hours' the population sample was engaged in unpaid care work. These estimates differ per valuation method. The valuation methods applied in this study are the Economy-wide Mean wage, Opportunity Cost, Generalist wage and Specialist wage imputation methods. There are, however, limitations to these methods.

The economy-wide mean wage method calculates and imputes the mean wage across all sectors to unpaid care work. This method assumes that when a care giver enters the labour market, he or she would earn a wage that is the average wage of all occupations in the economy. Practically, there is no uniform distribution of workers across different wage levels, so this assumption effectively ignores the prevailing labour market segmentation. Moreover, the imputed mean wage includes wages of high-income earning professionals, consequently distorting the earnings of unpaid care workers. Applying the Economy-wide mean wage method could likely understate the gendered barriers such as wage gaps between men and women, by assuming equal earning potential. That is why when this method is applied in 6.4.1, it is gender disaggregated in order to mimic real labour market conditions in the wages of men and women.

The Opportunity Cost method on the other hand, imputes wages on what individuals would have earned for spending their time in market work instead of unpaid care work. It assumes forgone wages for those with formal employment and assumes forgone market wages based on level of educational achievement for those who are outside of the labour force. The issue with this method is that it assumes a direct trade-off between paid work and unpaid care work. This reduces any time spent doing upcw to an economic loss, and fails to recognize the social value that rendering unpaid care work can bring.

When applying the Generalist Wage method for example, using the average wages of a housekeeper which are often very low as compared to other occupations, will create a downward bias producing lower wages as compared to other methods (Dong and An, 2015). Using a specialist wage on the other hand, also has its drawbacks because the specialist wages used are reflective of the level of expertise and quality of work produced (Jackson and Chandler, 1995; Dong and An, 2015). For example, a hotel chef is paid more for cooking a pot of stew because he or she has received culinary training that enables him or her to produce the stew at

a higher quality, with greater efficiency (e.g. speed) and effectiveness (replicating the same taste and quality of stew), as compared to a household member who has not received this training. Moreover, the chef's productivity is probably aided by the equipment at his or her disposal, coupled with bulk-buying power, resulting in high quality stew produced at minimum variable cost of quality inputs due to economies of scale. Conversely, the Specialist Wage method in the case of a child minder, may fail to account for the personal and emotional care that a mother provides. Consequently, the Specialist Wage for a mother's reproductive work may be undervalued by using the specialist wages of a child minder.

Due to these limitations, economists advise employing different methods to the valuation of unpaid care work to attain some measure of robustness.

6.4. Application of the impute valuation wage methods

6.4.1. The value of unpaid care work: Economy-wide mean wage method application

Table 6.1. displays the application of the Economy wide mean wage method of imputing monetary value top unpaid care work labour time. The minutes and hours values were sourced from the 2010 TUS, the derived Economy wide mean wage hourly rate generated using the 2010 LMDS dataset and the 2010 real GDP value was sourced from the South African Reserve Bank.

Table 6.1: Valuation using Economy-wide gender disaggregated mean wage from LMDS, and 24-hour measure for simultaneous activities.

	Male	**Female**	**Combined**
Minutes per day	97	229	165
Hours per year	590	1393	1004
Population 10 years plus	19543191	21027060	40 570 251
Total hours per year	11530482690	29290694580	40732532004
'Wage' per hour	45,07	32,23	39,55
Total wages per year (R)	519 678 854 838,30	944 039 086 313,40	1 463 717 941 151,70
2010 GDP value			3 973 801 836 544
% of GDP	13.08	23.76	36,83

Source: Own calculations using S.A. Time Use Survey (2010), S.A. Labour Market Dynamics Study dataset (2010) and S.A. real GDP dataset (2010). Results are weighted using the survey weights. Note: Estimates are rounded

The data indicates the systematic gender gap in unpaid care work in that the results reveal women spend more than twice the time men contribution to upcw. This represents a structural time-use allocation bias consistent with household bargaining and unitary/collective models of labour division. The Table presents that the value of upcw activity using the Economy-wide Mean Wage method imputed a GDP contribution of the care sector to the tune of R 519 billion for men, R 944 billion for women and a combined value of R 1.463 trillion by both genders into the South African economy in the year 2010. Thereby, using this impute valuation method indicated that the unpaid care work sector of the economy contributed 36.83% to the final goods and services sold in the South African economy for the year 2010.

For the purposes of robustness, other impute valuation methods were employed here below.

6.4.2. The value of unpaid care work: Opportunity cost method application

Table 6.2 indicates that as the level of educational attainment increases amongst South African men, the imputed wage per hour as well as the total economic value of the upcw sector increases, when applying the Opporttunity Cost method of valuation. This finding aligns with Human Capital Theory that postulates that higher levels of educational attainment are associated with higher earning potential, and this thereby increases the opportunity cost of time spent in upcw time use. Men within the post-secondary education cohort, made up 39.67% of the South African male population. Although their total annual hours (1.54 billion +) spent in upcw time use were a little lower than men with an incomplete secondary education (1.64 billion +), their higher wage rate of R70.33 resulted in a higher imputed economic value of their upcw time use that was valued at R108 billion +. After adding up all the imputed economic values of unpaid care work time use disaggregated by educational attainment, the total imputed value of the unpaid care work time use of South African men was estimated to be R153.9 billion for the year 2010. This is a substantial economic contribution of unpaid care work time use to the South African economy even among men who stereotypically allocate less time towards these upcw activities.

Table 6.2: Imputed value of upcw using the Opportunity Cost method for men.

	%	Population Age 10+	Wage (R/hr)	Minutes	Total hours/ year	Wage total (R)
No schooling	3.69	1 497 042	15,42	93.92	140 602 209	2 168 086 066,44
Incomplete primary	15.85	6 430 385	16,75	70.79	455 206 939	7 624 716 225,30
Incomplete secondary	40.79	16 548 605	21,41	99.69	1 649 730 471	35 320 729 376,00
Matric plus	39.67	14 877 111	70,33	104	1 547 219 548	108 815 950 834,53
Total value						153 929 482 502,28
2010 GDP value						3 973 801 836 544,00
% of GDP						3,87

Source: Own calculations using S.A. Time Use Survey (2010), S.A. Labour Market Dynamics Study dataset (2010) and S.A. real GDP dataset (2010). Results are weighted using the survey weights.

Table 6.3 similar to the previous table, presents the monetary value of upcw time use of South African women when using the Opportunity Cost method. Herein, wage rates specific to a women's educational status were allocated to their total annual hours spent in upcw time use activity. This table presents the forgone earnings of South African women associated with allocating time towards domestic and caregiving responsibilities instead of selling their time to the labour market. It is hereby noted that this is the application of the Opportunity Cost method as understood in (Budlender and Brathaug, 2002). The application of this method does not necessarily mean that all the observed South African women would have been gainfully employed had they sold their time to the labour market, as this is not the case in all nations, particularly South Africa with its high unemployment rates.

Comparing the results of Table 6.2 to those of 6.3, South African women earn lower mean wages across all levels of education and have significantly higher time use allocation towards unpaid care work, compared to their male counterparts. This results in higher forgone earnings for South African women. These results confirm the human capital and labour market postulations by Becker (2009a), wherein he posited that as women invest in further study, they gain access to better paying jobs, and therefore the opportunity cost of domestic and care work increases.

Table 6.3: Imputed value of upcw using the Opportunity Cost method for women.

	%	Population (Age 10+)	Wage (R/hr)	Minutes	Total hours/ year	Wage total (R)
No schooling	5.45	2 211 079	9,43	221.86	490 549 916	4 625 885 706,31
Incomplete primary	14.29	5 797 489	11,10	163.97	950 614 250	10 551 818 171,33
Incomplete secondary	39.92	16 195 644	20,67	237.73	385 0190 495	79 583 437 541,49
Matric plus	40.35	16 370 096	44,92	243.53	3 986 609 547	179 078 500 837,90
Value						273 839 642 257,03
2010 GDP value						3 973 801 836 544,00
% of GDP						6.89

Source: Own calculations using S.A. Time Use Survey (2010), S.A. Labour Market Dynamics Study dataset (2010) and S.A. real GDP dataset (2010). Results are weighted using the survey weights.

A key finding is within the post-Secondary education group wherein South African women's time allocation to upcw activity remains large despite their higher educational attainment. This confirms Becker's prediction that where traditional gender roles persist, women will continue to shoulder the burden of unpaid care work time use. This is evident in that time spent in upcw, 243.53 mean minutes a day for women compared to 104 mean daily minutes for men, is persistently larger even among highly educated women. South African women with the highest level of education are responsible for contributing the largest share of the total value of unpaid care work to the South African economy, with an imputed economic value of over R179 billion.

Ultimately, the total imputed economic value of unpaid care work time use contributed by South African women of different educational backgrounds, sums to over R273 billion.

6.4.3. The value of unpaid care work: Generalist Wage method application

On average, South African individuals from the ages of 10 and above, engaged in housework and care work activities for 322 minutes (or 5 hours 22 minutes) a day, translating to 2008[14] hours annually. The total annual monetary value of general domestic and care type activities came to over R1 trillion. The monetary value of the unpaid care work sector using the Generalist method contributes 25.82% to the South African real GDP. This method gives a higher value

[14] $\frac{330min\ x\ 365days}{60\ min} = 2007.5\ hours\ per\ year$

of the contribution of the unpaid care work sector than the Opportunity Cost valuation methods (men: 3.87% GDP, women: 6.89% GDP) but slightly lower than the Economy wide mean wage method (36.8% GDP). This is a significant economic contribution of unpaid care work which is stereotypically excluded from the conventional GDP calculations.

Table 6.4: Valuation using Generalist Wage from LMDS and 24-hour measure for simultaneous activities.

	Population
Minutes per day	322
Hours per year	2008
Population 10 years plus	40 570 251
Total hours per year	80 113 511 336
'Wage' per hour	12.81
Total wages per year (Rm)	1 026 254 080 214,16
2010 annual GDP (R)	3 973 801 836 544
% of GDP	25.82%

Source: Own calculations using S.A. Time Use Survey (2010), S.A. Labour Market Dynamics Study dataset (2010) and S.A. real GDP dataset (2010). Results are weighted using the survey weights.

6.4.4. The value of unpaid care work: Specialist Wage method

Contrary to the previous impute valuation methods, the Specialist Wage method disaggregates by activity and not by gender for the estimations. In this method, the focus is on the occupation and not the person doing the occupation. Different unpaid care work activities were equated with similar market occupations. Table 6.5 displays the average daily minutes spent on occupational activities, sourced from the 2010 TUS dataset, and the average hourly wage rates given by the market for each of those activities obtained through the LMDS dataset. As presented in Table 6.5, unpaid care work has a diverse nature, and this reflects in its imputed market wages.

The key observations from Table 6.5 Care-related activities namely, caring for the sick, the aged, and other dependents, have higher wage rates, approximately R15 and R18 per hour, perhaps due to their close relation to semi-skilled personal care occupations. On the other hand, domestic work including cleaning and laundry, has the lowest wage rates, reflecting how the labour market values this work. Although care activities indicate greater time spend, their

corresponding wage rates are still below those of construction work (R18.23 per hour) which is typically done by men. Tasks aligned with stereotypically male dominated fields, such as do-it-yourself and construction activities, have higher wage rates (R14 - R18 per hour), emphasising the gender bias in wage structures, whereby care and domestic tasks which are stereotypically female dominated, are consistently undervalued compared to male manual labour.

Table 6.5: Occupations selected for calculation of unpaid care work using the Specialist Wage method.

Activity	**Daily minutes**	**Average wage R/hr**
General domestic	304	11.62
Cooking	309	16.20
Laundry	343	14.19
Do-it-yourself	375	14.69
Care of sick, aged	403	17.79
Care of other people	441	15.22
Teaching	212	15.91
Construction	402	18.23
General unskilled	450	12.81

Source: 2010 TUS and 2010 LMDS datasets.

Table 6.6 presents the results of the application of the Specialist Wage valuation method. It reveals that General domestic work, which was performed by 70.49% of the South African population, contributed the largest share of unpaid care work time use amounting to over R614 billion in the year 2010. This was followed by Construction-related upcw activity time use, that amounted to over R169 billion in wages, but only performed by 9.36% of the South African population. The third largest contributor to the South African economy using the Specialist Wage method, was Cooking activity of Cooks of Chefs, which comprised of only 9.37% of the population, but contributed over R115 billion to the South African economy.

Table 6.6: Imputed value of unpaid care work using the Specialist Wage method.

	Proportion of population	**Target Population** Age 10+	**Minutes**	**Hours/ year**	**Total annual hours** Hrs/yr × target population	**Wage (R/hr)**	**Total annual wage (R)**
General domestic	0,7049	28597970	304	1849	52887179057	11.62	614 549 020 642,67
Cooking	0,0937	3801433	309	1880	7145742777	16.20	115 761 032 987,83
Laundry	0,0090	365132	343	2087	761878886	14.19	10 811 061 393,64
Do-it-yourself	0,0299	1213051	375	2281	2767271464	14.69	40 651 217 810,61
Care of sick, aged	0,0208	843861	403	2452	2068796105	17.79	36 803 882 700,12
Care of other people	0,0090	365132	441	2683	979558568	15.22	14 908 881 402,41
Teaching	0,0103	417874	212	1290	538917634	15.91	8 574 179 554,42
Construction	0,0936	3797375	402	2446	9286481770	18.23	169 292 562 659,79
General unskilled	0,0287	1164366	450	2738	3187452483	12.81	40 831 266 302,47
Value							1 052 183 105 453,96
2010 GDP value							3 973 801 836 544
% of GDP							26.47

Source: Own calculations using S.A. Time Use Survey (2010), S.A. Labour Market Dynamics Study dataset (2010) and S.A. real GDP dataset (2010). Results are weighted using the survey weights.

The total imputed value of time spent doing unpaid care work activity using the Specialist Wage method, summed to over R1 trillion in the year 2010. This contributed a 26.47 % share to the South African economy.

6.5. Comparison of the valuation results from different methods

Table 6.7 presents the results of the different impute valuation approaches. Each approach gives a different estimate of the monetary value of unpaid care work and its corresponding share of the South African economy for the year 2010. The Economy Wide Mean Wage method used the average wage from all the occupations across the economy to impute the value of unpaid care work. This resulted in the highest unpaid care work valuation, at over R1.4 trillion (36.83% of rGDP).

The Opportunity Cost method used individuals forgone wages to impute the value of the upcw sector of the economy. It proxied the individuals' level of education for work experience. This is the opportunity cost of being engaged in unpaid care work activity instead of being employed by the market. This approach was applied in a gender disaggregated manner. The estimated economic value of the upcw sector of the economy was lower (R153 billion +) when using male upcw time contributions than when using female (R 273 billion+) upcw time contributions.

Table 6.7: Comparison of results of different valuation methods

Data	Method	Time measure	Value (Rm)	% of GDP
LMDS	Economy-wide mean wage	24-hour	R 1.463 trillion +	36.83
LMDS	Opportunity cost wage (M)	24-hour	R 153.9 billion +	3,87
LMDS	Opportunity cost wage (W)	24-hour	R 273 billion +	6.89
LMDS	Generalist wage	24-hour	R 1 trillion +	25.82
LMDS	Specialist wage	24-hour	R 1 trillion +	26.47

Source: Own calculations

The Generalist Wage Method which strictly sourced occupations most similar to unpaid care and domestic work also provided a significant economic value contribution estimate. Application of this method resulted in over R1 trillion which is a 25.82% share of the national 2010 real GDP.

The Specialist Wage method with the Rand value of over R1 trillion was the second largest value imputation method, representing a 26.47% share of the national real GDP. The results of this method may be more realistic than the economy-wide mean wage method because it includes a wide array of upcw activities which are valued at different market wages instead of a general wage as in the Economy wide method.

6.6. South Africa 2000 versus 2010 Time Use Valuation Comparison

Table 6.8 presents a brief comparative analysis of the imputed value of unpaid care work as a share of GDP for the years 2000 and 2010, from the application of different wage valuation methods. The Table compares the results obtained using the 2000 TUS dataset - see (Budlender and Brathaug, 2002; Budlender and Brathaug, 2004) and the 2010 TUS dataset as presented by this study herein. Table 6.8 indicates a decline in the estimated contribution of upcw time use to GDP over a ten-year period. The reasons for these significant declines are unknown and could be emanating from either amendments in the application of the valuation methods, changes in economic conditions or the influence of labour market trends.

Table 6.8: South Africa 2000 versus 2010 Time Use Valuation Comparison

(a) 2000 Time Use Valuation		**(b) 2010 Time Use Valuation**	
Approach	**% of GDP**	**Approach**	**% of GDP**
Economy-wide mean wage	50	Economy-wide mean wage	36.83
Opportunity cost wage	38	Opportunity cost wage	3.87 (M) & 6.89 (W)
Generalist wage	18	Generalist wage	25.82
Specialist wage	24	Specialist wage	26.47

Source: (a) see Budlender and Brathaug (2002) (b) Own calculations using S.A. Time Use Survey (2010), S.A. Labour Market Dynamics Study dataset (2010) and S.A. real GDP dataset (2010). Results are weighted using the survey weights.

The 2010 valuations confirm the rank order predicted in the literature: the economy-wide mean wage yields the largest imputed value (36.83% of GDP), followed by the specialist (26.47%) and generalist (25.82%) methods, with the opportunity-cost approach producing the lowest values (3.87% for men; 6.89% for women). In contrast to the 2000 study, the economy-wide estimate falls to 36.83%, while specialist and generalist valuations rise modestly to 25.82 and 26.47 respectively. The 2010 Opportunity Cost estimates are markedly lower.

6.7. Conclusion

Different valuation methods yielded different economic values of unpaid care work time use. The Economy-wide mean wage method yielded the highest monetary value (R1.463 trillion) of unpaid care work time use, representing a 36.83% contribution of the Care economy to the South African GDP.

For its name sake, the Opportunity Cost Method estimated value reflected the forgone earnings that unpaid care workers could have received had the markets employed their time use. The lower wage rates for women across all educational levels of the Opportunity Cost wage method, indicated persistent gender wage gaps between men and women. Despite women's higher educational attainment, they still shouldered the burden of household work activities limiting their labour market participation and possibly – career advancement. The over R273 billion total imputed economic value of unpaid care work using the Opportunity Cost method for women, represented systemic undervaluation of the economic contributions of the household care sector. Should this work be included in national income accounts, it could bring to light the critical role of upcw that sustains both households and the labour market productivity of workers. This shows that unpaid care work is a significant contributor to the economic wellbeing of a nation's citizenry and its economy.

The value of unpaid care work to the tune of one trillion, 26 billion Rands using the Generalist Wage method, is a significant monetary valuation that strengthens the call to include the value of unpaid care work in the National System of Accounts. This economic value of over R1 trillion contributed a GDP share of 25.82%, a significant result for advocating for policy reform and the inclusion of the contributions of the Care economy into the National System of Accounts.

The GDP contribution obtained from the application of the Specialist Wage method, the second largest valuation at over R1 trillion and 52 billion, indicated a positive and significant contribution towards the 2010 South African GDP. For those that due to life's circumstances find themselves engaging most in unpaid care work activity in the household, it shows how much they carry the economy through their labour time sacrifices.

7. CONCLUSION

"How does the allocation of time use differ by gender??" was the first research question to be explored in this study. It stems from seeking to understand what time use data can reveal about the gender patterns of unpaid care work, paid work and non work activities for the South African economy. The research question aimed to shed light on the factors that influence a person's time allocation towards engaging in various time use activities. The gender disaggregated nature of the research question further allows the exploration of potentially gender unequal allocation of time towards pw, upcw and nw activity. Literature had postulated that women were found to have allocated more time towards unpaid care work, lesser time in paid work and non-work activity (Becker, 1965; Becker, 1991; Beneria, 1999b; Braunstein and Folbre, 2001; Budlender and Brathaug, 2002; Budlender and Brathaug, 2004; Chiappori and Lewbel, 2015; Dong and An, 2015). Men were generally found to allocate their time in such a way that they engaged more in paid work and non-work time use then time use on unpaid care work activities.

Consequently, this study found in the Chapter 4 that the average daily minutes spent in paid work were larger for men (214 minutes), than women (130 minutes). Similarly, non-work activity time use had a larger minutes allocation for men than women. These were 1129 average daily minutes for men and 1081 average daily minutes for women. Confirming the assumption posited by literature, women had allocated a daily average of 229 minutes to unpaid care work time use, 132 minutes more than men had allocated (97 minutes). Moreover, the labour force participation of women was lesser than that of men, when analysing the 2010 Time Use Survey (TUS) data. The study also found that women were most represented in part time employment whilst men dominated full time and overtime employment.

33061 respondents out of 39019 of the sample had positive non-zero values of upcw time use. The prevalence rate of upcw was estimated at 83.26% of the sample. Indicative that over 33 million South Africans likely engaged in unpaid care work activity in the year 2010. This indicates a high prevalence rate of unpaid care work time use in the population.

These above-mentioned results thereby necessitated further inspection of the gender patterns of time use through a seemingly unrelated regression model (SUR). The SUR was used for exploring and capturing the time trade-offs and explore the gender patterned time allocation.

The SUR ran three equations, estimated jointly as a system using the same set of explanatory variables to determine time use on paid work (equation 1), unpaid care work (equation 2), and non-work (equation 3) activities. These three equations represented the trichotomous nature of time use decisions that needed to be made with limited time available. Two restrictions were placed on the model, firstly, that all time use activities undertaken in a given 24-hour day, must sum up to 1440 minutes. Each 24-hour day has a maximum of 1440 minutes when using the 24-hour (timpeper) minutes aggregation method. This first restriction was on the intercepts to ensure that they summed up to 1440 minutes per day. The second restriction was on all the coefficients of the explanatory variables, ensuring that when they were added together, they summed to 0. These restrictions were imposed to examine if time use changes in one category of time use have a resulting effect on the other categories of time use. Meaning that, would an increase in upcw time use, result in a proportional decrease in time available for paid work and nonwork activities.

The main aim of the SUR was to estimate, ceteris paribus, the gender differences in the allocation of time towards, paid work, upcw and non-work activities. The intercepts measured the mean daily minutes spent in each of the three time use categories by a rural resident, of a particular gender, that is single, has no young children in the household, aged between 15 to 24, employed and lives in the Western Cape. The intercepts indicated that women with the above characteristics, on average, allocated 167 minutes to upcw, 315 minutes to paid work, and 957 minutes to non-work activities. In contrast, men allocated 119 minutes to upcw, 386 minutes to paid work, and 935 minutes to non-work activities. As postulated by literature, women allocate more of their time towards unpaid care work activity. Men were observed to allocate more of their time towards paid employment and non-work time use, than unpaid employment.

Although urban residency had an effect of reducing time spent doing upcw activity for both men and women, it interestingly was significant in raising non-work time for both men and women. Other factors significantly explaining the allocation of time towards upcw, paid work and non-work activity are found in the regression analysis in Chapter 5.

Several significant coefficients indicating greater reductions in non-work time for women relative to men across various determinants of time allocation' were observed. It is inferred that men generally allocated more minutes to non-work activities than women. The opportunity cost

of engaging in upcw time use is that when women engage more in unpaid care work tasks, they have less time available for non-work activities. This was observed amongst women who were married and had young children. Should they seek to allocate more time towards learning – which is a non-work activity, the more upcw activities they engage in, the less time available for learning. Forgoing time spent learning could cost them future income generating time use. This means that people most engaged in upcw activity miss out on current opportunities to secure their productive futures. This burden of care has a tax on their current time and negates their ability to hedge against economic lack particularly in their elderely years and possibly becoming a financial burden to the state. Therefore, shedding light on these issues and acknowledging the effect of engaging in unpaid care work time use, gives rise to the need to seek to quantify its economic value.

Given that unpaid care work is systematically omitted in the records of the System of National Accounts, quantifying its empirical value has been a subject of contention. Some agree that it must be given a monetary value so it can be counted and made visible in GDP estimations. Others agree that because it does not have one universally accepted reliable estimation method, it cannot be reliably counted in GDP estimations. The former argues that there are two approaches for imputing monetary value to upcw, these are: input and output approaches. The latter focuses on finished goods whilst the former focuses on the service inputs. The input valuation method uses data that is obtainable. For example, as observed in this study, the time use survey dataset was used as source data to attempt to impute monetary value to unpaid care work time use. This study employed the input valuation approach by imputing economic value to upcw using the Economy-wide Mean Wage, Opportunity Cost, Generalist Wage and the Specialist Wage methods.

The analysis on Chapter 6 presented the answer to the second research question on, “What is the monetary value of time spent in unpaid care work activity in South Africa?”. Using the Economy-wide Mean Wage method, the imputed monetary value of upcw summed to R1.463 trillion, a 36.837% contribution towards the South African real GDP. The application of the Opportunity Cost method resulted in the value of unpaid care work that was R153.9 billion amongst men, and R273 billion amongst women. Interestingly, women with the highest level of educational attainment engaged most in unpaid care work activity, averaging 3.9 billion hours in the year 2010, resulting in an economic value of R179 billion Rand.

When applying the Generalist Wage method, the imputed monetary value of unpaid care work was estimated to be a little over 1 trillion and 26 billion of South African Rands. This represented a 25.82% contribution of the unpaid care work sector towards the South African economy. Alternatively, when using the Specialist Wage method, the imputed monetary value of upcw activity towards the South African real GDP was over 1 trillion 52 billion South African Rands. The share of real GDP from the upcw sector using the Specialist Wage method was 26.47%. The real GDP contributions of 36.83% using the Economy-wide mean wage, 3.87% Opportunity Cost (Men), 6.89% Opportunity Cost (Women), 25.82% Generalist wage and 26.47% Specialist wage sought to answer the third research question.

The third research question asked, "What is the percentage contribution of the value of unpaid care work activity to the South African economy?" These GDP contributions vary. The Economy-wide Mean Wage method is assumed to be this high (36.83%) given that all wages from low to high income earners were included to estimate the mean wage across the economy. This likely inflated the mean wage due to the inclusion of high-income earners such as doctors and CEOs. The GDP contributions of the Opportunity Cost methods applied separately for men (3.87%) and women (6.89%) are moderate. The Opportunity Cost contribution of women was 3.02 percentage points greater than that of their male counter parts. This was to be expected as theory postulates that women engage more in unpaid care work time use. Therefore, by extension, imputing a monetary value to their upcw time use indicates their significant contributions towards the performance of the South African economy through the unpaid care work sector.

The GDP contributions of the Generalist method (25.82) and Specialist method (26.47%), reveal that labour time allocated towards the provision of unpaid care work activity has positive and significant contributions to the South African economy. The Specialist method, revealed that construction related activities, typically performed by men, yielded R169 billion in wages even though it was performed by 9.36% of the sub population that engages in unpaid care work when applying the Specialist Wage method. Wheras the activity of Cooks and Chefs, stereotypically done by women, yielded R115 billion, yet accounted for 9.37% of the sub population that engages in upcw using the Specialist wage method. Therefore, persistent labour wage biases between men and women were still evident in the economy using the 2010 LMDS dataset.

The magnitude of the share of GDP that each impute valuation method produced was communicated in order to bring economic visibility to the value of labour time allocated towards unpaid care work. Presenting the GDP shares makes important work that sustains households and market agents, namely household work, childcare, and elderely care, statistically visible. Through this, the government is encouraged to support Social Protection Systems such as, pension credits for unpaid care workers to safeguard against retiring in poverty

The valuing of unpaid care work activity would not have been possible without the estimation of, total minutes spent doing these activities. The 2010 Time Use Survey dataset which provided these estimates albeit dated, was the only dataset wherein time allocation statistics could be obtained. And because the surveys included self-reported figures of work done in the previous 24 hours of doing the survey, it allowed this study to acknowledge and count the time that South Africans spent on upcw activity, forgoing the opportunity to engage in paid time use or non-work time use. This analysis provided visibility to unpaid care work time use. Making this work count so that policy makers would see that labour time invested in these activities is not negligible. This unpaid labour time use could if given the opportunity, earn paid wages in the labour market and the South African economy. Moreover, this analysis could motivate policy makers to propose solutions that can free up time spent on upcw activity so that those most engaged in it could have an opportunity to invest that time on productive time use such as paid employment. For example, the country can improve subsidised care given to minors, the elderly and the sick so that those engaged most in these activities can obtain more efficient assistance with these activities and use the labour time they saved on other income generating activities such as formal or informal trading.

Although the analysis used data from 2010, it was however the most recent Time Use Survey dataset. To be able to ascertain an up-to-date assessment of unpaid care work a new preferably more regularly administered Time Use Survey could be administered. This will be particularly more interesting in an era post the 2020 Covid-19 pandemic where some organizations still have work from home flexibility and other workers have purely remote jobs. This could possibly significantly affect the allocation of time use between paid work, unpaid care work and nonwork activity. Therefore, should more up to date datasets be available, this could be an interesting aspect to explore the impact of working from home on upcw.

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APPENDICES

Appendix A

Table A.1: Gender disaggregated presentation of time-use activities for the population sample

Broad Categories	Categories of Time Use	Men	Women	Full Population
Paid Work	Work in establishment	5.39	3.62	9.02
	Primary production	0.59	0.54	1.13
	Work in non-establish	0.34	0.29	0.64
Unpaid Care Work	Household maintenance	3.34	8.25	11.59
	Care of persons	0.13	1.17	1.29
	Community service	0.13	0.19	0.32
Non-work	Learning	2.10	2.02	4.12
	Social and cultural	5.32	4.91	10.22
	Mass media use	4.65	5.07	9.72
	Personal care	23.77	28.18	51.5
	Total	45.75	54.25	100

Source: Own calculations using 2010 S.A. Time Use Survey dataset.

Appendix B

Table A.2: Presentation of time-use activities that make up the unpaid care work variable

Activity Code	Household Maintenance	Care of persons	Community Service
410	Cooking, making drinks, setting and …	-	-
420	Cleaning and upkeep of dwelling and …	-	-
430	Care of textiles: sorting, mending,	-	-
440	Shopping for personal and household ...	-	-
441	Accessing government service …	-	-
448	Waiting to access government service	-	-
450	Household management: planning, supervision …	-	-
460	Do-it-yourself home improvements …	-	-
470	Pet care	-	-
480	Travel related to household maintenance	-	-
490	Household maintenance, management and …	-	-
491	Chopping wood, lighting fire and heating …	-	-
511	-	Physical care of children: washing … mentioned spontaneously	-
512	-	Physical care of children: washing … not mentioned spontaneously	-
521	-	Teaching, training and instruction of household children, mentioned spontaneously	-
522	-	Teaching, training and instruction of household children, not mentioned spontaneously	-
531	-	Accompanying children to places… mentioned spontaneously	-

532	-	Accompanying children to places… not mentioned spontaneously	-
540	-	Physical care of the sick, disabled, el	-
550	-	Accompanying adults to receive personal	-
561	-	Supervising children and adults needing	-
562	-	Supervising children and adults needing	-
580	-	Travel related to care of children, the	-
588	-	Care of children, the sick, elderly and	-
590	-	Community organised construction and re	-
610	-	-	Community organised construction and repairs: buildings, roads, dams, wells, etc.
615	-	-	Cleaning of classrooms
620	-	-	Community organised work: cooking for collective celebrations, etc.
630	-	-	Volunteering with or for an organisation
650	-	-	Participation in meetings of local and informal groups/caste, tribes, professional associations, union, political and similar organisations.
660	-	-	Involvement in civic and related responsibilities: voting, rallies, etc.
671	-	-	Caring for non-household children, mentioned spontaneously
672	-	-	Caring for non-household children, not mentioned spontaneously
673	-	-	Caring for non-household adults
674	-	-	Other informal help to other households
680	-	-	Travel related to community services
690	-	-	Community services not elsewhere classified

Source: Own calculations using 2010 S.A. Time Use Survey dataset.

Supervisors Permission Letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

College of Law and Management Studies

Supervisors Permission to Submit Thesis/ Dissertation for Examination

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Ethical Clearance Letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

1 Dec 2022

Ms Nokukholwa Ruth Nkwanyana (209503020)
School Of Acc Economics&Fin
Westville

Dear Ms Nokukholwa Ruth Nkwanyana,

Protocol reference number: 00003890
Project title: Unpaid care work: Calculating its value to the South African economy

Exemption from Ethics Review

In response to your application received on 11 September 2019, your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

[redacted]

Prof Josue Mbonigaba
Academic Leader Research
School Of Acc Economics&Fin

UKZN Research Ethics Office
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Website: http://research.ukzn.ac.za/Research-Ethics/