COUNTING WOMEN'S WORK

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Counting Women's Work South Africa

Counting Women's Work in South Africa:
Incorporating Unpaid Work into Estimates of the Economic Lifecycle in 2010

Morné Oosthuizen

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Counting Women's Work in South Africa*

Incorporating Unpaid Work into Estimates of the Economic Lifecycle in 2010

Morné Oosthuizen†

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Abstract

National Transfer Accounts (NTA) have been used to describe the generational economy in countries around the world, including South Africa. However, gender disaggregations highlight the fact that the contributions made particularly by women within the household are invisible, the result of NTA's link to the System of National Accounts. Women's economic contribution (i.e. production) is therefore underestimated, giving a false sense of patterns of dependency by gender and age. This paper addresses this issue by constructing National Time Transfer Accounts (NTTA) for South Africa using time-use and NTA data from 2010, allowing the construction of a more complete picture of total production and consumption across the lifecycle. Based on these estimates, household production is valued at 27.3 percent of GDP in 2010, of which almost three-quarters is contributed by females. While per capita consumption rises at all ages once household production is included, it is more than tripled for infants, revealing that the majority of the consumption by infants and young children is of non-market services, particularly care. Reducing gender-based differences in labour income is found to have a beneficial impact on both the magnitude and duration of the first demographic dividend.

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Contents

1 Introduction

Societies around the world have evolved institutions and systems to facilitate the flows of resources across age as individuals produce, consume, share and save over the lifecycle. Children and the elderly tend to produce relatively little, but still need to finance their consumption, whereas the prime working-age cohorts tend to produce more than they require for their own consumption. Thus, resources are shared across age, mediated either by households or by government, while resources may be saved and dissaved as a means of financing consumption, particularly amongst older cohorts.

These resource flows that characterise all societies can be described using National Transfer Accounts (NTA), with the exact patterns of these flows determined by the particular institutional and cultural contexts prevalent within a given society. NTAs are typically constructed for individual age cohorts at a national level and, when combined with population projections, can be used to analyse the impact of demographic change on a country's economy.

Disaggregation of NTAs by gender, however, highlight the gap in the System of National Accounts (SNA) caused by the exclusion of non-market services from the production boundary. What this means is that aggregates that measure total economic production, such as GDP, ignore the production of non-market services that occurs without remuneration within the household. These services include activities such as cooking, doing laundry and caring for others, and are activities in which women around the world tend to specialise in relative to men. Because of their strong link to national accounts, NTAs also ignore these services. As a result, in many countries, gender-disaggregated NTAs suggest that men far outproduce women over much, if not all, of the lifecycle and that, in many cases, women produce little or no surplus over their consumption.

The result is that gender-disaggregated NTAs are unable to provide a complete understanding of the nature of dependency within a society. Furthermore, the extent to which this is a problem varies across countries due to factors such as the extent to which women specialise in these activities relative to men, as well as the extent to which these services may or may not be provided in the market in a particular country.

This paper employs the National Time Transfer Accounts (NTTA) methodology to address this gap in the measurement of the generational economy in South Africa, using data for 2010. Specifically, age profiles of household production are constructed for South Africa across the lifecycle and by gender using time-use data. By applying an appropriate wage to the time spent in these activities, it is possible to combine these profiles with gender-disaggregated NTA profiles, which allows the construction of a more complete picture of total production and consumption across the lifecycle for males and females. This paper also explores the implications of these results for the demographic dividend in South Africa.

2 Methodology and Data

2.1 Methodology[1]

2.1.1 National Transfer Accounts

This paper employs the National Transfer Accounts (NTA) methodology to analyse the generational economy in South Africa. The generational economy is defined as "(1) the social institutions and economic mechanisms used by each generation or age group to produce, consume, share, and save resources; (2) the economic flows across generations or age groups that characterize the generational economy; (3) explicit and implicit contracts that govern intergenerational flows; (4) the intergenerational distribution of income or consumption that results from the foregoing" (Mason and Lee, 2011*b*, p.7).

The conceptual origins of the NTA framework lie in the work of Samuelson (1958), Diamond (1965), Arthur and McNicoll (1978), and Willis (1988). However, work by Lee (1994*a*; 1994*b*) is recognised as the genesis of NTA. National Transfer Accounts are comprised of profiles of economic flows by single-year age cohorts, from age zero to the very oldest (usually a combined 90+ age cohort). These flows are important in that they "reflect a fundamental feature of all societies: the economic lifecycle" (Mason and Lee, 2011*a*, p.55). For any individual, inflows must equal outflows and the following identity holds:

$$Y^l + Y^A + \tau^+ = C + \tau^- + S \tag{1}$$

In other words, individuals can receive resource inflows in the form of labour income (Y^l), asset income (Y^A) and transfer inflows (τ^+), and consumption (C), transfers to others (i.e. transfer outflows, τ^-) and savings (S) represent the three ways in which these resources can be used. This identity can be rewritten as:

$$\underbrace{C(x) - Y^l(x)}_{\text{Lifecycle Deficit}} = \underbrace{\underbrace{\tau^+(x) - \tau^-(x)}_{\text{Net Transfers}} + \underbrace{Y^A(x) - S(x)}_{\text{Asset-Based Reallocations}}}_{\text{Age Reallocations}} \tag{2}$$

where x represents a given cohort's age. Consumption, transfers and asset-based reallocation are all further disaggregated into public and private flows, while private transfers are disaggregated into interhousehold and intrahousehold flows. Transfers are flows characterised by a lack of an "explicit qui pro quo", while asset-based reallocations "realize inter-age flows through inter-temporal exchange" (United Nations, 2013).

National Transfer Accounts are compiled using a variety of per capita age profiles that are constructed to reflect particular resource flows at each age over the lifecycle, for example, employment earnings, private consumption of primary education or public transfer inflows in the form of state pensions. These are constructed primarily on the basis of household survey data. Where individual-level data exists, flows for each age cohort are averaged to obtain mean age profiles. Where only household information is available, household-level totals are

[1] This section is drawn from Oosthuizen (2018).

allocated econometrically to individuals within the household on the basis of usage, enrolment or participation rates or, in the case of general consumption, using adult equivalence scales. Since the age profiles thus constructed are often subject to significant noise, age profiles are typically smoothed using a cross-validation smoother. Education age profiles are not smoothed, due to the real discontinuities in educational participation, while care is taken not to smooth over potential discontinuities in other age profiles. Smoothed per capita age profiles are then adjusted multiplicatively to ensure that the aggregate flow calculated from the age profile matches the appropriate aggregate calculated from national accounts data.

There are, though, certain instances where it is not possible to observe actual flows in household survey data or to assign household-level values to individuals using participation or usage rates. In these instances, allocations of flows to particular individuals are driven by simplifying assumptions. One such assumption is that the household head is the owner of all the assets within a household and all private asset-based reallocations flow to and from the household head (United Nations, 2013). This assumption, and the method of allocating household headship, has important implications in terms of the structure of intra-household transfers, which are not observable in survey data. Full details of the NTA methodology can be found in United Nations (2013).

2.1.2 National Time Transfer Accounts

The objective of NTTA is to estimate patterns of time allocations to productive activities in particular across the lifecycle and by gender. With estimated age profiles of production and consumption of non-market services (i.e. household production), it is then possible to estimate flows of 'time' (and the value of that time) across the lifecycle in a way that is analogous to the flows of transfers within the standard NTA framework. Full details of the NTTA methodology can be found in Donehower (2018).

Comprehensive time-use surveys contain data on a wide variety of activities, both productive and non-productive. The first task is to identify activities that would have been included within GDP had they not been performed within the household. Unpaid productive activities are identified as those meeting the "third party criterion". Originally articulated by Reid (1934), the third party criterion defines as 'work' any unpaid activity performed by a household member that a third person could be paid to perform. Within the International Classification of Activities for Time Use Statistics (ICATUS), categories of productive activities that are not included in national income are major groups 4 through 6, namely: household maintenance, management and shopping for own household; care for children, the sick, elderly and disabled for own household; community services and help to other households. Statistics South Africa (2013) also uses the ICATUS classification and refers to these three major groups as "Non-SNA production".

Time-use surveys typically allow respondents to report doing more than one activity within a given time slot. Depending on the survey, these activities might be performed sequentially within a time slot, or they might be performed simultaneously (i.e. multitasking). Further, in the case of simultaneous activities, surveys may allow respondents to identify

which is the primary activity and which are secondary activities. There is, however, substantial variation in the approach taken in different surveys and, as a result, the NTTA approach is to ignore multitasking and to consider only the primary activity. In the case of the South African data, this is not possible. The South African surveys do not distinguish between primary and secondary activities; instead, they allow respondents to list up to three activities performed either simultaneously or sequentially within a 30-minute slot. The result is that it is not possible to select the 'primary' activity. The approach taken in the estimations is to split the 30 minutes between the reported activities: two activities within a given slot are each allocated half of the time (i.e. 15 minutes each in a 30-minute slot), while three activities within a single slot are each allocated one-third of the time (i.e. 10 minutes each).

Four types of age profiles are constructed: production, consumption and transfers (inflows and outflows). The production profile for a given activity is calculated as the time spent on that activity averaged across *all* members of each age cohort. Individuals who do not spend any time in that activity are allocated a zero for the purposes of calculating the mean. For example, the average time spent cleaning by 20 year olds is the value of the cleaning production profile at age 20.

Consumption of household production is not directly observed in the surveys, and is therefore estimated indirectly. In the case of activities of which all household members are beneficiaries, such as cooking, cleaning and household management, production is allocated equally as consumption to all household members including the producer. In contrast, in the case of activities for which only specific household members are beneficiaries, the approach is to allocate consumption using a regression where the dependent variable is the time spent by respondents in the activity and the independent variables are the number of individuals in the household of relevant ages. For example, in the case of childcare, the independent variables would be the number of household members aged zero, the number aged one and so on. This approach is similar to that used in the allocation of certain types of consumption in NTA.

Since household production is typically only observed for a subset of household members, a matrix is constructed where each cell represents the average time consumed by individuals of a particular age and gender (the columns) of a given activity produced by individuals of a particular age and gender (the rows). By multiplying the rows by the corresponding population estimates, a matrix of aggregate production and consumption is constructed. Dividing the columns by the corresponding population estimates generates a matrix of average consumption by individuals of a particular age and gender of activities produced by individuals of a particular age and gender. Summing each column (i.e. across producer characteristics) yields the total consumption of a given activity by individuals by age and gender.

Transfer inflows and outflows are calculated differently depending on the activity in question. For intra-household transfers – where all production and consumption occurs within the household – there are two procedures. In the case of targeted care, such as care of children within the household, the production of the activity is recorded as an outflow,

while the consumption is recorded as an inflow. In the case of activities that benefit all members of the household, the time consumed by the producer him- or herself must be excluded from the transfers. Thus, if an individual cleans for one hour in a household of four, he is deemed to consume one-quarter of that production and to transfer three-quarters to the other three household members. In this case, at the household level, production is one hour, consumption is one hour, there is a transfer outflow of 45 minutes and a matching transfer inflow of 45 minutes.

For activities where beneficiaries of the household production are not members of the household (e.g. care of non-household members), the production-consumption matrix described above is used. All production of these activities is designated as transfer outflows and all consumption is designated as transfer inflows.

As in NTA, calculated profiles are smoothed to deal with some of the noise in the data. The key exception is for the consumption and transfer inflows of care time for infants, since smoothing is likely to substantially underestimate their consumption. Once the profiles are smoothed, various checks are implemented to ensure consistency across profiles. Specifically, the checks ensure that total production equals total consumption, that total inter-household inflows equal total inter-household outflows, and that total intra-household inflows equal total intra-household outflows.

There are two areas in which the NTTA methodology currently makes no adjustments. The first is the issue of potential differences in efficiency or quality between production in the market and production in the home. It is quite possible that market production may be systematically more (or less) efficient or of higher (or lower) quality than home production, but we lack the data that would allow us to address these differences. The second issue is the relationship between age and efficiency in home production. For example, an hour spent cleaning by a 10 year old may not be equivalent to an hour spent cleaning by a 30 year old, or to an hour spent cleaning by an 80 year old; however, replacement wage approaches will value each of these hours identically.

2.1.3 Determining the Value of Household Production

Once the age profiles of production, consumption and transfers have been estimated, these need to be valued using an appropriate wage. Valuing time spent in household production is useful in assessing its magnitude relative to, say, GDP; it is also important if these estimates are to be combined with NTA estimates of market production. However, while national accounts values production using the price in the market of the outputs produced (Abraham and Mackie, 2005), this poses substantial challenges for the valuation of non-market production. In particular, since we are dealing with non-market production, none of the outputs have market prices. Determining the value of these services would require additional data on price and quality across activities, data which does not exist in most contexts.

The NTTA approach instead uses the labour input as a basis for valuing household production; it does, however, ignore the value of the capital inputs, potentially resulting in a underestimate of the total value of household production. While valuing labour inputs

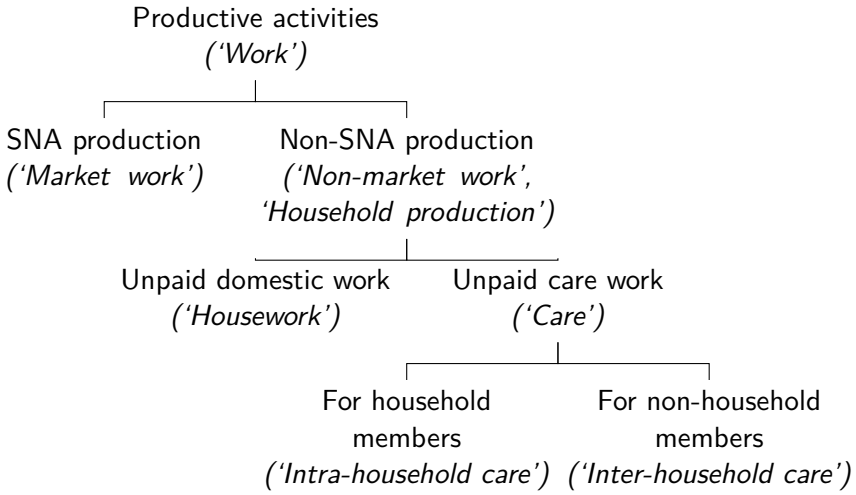
rather than the outputs of household production may result in a downward bias in the NTTA estimates, it helps avoid issues such as double-counting production that includes purchased and non-purchased inputs (Donehower, 2018).

The wage rates used to value time inputs can be estimated in two broad ways: using a replacement wage or an opportunity cost wage (Abraham and Mackie, 2005; Budlender, 2008). Replacement wages are the answer to the question of what it would cost to hire someone in the market to perform the activity, and there are two approaches to calculating them. The first approach – the generalist replacement approach – assumes that the activity can be performed by someone from a wide range of occupations related to household production activities. Thus, the mean wage of workers engaged in the market in a broad range of the activities to be valued is used (e.g. the mean wage of a domestic worker may be used to value time spent on childcare, cleaning and cooking). The second approach – the specialist replacement approach – uses the wage of workers engaged in market activities equivalent to the household production activity being valued. Thus, for example, one might use the mean wage of workers in a variety of cooking-related occupations (e.g. cooks, chefs, caterers) to value time spent cooking for the household. The opportunity cost approach differs from the replacement approach in that it asks what an individual might otherwise have earned in the market instead of spending time in household production activities. For employed individuals, the opportunity cost wage is simply equal to their wage; for those not employed, an opportunity cost wage needs to be imputed on the basis of individual characteristics.

Within NTTA, the preferred methodology is the specialist replacement approach (Donehower, 2018, p.23), since the opportunity cost wage rates in most countries tend to be very high – the method imputes skilled inputs not required to complete the task – while the generalist replacement approach is avoided due to the relatively small number of households in most countries that can afford to employ housekeepers (the typical generalist) (Donehower, 2018, p.23). Opportunity cost wages are also controversial in that they imply that, for example, an hour of childcare performed by a highly educated parent is more valuable than an hour of childcare performed by a parent with no education. Given widespread employment of domestic workers in South Africa, both replacement approaches are viable from a data perspective. Data on wages are typically obtained from either the time-use survey itself if it has sufficient detail on wages and employment, or a labour market survey preferably conducted at a similar point in time to the time-use survey.

Figure 1 outlines the terminology used in this paper to describe different types of productive activities (or 'work'). Two types of productive activities are distinguished, namely SNA production or market work, and non-SNA production or non-market work. Non-market work is also referred to as household production. Household production is comprised of unpaid domestic work ('housework') and unpaid care work ('care'), which consists of care for household members ('intra-household care') and care for others outside the household ('inter-household care').

Figure 1: Types of Work



Source: Oosthuizen (2018).

2.2 Data

For the NTTA estimates, the key source of data is the Time Use Survey (TUS) of 2010, conducted by Statistics South Africa (2014). The 2010 TUS was South Africa's second nationally representative time-use survey. Fieldwork took place between October and December 2010. Within surveyed households, details on all respondents were collected within a household roster, while two respondents aged ten years or older were selected to fill out the time-use component of the survey. In households with only one age-eligible respondent, only that respondent was surveyed. The survey made use of a 24-hour diary, divided into 30-minute slots, covering the previous day beginning at 4am. Up to three activities within a slot were recorded. Multiple activities within a slot could be identified as being performed simultaneously or sequentially. Activities were classified according to the International Classification of Activities for Time Use Statistics (ICATUS).

One unique aspect of the South African TUS questionnaires lies in the fact that it specifically prompts respondents, once they have completed the survey, to check whether they had mentioned all childcare performed. If necessary, respondents went back and filled in any missing childcare; any childcare that was filled in during this process was coded slightly differently so that it is possible to differentiate between spontaneously reported childcare and the childcare that was recorded only after the respondent was prompted. This means that the surveys are likely to have captured more childcare than other surveys without the additional prompt.

The second data source is used to derive the wage rates with which the time spent in household production is valued. Wage rates for 2010 are derived from the Labour Market Dynamics in South Africa (LMD) data, published by Statistics South Africa (2011). This dataset is essentially a pooling of the four Quarterly Labour Force Surveys conducted during 2010, with the only difference being that the wage data collected as part of the QLFS is only published in the LMD (and not in the QLFS itself). The QLFSs are nationally representative

household surveys, with a sample size of roughly 30 000 dwellings each, and are the key source of survey data on the South African labour market.

Although not discussed or described in detail here, the gender-disaggregated NTA profiles are constructed using the 2010/11 Income and Expenditure Survey (Statistics South Africa, 2012) and following standard NTA methodology (United Nations, 2013). For population estimates and projections, the 2017 Revision of the *World Population Prospects* (United Nations, 2017) is used. All projections presented are based on the medium fertility variant.

3 Results

3.1 Gender Differences in Labour Income and Consumption

NTA profiles reflect general patterns of behaviour that exist within societies. Thus, to the extent that behaviour varies across across groups, disaggregations of the average profiles will begin to reveal these behavioural differences. Thus, disaggregation of labour income profiles by gender, for example, reveals the extent to which labour market engagement and labour market outcomes vary by gender. In all countries for which there is data, mean labour income for males is typically higher than that of females at every age. South Africa is no exception.

Figure 2 presents overall and gender-disaggregated labour income and consumption profiles for South Africa for 2010. The upper panel of the figure presents the profiles for the total population, while the lower panel presents the same profiles disaggregated by gender. Profiles are presented as mean values at each age, with age on the horizontal axis. Values are expressed relative to 'peak labour income', following NTA convention, by dividing all values by the unweighted mean of labour income between the ages of 30 and 49 years.

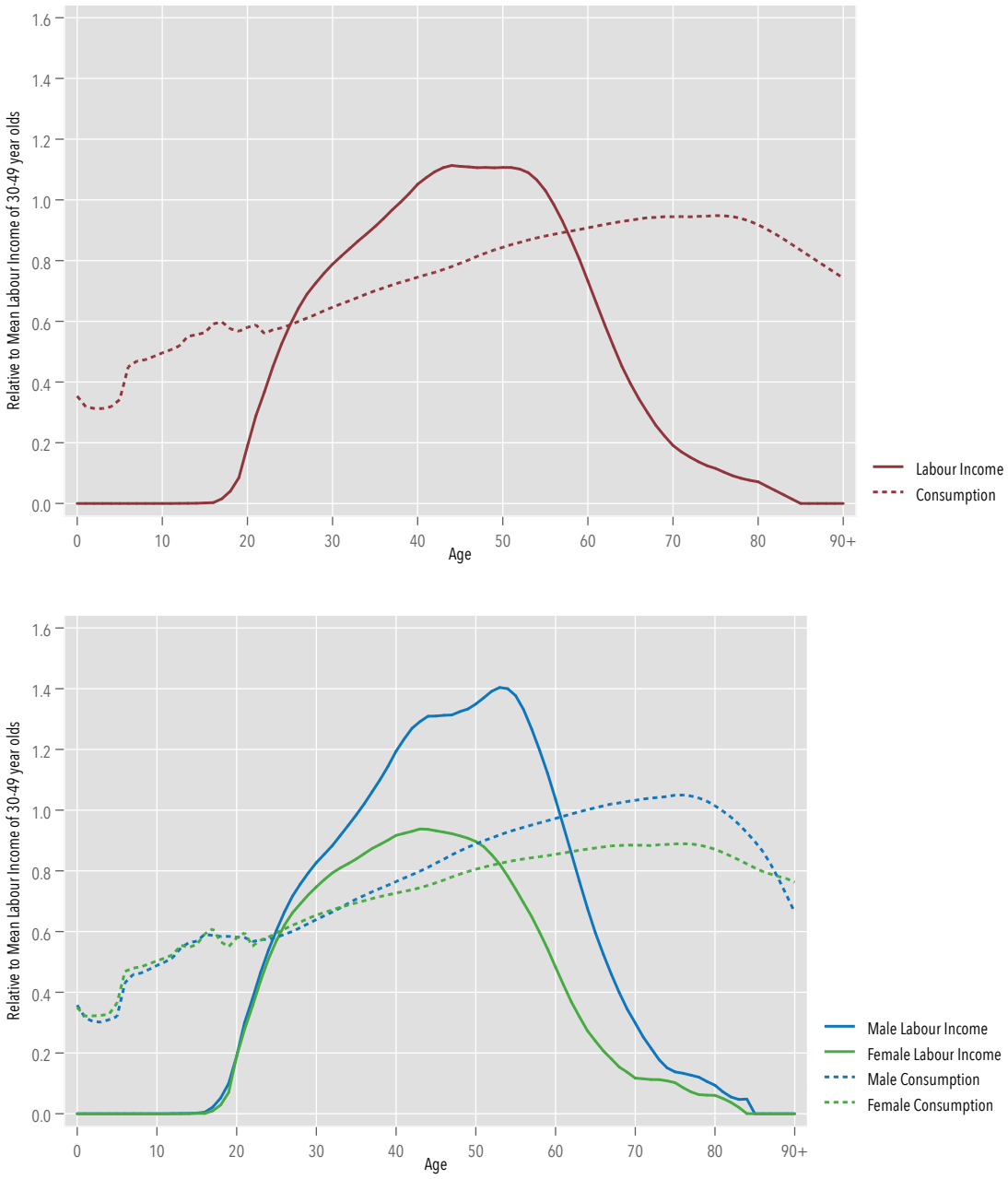
Labour income follows the typical bell-shaped profile, with very little labour income amongst children and the elderly. At age 20, labour income is still less than 20 percent of peak labour income, but it rises rapidly to pass 80 percent by age 31 and 100 percent by age 39. Between the ages of 39 and 55 years, labour income remains above one, but begins to drop sharply during the late fifties. By age 65 labour income is just 40 percent of peak labour income and at age 70 it is just 19 percent.

Consumption generally rises once children reach school-going age, levels off during the late teens and twenties, and gradually rises thereafter. Infants (under the age of one year) consume the equivalent of 35 percent of peak labour income and, although it falls slightly for toddlers, it rises sharply at age six as children start entering the education system in significant numbers. The South African profile is somewhat unusual in that consumption continues to rise throughout much of adulthood, peaking in the mid-seventies and falling thereafter.[2]

The extent of gender specialisation in market work is clear. While per capita labour income is very similar for younger males and females, a gap begins to emerge in the mid-twenties and, by age 40 is substantial. This gap only really narrows at very old ages when

[2]Generally, countries show relatively stable consumption levels during adulthood, which may gradually drift upwards or downwards as age increases.

Figure 2: Labour Income and Consumption across the Lifecycle by Gender, 2010



Source: Own calculations, South African Reserve Bank (2018); Statistics South Africa (2012).
Note: Profiles are standardised by dividing through by the average labour income for 30 to 49 year olds ('peak labour income'); this average equals one income unit.

relatively few individuals remain active in the labour market. At age 25, mean labour income for males is only 3.4 percentage points of peak labour income higher than that of females. However, by age 35, the gap has widened to 14.5 percentage points and is 27.7 percentage points by age 40. The gap peaks at over 60.0 percentage points during the mid-fifties, but is still 18.1 percentage points at age 70, which is between five and ten years beyond common retirement ages.

For consumption, the differences are far more muted. Consumption is very similar for males and females up to the mid-thirties, after which a relatively small gap favouring males emerges. At its peak during the seventies, mean per capita consumption for males is estimated to be just over 15.0 percent of peak labour income. Although the methods for disaggregating consumption within households between males and females are not particularly robust, this finding is congruent with poverty results for South Africa. Thus, adult women are found to reside in poorer households than their male counterparts, while this difference is not evident for children (Rogan, 2015; World Bank, 2018).

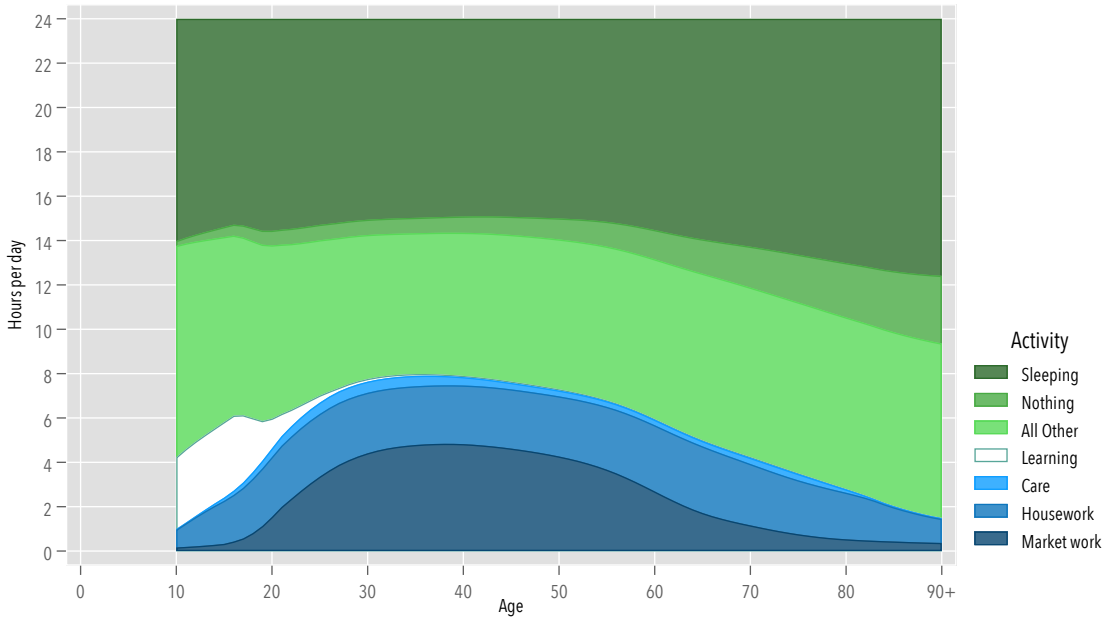
What is clear from the lower panel of Figure 2 is that men and women differ substantially in the extent to which labour income exceeds consumption during the prime working ages. The lifecycle surplus—where labour income is greater than consumption—for males is larger than that of females in absolute terms, while also lasting longer. This difference in the ability of men and women to generate lifecycle surpluses highlights the need to include unpaid household production in these estimates in order to derive a more comprehensive picture of production and consumption and, by extension, of dependency.

3.2 Allocation of Time across the Lifecycle

In constructing the NTTA, the focus is on the distinction between market work and non-market work and, while a variety of activities are distinguished within non-market work or *household production*, they are categorised into housework and care. Housework includes all household production that is not care-related; in other words, activities such as cooking, cleaning and household maintenance. Care work includes care of children and adults within the household, as well as care for non-household members and volunteer work.

Figure 3 presents the average pattern of time use at each age across seven main activity groups. Three of these groups—market work, housework and care—are viewed as productive activities, while the remaining four—learning, doing nothing, sleeping and all other—are non-productive activities. For the entire population aged ten years and above, an average of 2.8 hours per day is spent in market work activities, while a further 2.8 hours is spent in unpaid household production (2.5 hours doing chores, and 0.3 hours in care activities). An average of 0.9 hours per day is spent in learning activities, while sleep, doing nothing and all other activities account for 9.3 hours, 0.8 hours and 7.3 hours per day respectively. These estimates of time spent in market work and unpaid work in 2010 are very similar to those observed in 2000: NTTA estimates for 2000 reveal that the average person aged 10 years and above allocated 2.7 hours to market production and 2.7 hours to unpaid work (Oosthuizen, 2018, p.11).

Figure 3: Time Use by Age in South Africa, 2010



Source: Own calculations, Statistics South Africa (2014).

Time allocations to market work rise gradually from 0.2 hours per day amongst 10-year-olds to 0.8 hours amongst 18-year-olds. Thereafter, the rise is more rapid with time in market work reaching 3.0 hours at age 24, 4.1 hours at age 28, and peaks at 4.8 hours per day between the ages of 35 and 42 years. There is a gradual decline during the forties and early fifties, which accelerates during the late fifties and early sixties: from 4.0 hours at age 53, the allocation falls to under three hours by age 59 and 1.9 hours by age 64. Cohorts in their eighties allocate roughly 0.4 hours per day to market work.

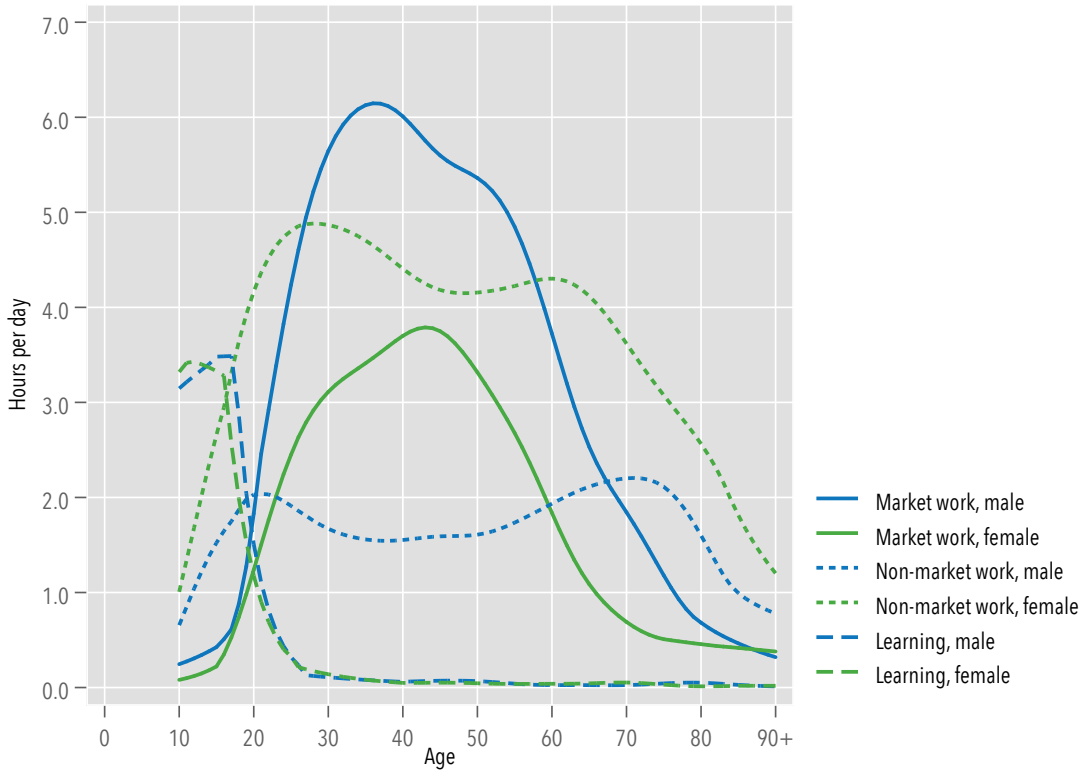
For housework, the time allocation is more stable across age. It rises from 0.8 hours amongst 10-year-olds to 2.5 hours by age 18. However, between the ages of 19 and 73, time allocated to housework remains in a narrow range between 2.6 and 3.0 hours per day. On average, time spent caring for others peaks at 0.5 hours per day for cohorts in their twenties and thirties, but consumes less than half that time for cohorts over the age of 40.

Learning activities, including attending school and doing homework, consume an average of between 3.0 and 3.4 hours per day for cohorts aged 10 to 17 years. This falls to 1.0 hours by age 21 and 0.3 hours by age 25. Sleep consumes relatively more time amongst the youngest and the oldest cohorts, while the same is true of 'all other activities'. In contrast, age is positively associated with time spent "doing nothing": cohorts aged 70 years and older report spending an average of 2.4 hours per day doing nothing, compared to 0.6 hours per day for cohorts under the age of 40 years.

Gender-specific patterns of time allocation across the lifecycle are presented in Figure 4. Allocation of time to market work follows the expected pattern, linked to labour force participation rates: hours are very low for those in their teens, high during the prime working ages, and fall to low levels again for the elderly. There are, though, important differences

by gender. First, men spend more time in market work than women at virtually every age: averaging across the population aged 10 and above, men spend 3.5 hours per day in market work compared with 2.1 hours for women. As a result, the peak in time allocated to market work is significantly higher for men than for women (6.1 hours compared with 3.8 hours).

Figure 4: Allocation of Time across the Lifecycle by Gender, 2010



Source: Own calculations, Statistics South Africa (2014).

Second, men's and women's hours in market work peak at different ages, with peak hours occurring roughly half a decade earlier for men than for women. Third, women's hours in market work drop relatively steeply from its peak. By age 60, for example, men spend 3.7 hours in market work, roughly three-fifths of the peak for males, whereas women spend 1.8 hours in market work, or just under half of the female peak. This gap persists until the late seventies.

Allocations of time to non-market work are quite different, with women spending significantly more time than men in these activities at all ages. Averaged across the population aged at least 10 years, women spend 3.9 hours per day in non-market work, more than twice the 1.6 hours of men. Using 2000 data, Budlender and Brathaug (2004, p.36) find slightly less time being spent in productive activities that fall outside the GDP production boundary: 1.3 hours per day for men and 3.7 hours for women; however, Sambt et al. (2016, p.260) find slightly more time allocated to these activities (1.9 hours and 4.3 hours per day respectively). While time allocations to non-market work are similar to those of market work in terms of being substantially lower during the teens and old age, they are different in the extent to

which they remain relatively stable in the intervening years. Thus, women spend between four and five hours on average in non-market work for close to 50 years, while men allocate between 1.5 and 2.2 hours for 66 years. Importantly, for both genders there are two peaks in time spent in non-market work: for men there is a peak in the early twenties and then again in the late sixties and early seventies, while for women there are peaks in the twenties and thirties and again in the late fifties and early sixties. Interestingly, while women's peak time allocation to non-market work occurs during the main childbearing ages, the peak for men is during what is traditionally seen as the first decade post-retirement.

The ramping up of time allocated to market and non-market work during the teenage years coincides with declining time spent in learning activities, which includes attendance, homework and study time. This is not particularly surprising, given that children are allowed to exit the education system from age 16, and in this sense the patterns observed in terms of time are consistent with falling rates of participation at these ages (Department of Basic Education, 2018). For girls, though, declines in time allocated to learning activities are observed at much younger ages than they are for boys. While young girls spend more time on average in learning activities than boys, by age 14 their positions are reversed and the time advantage that boys enjoy over girls continues to widen until age 18, by which age boys are spending almost 53 minutes per day more than girls in learning activities.

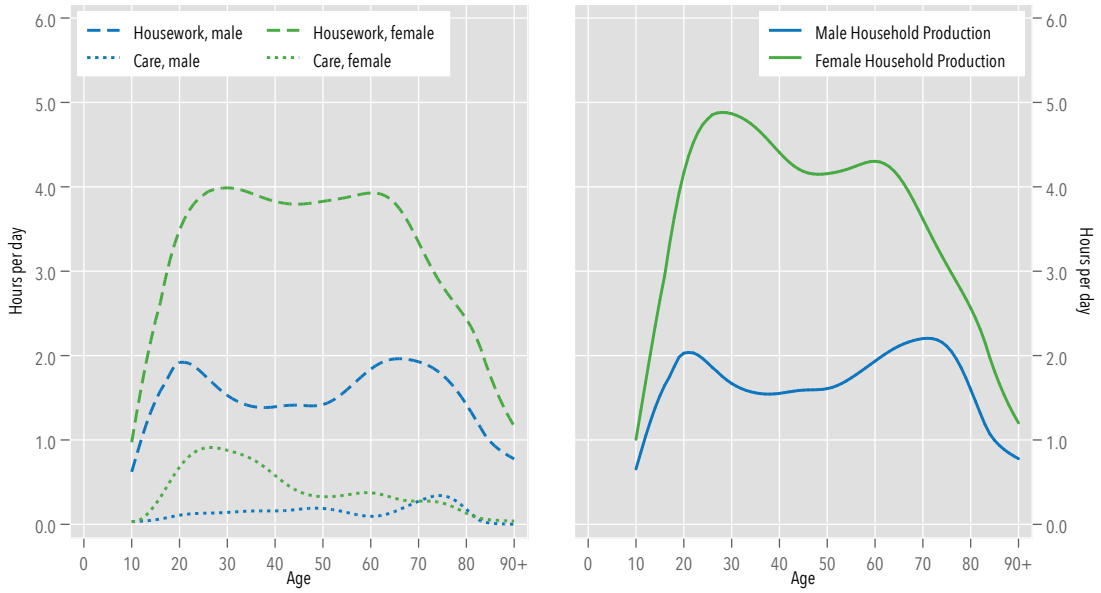
Within non-market work, household activities dominate the time allocations of both men and women (Figure 5). Averaged across the population aged 10 years and above, care activities represent 7.6 percent of men's time in non-market work and 13.3 percent for women. For women, time allocated to care peaks at just under one hour (48-54 minutes) per day between the ages of 22 and 34 years, with a second, much smaller peak of just over 20 minutes per day between the ages of 54 and 63 years. Men, in contrast, spend minimal time in care activities. Average time spent in care generally remains below ten minutes per day, apart from the late forties—where it reaches just over 11 minutes per day—and the late sixties and seventies during which the time allocated to care ranges between 10 and 21 minutes per day.

While peaks in time in care activities are synchronised with demanding stages of the lifecycle, time spent in household activities remains within a relatively narrow range for a large proportion of the lifecycle. This is particularly true for women, whose time in household activities remains within a 10 percent range of its 4.0 hour peak for 47 years, between the ages of 21 and 67 years. For men, this is true for eight years around the age of 20 and another 12 years between the ages of 59 and 74 years.

Consumption of non-market work across the life course is calculated by allocating time spent in non-market production as described above. These consumption profiles for males and females are presented in the left-hand panel of Figure 6. Total consumption for each gender is disaggregated into consumption of housework, and of care.

Gender differences in the consumption of housework and care are, for the most part, very small. In terms of housework, the gap in consumption at each age is never more than 17 minutes. Consumption of housework generally rises to around age 21, reaching just over two hours per day; initially thereafter consumption declines marginally, but peaks again in the

Figure 5: Household Production across the Lifecycle by Gender, 2010



Source: Own calculations, Statistics South Africa (2014).

Figure 6: Consumption of Non-Market Work across the Lifecycle by Gender, 2010

Source: Own calculations, Statistics South Africa (2014).

sixties for women and early seventies for men at around 2.7 hours per day before declining again. The pattern for the consumption of care is very different: it is highest at age zero and declines rapidly thereafter. After age 11 consumption of care never exceeds 10 minutes per day for either gender. Female infants tend to consume more care than male infants: 28 minutes a day more at age zero and 15 minutes at age one. The very small amount of care for adults, particularly for the elderly, is somewhat surprising, although it may be a function of the survey focussing much more on childcare and not differentiating between care for the elderly and for general 'adultcare'.

The result of these small gender differences means that the overall consumption profiles for males and females are also very similar. Consumption is highest amongst infants and young children, driven by the large quantities of care consumed at these ages, with local peaks in the early twenties for both genders and in the late sixties and early seventies for females and males respectively. While it is possible that actual consumption of non-market work is very similar for males and females, it is likely that these similarities are the result of the methods used to allocate total household production to household members. It is rare in the South African data that production can be allocated to a particular household member, with production of housework in particular simply allocated on a per capita basis. For this reason, in the analyses below, the average profiles in the righthand panel are used.

3.3 The Value of Unpaid Work

3.3.1 Choosing Appropriate Wage Rates

The wage data used here comes from the LMD dataset described above. Occupational data is coded using the South African Standard Classification of Occupations (SASCO). Gross monthly earnings reported in the microdata for all employed individuals are converted to gross hourly earnings by dividing by monthly hours, calculated as usual weekly hours worked multiplied by 52 weeks and divided by 12 months. Outliers are identified using a cutoff of three standard deviations above the mean; this impacts less than 0.1 percent of the total number of observations with data on wages and hours worked.[3]

As noted earlier, there are a number of approaches to valuing unpaid work: a generalist replacement approach, a specialist replacement approach, and an opportunity cost approach. The NTTA methodology (Donehower, 2018, p.23) favours the use of specialist replacement wages for the valuation of unpaid work and this is the approach followed here for combining the NTA estimates of labour income and consumption with the NTTA estimates. However, since there is a measure of discretion in choosing a particular methodology, certain aggregate estimates will be presented using various other approaches.

Generalist Replacement Approach: The generalist replacement approach uses a broad range of occupations as a basis of determining a wage to value time spent in household production. An alternative is to use the wage of the classic generalist in terms of household production, namely the domestic worker. Both options are tested. A mean domestic worker

[3]Further detail on the impact of identifying outliers is presented in Appendix A.2.

wage is calculated based on individuals in three narrow occupational categories (codes 9131-9133): domestic helpers and cleaners; helpers and cleaners in offices, hotels and other establishments; and hand-launderers and pressers. Following Budlender and Brathaug (2004), I use an economy-wide wage across all occupations as a second option for a generalist wage. However, instead of using a mean wage as they do, I use the median wage. The use of the median in this context is justified on the basis of South Africa's extremely high levels of inequality, which would result in a relatively high mean wage and would represent a departure from the idea of a generalist wage.

Specialist Replacement Approach: Since the aim of the specialist replacement approach is to arrive at a value that one might expect to pay someone skilled in a particular household production activity to perform that activity, the approach requires matching occupational categories to household production activities. There is a degree of subjectivity in the approach. For example, does one consider a "pre-primary education teaching professional" to be an appropriate match to an activity such as childcare, or is a "secretary" an appropriate match to an activity like household management?

Here again, two options are explored. The first, termed occupation matching here, tries to match occupational categories to particular household production activities. The second option is an attempt to recreate the occupational classification used by Budlender and Brathaug (2004) for their estimates of the value of household production in 2000. While they detail the occupations they associate with each activity code, these do not always match to the current SASCO descriptors. Further, their valuations are done at a slightly different level of aggregation to those done here. In terms of both specialist replacement wages, a mean wage is calculated.

Opportunity Cost Wages: Estimating opportunity cost value of individuals' time is complicated by the fact that the TUS 2010 does not collect information on the wages of the employed; instead, it asks individuals about the total value of income from all sources. It is therefore necessary to look to alternative data sources to provide an approximation of the opportunity cost of time spent in household production. Using the LMDS 2010 data to estimate opportunity cost hourly rates for all individuals aged 10 and above, I calculate mean rates for all combinations of age (10 to 75+) and educational attainment (primary, incomplete secondary, complete secondary, diploma/certificate, and degree) and impute these mean rates to individuals in the TUS 2010 dataset. Where a particular age-education combination is missing in the LMDS data but exists in the TUS data, the mean rate for the full age cohort is used instead. With these opportunity cost wage rates, time spent in household production is valued at the individual level. Individual time spent in household production and the individual value of household production are then aggregated to the national level, from which an average opportunity cost rate can be calculated.

To estimate opportunity cost hourly rates in the LMDS 2010 data, the following basic earnings model is used:

$$lnW_i = \boldsymbol{X}_i\beta + \mu_i \tag{3}$$

where W_i denotes the hourly wage of individual i, $\boldsymbol{X}_i$ is a vector of individual character-

istics and μ_i is a random error term. Since the wage earners are not a random sample of the population, I follow the Heckman (1979) approach and include a selection equation to estimate the probability of an individual being employed. Explanatory variables included in the selection equation are age, broad educational attainment groupings (primary; incomplete secondary; complete secondary; diploma or certificate; degree; other), the number of children under the age of 15 in the household, gender, and marital status. For the wage equation, included explanatory variables are: race; age (15 to 75+); educational attainment; province and whether the individual is in an urban area. Since the purpose of running the model is to predict wages for the non-employed population, I do not include controls for variables such as occupation or industry of employment. The results are presented in Table 4 in the appendix.

The estimated coefficients are used to predict hourly wages for the non-employed population aged 10 years and older. Thus, an individual's opportunity cost wage rate is equal to their hourly wage if they are employed, or their predicted hourly wage if they are not employed.

Table 1 presents estimated hourly wages according to the five options described above: the generalist replacement wage rates using (1) mean domestic worker wage and (2) an economy-wide median wage; the specialist approach using (3) occupation matching and (4) following the methodology of Budlender and Brathaug (2004); and (5) the opportunity cost wage. As expected, the domestic worker generalist wage is the lowest of the five across all activities, while the economy-wide generalist wage is the second-lowest for eight of the 15 activities. The two sets of specialist wages range between R10 and R44 per hour and, depending on the activity, can be very similar or very different. Substantial differences are, for example, observed for household management and childcare, where the occupation matching approach yields wages that are roughly four and two times the wages calculated following Budlender and Brathaug (2004). Opportunity cost wages are the highest wages for nine of the 15 individual activities, being surpassed by specialist wages for household management and the five care activities.

Weighted by the total time spent in each activity by the entire population, opportunity cost wages are, though, significantly higher than the other four types of wages. At R24.77, the average opportunity cost wage is approximately 40 percent to 60 percent higher than the average specialist replacement wages, and 60 percent to 160 percent higher than the generalist replacement wages.

3.3.2 Unpaid work valued

Combining the wages presented in Table 1 with the total time spent in household production activities, it is possible to estimate the value of household production. In Table 5, estimates of the value of household production relative to GDP are presented. In total, the value of household production is estimated at between R402.2 billion and R1 047.3 billion in 2010, equivalent to between 14.6 percent and 38.1 percent of GDP. Compared with previous estimates for South Africa, this is a somewhat narrower range. Budlender and Brathaug

Table 1: Estimated hourly wage rates by type of activity (2010 Rands)

	Generalist		**Specialist**		**Opportunity Cost**
	Domestic Worker (mean)	Economy-wide (median)	Occupation Matching	Following Budlender & Brathaug (2004)	
	(1)	(2)	(3)	(4)	(5)
Cleaning	9.51	15.38	10.55	11.38	23.86
Laundry	9.51	15.38	18.16	14.08	22.36
Cooking	9.51	15.38	16.98	16.98	24.70
Household maintenance	9.51	15.38	22.87	19.77	27.49
Household management	9.51	15.38	43.63	11.38	37.42
Pet care	9.51	15.38	13.29	15.72	36.89
Travel	9.51	15.38	19.10	19.10	29.64
Purchases	9.51	15.38	13.29	11.38	32.23
Collecting fuel and water	9.51	15.38	13.29	11.38	18.06
Childcare, intra-household	9.51	15.38	42.75	22.38	23.87
Childcare, inter-household	9.51	15.38	42.75	22.38	28.01
Adultcare, intra-household	9.51	15.38	32.21	41.72	35.87
Adultcare, inter-household	9.51	15.38	32.21	41.72	19.87
General care, intra-household	9.51	15.38	29.05	15.72	27.52
Volunteering	9.51	15.38	13.29	13.29	30.70
Average	9.51	15.38	17.73	15.48	24.77

Source: Own calculations, Statistics South Africa (2011).

Note: Average wages are weighted by the total number of hours of work performed in each activity by the population.

(2004, p.39), using a range of wage rates and a 24-hour time measure based on the 2000 Time Use Survey, estimate household production to be equivalent to between 11 percent and 50 percent of GDP, respectively calculated using a generalist replacement wage calculated from census data, and an economy-wide mean wage calculated from Labour Force Survey data. Their upper bound estimate uses an economy-wide mean wage as opposed to the economy-wide median wage used here. Interestingly, their estimate based on opportunity cost wages is 38 percent, very similar to the corresponding estimate here.

The majority of the value of household production is from housework activities, which represents between 75 percent and 89 percent of the total, depending on the wage rate used. Care for household members accounts for between 9 percent and 22 percent of the total. Females account for roughly seven-tenths of the value of total household production, ranging from 70.8 percent (opportunity cost wage rates) to 73.8 percent (occupation matching wage rates). That opportunity cost wage rates would provide the lower bound for females' share of household production is unsurprising, given higher actual wage rates for men (noting that gender was not used as an explanatory variable in predicting wages for the non-employed). For housework, females' share of the total value is within one percentage point of 70 percent across valuation methods, while for care it ranged between 80 percent and 85 percent. Males account for very little of the care for household members—roughly 11 percent—but account for between 42 percent and 48 percent of care for non-household members.[4]

[4]Additional disaggregations of total time allocated to productive activities and of the value of this time using a specialist replacement (occupation matching) wage are presented in Table 5 in the appendix.

Table 2: Value of aggregate household production relative to GDP, 2010

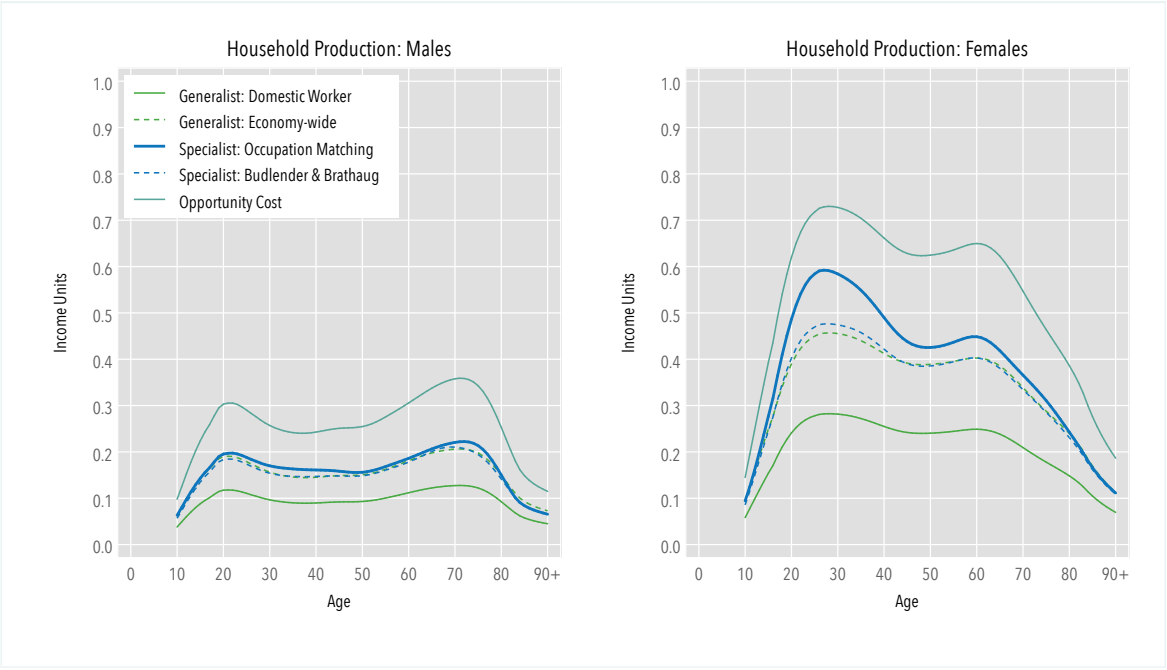
	Under 18 yrs	18-39 yrs	40-59 yrs	60 yrs plus	Male	Female	TOTAL
Generalist: Domestic Worker							
Housework	1.6	6.8	3.2	1.3	3.9	9.0	12.9
Care	0.1	1.1	0.3	0.1	0.3	1.4	1.7
Care for HH members	0.1	1.0	0.2	0.1	0.1	1.2	1.3
Care for non-HH members	0.0	0.2	0.1	0.0	0.2	0.2	0.4
Household Production	1.8	7.9	3.6	1.4	4.2	10.4	14.6
Value in R (billions)	*48.3*	*217.3*	*98.5*	*38.0*	*115.5*	*286.7*	*402.2*
Generalist: Economy-wide							
Housework	2.7	10.9	5.2	2.1	6.3	14.6	20.9
Care	0.2	1.8	0.6	0.2	0.5	2.2	2.8
Care for HH members	0.1	1.5	0.3	0.1	0.2	1.9	2.1
Care for non-HH members	0.0	0.3	0.2	0.1	0.3	0.3	0.6
Household Production	2.8	12.8	5.8	2.2	6.8	16.9	23.7
Value in R (billions)	*78.2*	*351.5*	*159.4*	*61.5*	*186.8*	*463.8*	*650.6*
Specialist: Occupation Matching							
Housework	2.6	10.8	5.2	2.0	6.2	14.4	20.6
Care	0.4	4.7	1.2	0.4	1.0	5.7	6.7
Care for HH members	0.4	4.2	0.9	0.3	0.6	5.2	5.8
Care for non-HH members	0.1	0.5	0.3	0.1	0.4	0.5	0.9
Household Production	3.0	15.5	6.4	2.4	7.2	20.1	27.3
Value in R (billions)	*82.9*	*425.0*	*176.1*	*66.0*	*196.8*	*553.1*	*749.9*
Specialist: Following Budlender & Brathaug (2004)							
Housework	2.5	10.3	5.0	1.9	5.9	13.9	19.7
Care	0.3	2.7	0.8	0.3	0.8	3.3	4.1
Care for HH members	0.2	2.3	0.5	0.2	0.4	2.8	3.2
Care for non-HH members	0.1	0.4	0.3	0.1	0.4	0.4	0.9
Household Production	2.7	13.1	5.8	2.2	6.7	17.2	23.8
Value in R (billions)	*75.1*	*359.3*	*159.2*	*61.0*	*182.9*	*471.6*	*654.5*
Opportunity Cost							
Housework	4.2	17.6	8.5	3.4	10.2	23.3	33.6
Care	0.3	3.0	0.9	0.3	0.9	3.6	4.5
Care for HH members	0.2	2.4	0.6	0.2	0.4	3.0	3.4
Care for non-HH members	0.1	0.5	0.4	0.1	0.5	0.6	1.1
Household Production	4.5	20.5	9.4	3.7	11.1	27.0	38.1
Value in R (billions)	*122.8*	*564.2*	*259.3*	*101.0*	*306.2*	*741.1*	*1 047.3*

Source: Own calculations, Statistics South Africa (2011, 2014); South African Reserve Bank (2018).
Note: Figures expressed as share of GDP, which was R 2 748.0 billion in current prices (South African Reserve Bank, 2018). Rand values of household production are in 2010 current prices.

The time profiles of household production and consumption presented in figures 5 and 6 are valued using the various wage rates calculated above, and are standardised using peak labour income. These profiles are presented in Figure 7.

The general shapes of the profiles of time spent in household production for males and females are preserved once the time is valued. In the case of the generalist wages–both the domestic worker wage and the economy-wide wage–the shape is preserved exactly since all

Figure 7: Value of Household Production across the Lifecycle by Gender, 2010



Source: Own calculations, Statistics South Africa (2011, 2014).
Note: Time spent in household production is valued using specialist replacement wages. Profiles are standardised by dividing through by the average labour income for 30 to 49 year olds ('peak labour income'); this average equals one income unit.

time is valued using the same wage, irrespective of the activity or the individual performing the activity. However, specialist wages differ by activity, while the opportunity cost wages differ by individual characteristics; as a result, the shapes of the profiles valued with these wages differ from each other and from the time profiles.

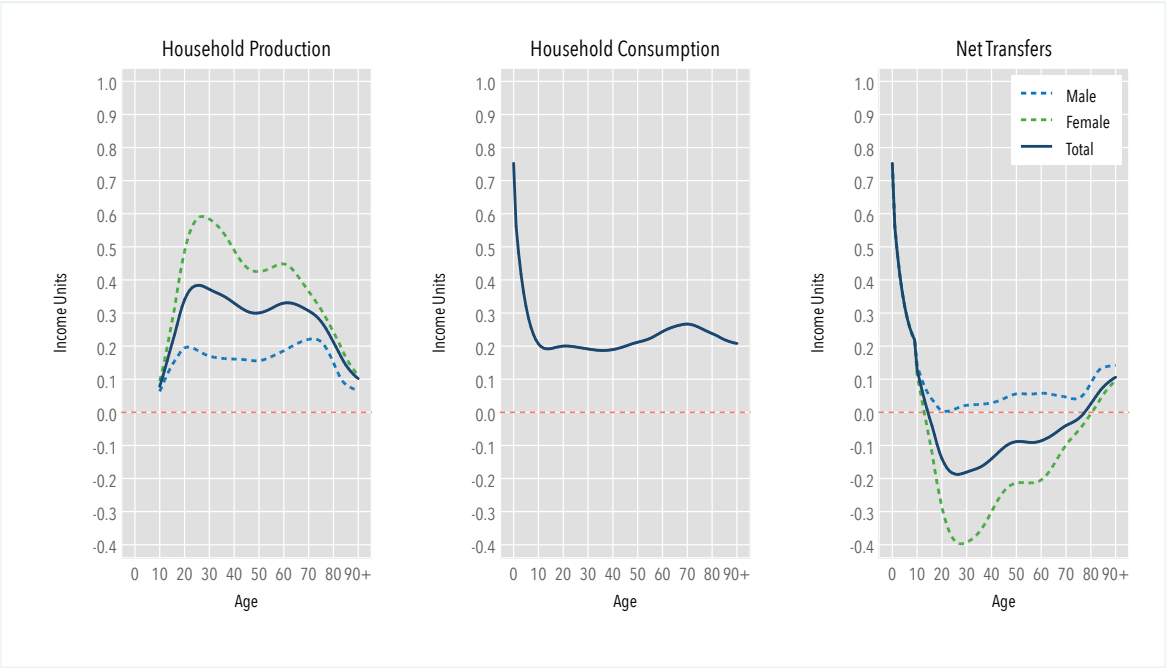
The overall ranking of the five sets of wage rates is broadly reflected in the levels of the two sets of profiles, with the generalist wage profiles consistently lowest of the five and the opportunity cost wage profiles consistently highest. For males, the remaining three profiles are virtually indistinguishable from each other across the life course; for females, the profile based on the occupation matching specialist replacement wage is generally somewhat higher than the alternative specialist replacement wage-based profile and the economy-wide generalist wage-based profile.

3.4 Combining Market and Home Production

By converting the time profiles for household production into monetary terms it is possible to get a sense of total production by gender across the life course. Time spent in household production is valued using specialist replacement wages (occupation matching); values are annualised and standardised as per NTA convention. Figure 8 presents the production, consumption and transfers of non-market work over the life course.

Overall, the per capita annual value of household production ranges between 30 and 40 percent of peak labour income (i.e. 0.3-0.4 income units) for all but two years between the

Figure 8: Value of Household Production, Consumption and Transfers across the Lifecycle by Gender, 2010



Source: Own calculations, Statistics South Africa (2011, 2014).
Note: Time spent in household production is valued using specialist replacement wages. Profiles are standardised by dividing through by the average labour income for 30 to 49 year olds ('peak labour income'); this average equals one income unit. Net transfer are calculated as consumption less production.

ages of 19 and 71 years. Under the age of 15 years and over the age of 80 years, the value is below 20 percent of peak labour income. As with the time profiles, the gap between the value profiles for males and females is substantial, reaching over 40 percent of peak labour income between the ages of 26 and 33 years. The gap is at least 20 percent of peak labour income for each cohort aged 18 to 65 years. The per capita annual value of household production amongst females peaks at just over 59 percent of peak labour income in the late twenties, with a second lower peak at almost 45 percent of peak labour income around the age of 60 years. For males, there are also two peaks, although they are at much lower levels and the peak at older ages (around 22 percent of peak labour income) is slightly higher than that at younger ages (just under 20 percent of peak labour income).

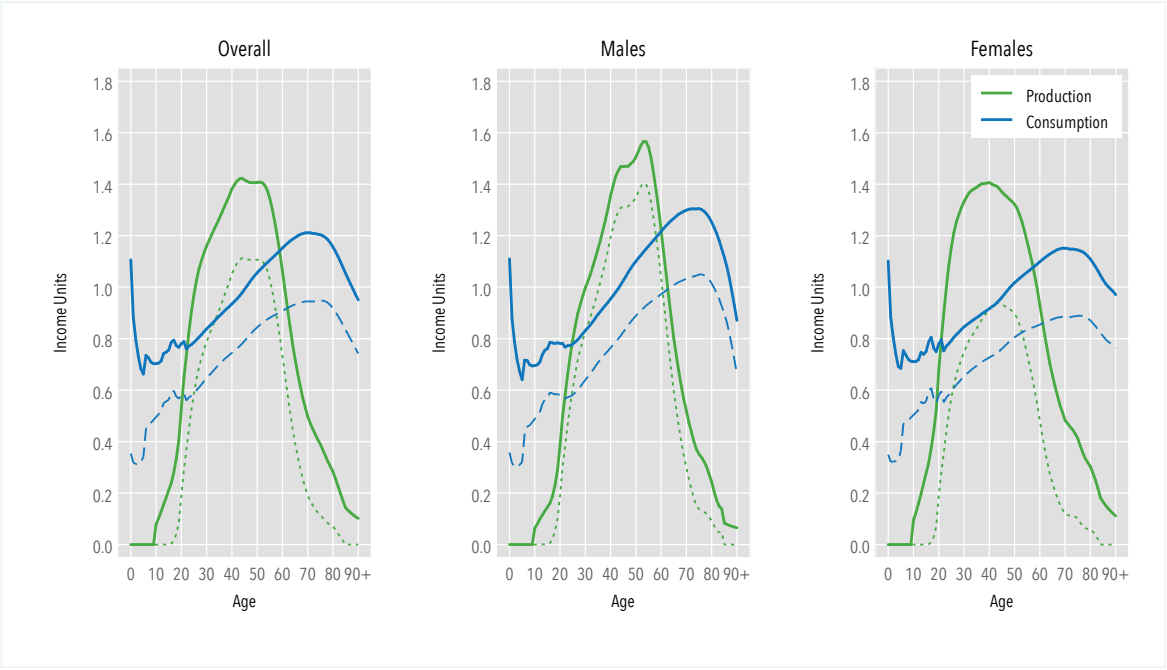
Consumption of non-market production is highest for infants and is estimated to be 75 percent of peak labour income. Following a rapid decline, it remains between 18 percent and 21 percent of peak labour income for cohorts aged between 10 and 49 years. For most cohorts in their sixties and seventies, consumption is higher at between 25 percent and 27 percent of peak labour income, but falls again to under 21 percent for those aged 90 years and older.

Combining production and consumption profiles reveals large transfers to children, ranging between 75 percent of peak labour income at age zero and 22 percent at age 9. On average, cohorts become net producers at age 15 and only return to being net consumers again at 78 years of age. By age 89, younger cohorts are making net transfers of non-market

production to the value of more than 10 percent of peak labour income. Male cohorts, however, are never net producers: net transfer inflows fall below two percent of peak labour income between the ages of 18 and 28, but never turn negative (indicating net transfer outflows). Female cohorts, in contrast, make net transfers from age 13 to age 80: net transfer outflows rise to almost 40 percent of peak labour income during their late twenties and remain above 20 percent until age 60.

Figure 9 illustrates the impact of including non-market work in NTA estimates of production and consumption by gender. The dotted lines represent NTA labour income (YL), while the dashed line represents NTA consumption (C); the solid lines represent total production/consumption, inclusive of the production/consumption of non-market work.

Figure 9: Total Production and Consumption across the Life Course by Gender, 2010



Source: Own calculations, Statistics South Africa (2011, 2012, 2014); South African Reserve Bank (2018).
Note: Time spent in household production is valued using specialist replacement wages. Profiles are standardised by dividing through by the average labour income for 30 to 49 year olds ('peak labour income'); this average equals one income unit. Broken lines represent NTA flows (i.e. market production/consumption only).

Clearly, the inclusion of non-market boosts per capita production for all cohorts aged at least 10 years and per capita consumption at all ages. At age 44 when total production is at its peak for the total population, total production is almost 28 percent higher than labour income, while total consumption is 25 percent higher than NTA consumption. While the impact on consumption is identical in absolute terms for males and females–as previously noted, the overall non-market consumption profile is used–the impact on production is very different by gender. Considering the cohorts aged 30 to 49 years, for example, including non-market production raises per capita production by between 11 and 21 percent for males, compared to between 46 and 78 percent for females. In terms of total production, using the specialist replacement wages, females outproduce males in per capita terms in all cohorts up

to age 41 and in all cohorts aged 72 years and older; in contrast, considering only labour income, males outproduce females at all ages.

Including consumption of non-market services in our estimates of total consumption has a very large effect on the value of per capita consumption amongst infants and young children. Thus, children are revealed to be substantially more 'expensive' than pure market estimates would suggest. Total consumption is more than triple the level of NTA consumption at age zero, more than double NTA consumption between the ages of one and four years, and more than 40 percent higher between the ages of five and 10 years. Not only are children more expensive in absolute terms relative to their own NTA consumption levels, they are also more expensive relative to other cohorts. For example, using unweighted averages, total consumption per capita amongst children under 10 years is almost 83 percent of that amongst adults between the ages of 30 and 49 years; using only NTA consumption, this ratio falls to under 52 percent.

3.5 Demographic Dividends and the Potential for Gender Dividends

3.5.1 Estimating Demographic Dividends

Including non-market production within a broader measure of total production has a number of implications for our conceptualisation of the demographic dividend. First, by changing the labour income and consumption profiles, the magnitude and trajectory of the first demographic dividend are impacted. Critically, the inclusion of unpaid childcare means that the cost (i.e. consumption) of children is raised substantially compared with pure market NTAs, with the implication that conventional estimates of the first demographic dividend may be underestimates of the true dividend. Second, demographic change has implications for the household production demands placed on both women and men. For example, assuming a constant per capita consumption profile of childcare, as fertility declines and the number of children relative to adults falls, caregivers would theoretically experience reductions in the time required for childcare. Caregivers would consequently be able to allocate additional time to market production, to other types of household production, or to leisure and self-care activities; they could also opt to increase the time allocated to care per child.

Within the NTA framework (Mason and Lee, 2007, p.133), estimation of the demographic dividend begins with the following identity describing consumption per effective consumer:

$$\frac{C(t)}{N(t)} = c(t)\frac{Y(t)}{L(t)}\frac{L(t)}{N(t)} \tag{4}$$

where $C(t)$ is total consumption, $Y(t)$ is labour income, $c(t)$ is the ratio of consumption to labour income, and $N(t)$ and $L(t)$ are the effective number of consumers and the effective number of producers respectively. The effective number of producers and of consumers are calculated from the NTA labour income and consumption profiles, and are defined as:

$$L(t) = \sum_{a=0}^{\bar{\omega}} \gamma(a)P(a,t) \tag{5}$$

$$N(t) = \sum_{a=0}^{\bar{\omega}} \phi(a) P(a,t) \tag{6}$$

Here, $P(a,t)$ refers to the population aged a in period t, while $\gamma(a)$ and $\phi(a)$ are "age-specific, time-invariant vectors of coefficients measuring age variation in productivity and consumption, respectively" (Mason and Lee, 2007, p.133).

The original concept of the demographic dividend as used by Bloom et al. (2003) is divided into two components, referred to as the first and second demographic dividends. The first demographic dividend measures the pure effect of a changing population structure on consumption per effective consumer, *ceteris paribus*, and is reflected in the economic support ratio, $L(t)/N(t)$, in equation 4. Holding the consumption ratio $c(t)$ and labour productivity $Y(t)/L(t)$ constant, there is a direct positive relationship between the support ratio and consumption per effective consumer. The first demographic dividend therefore refers to the period during which the effect of the changing population age structure is to raise consumption per effective consumer, *ceteris paribus*. The second demographic dividend operates through the impact of demographic change on the consumption ratio and on labour productivity, as savings increases.

The first demographic dividend is directly estimated through the support ratio (SR), which is calculated as:

$$SR_t = \frac{L(t)}{N(t)} = \frac{\sum_{a=0}^{\bar{\omega}} \gamma(a) P(a,t)}{\sum_{a=0}^{\bar{\omega}} \phi(a) P(a,t)} \tag{7}$$

Here, $\gamma(a)$ and $\phi(a)$ are respectively the per capita labour income and consumption age profiles, and $P(a,t)$ is historical or projected population data by age. The support ratio is therefore calculated as the population-weighted labour income profile divided by the population-weighted consumption profile. Put simply, it is the ratio of total production to total consumption: the greater the support ratio, the higher total labour income is relative to total consumption. The rate of change of the support ratio over time is the first demographic dividend. By combining the profiles of per capita value of household production and consumption with the per capita labour income and consumption profiles, a 'full' support ratio and a 'full' demographic dividend can be estimated.

In the same way, it is possible to estimate a 'time dividend' using the age profiles of the household production and consumption expressed in time units, instead of the NTA labour income and consumption profiles. A time support ratio (TSR) can therefore be defined as:

$$TSR_t = \frac{\sum_{a=0}^{\bar{\omega}} \gamma_{hh}(a) P(a,t)}{\sum_{a=0}^{\bar{\omega}} \phi_{hh}(a) P(a,t)} \tag{8}$$

where $\gamma_{hh}(a)$ and $\phi_{hh}(a)$ are respectively the time-invariant per capita household production

and consumption age profiles (expressed in time units). The time dividend is then the rate of change of the time support ratio. A distinction is therefore made here between the market or NTA support ratio (SR), which incorporates the NTA labour income and consumption profiles only; the household or NTTA support ratio (HSR), which incorporates the monetary-value NTTA household production and consumption profiles only; the full support ratio (FSR), which incorporates the NTA labour income and consumption profiles and the monetary-value NTTA household production and consumption profiles; and the time support ratio (TSR), which incorporates the time-denominated NTTA household production and consumption profiles only.

3.5.2 Gender and Demographic Dividends

Three results from the preceding analysis inform the analysis of demographic dividends here. First, section 3.1 found substantial differences in the labour income profiles of males and females. Second, section 3.2 illustrated significant gender specialisation in productive activities, with females spending significantly more time in household production and less in market production. Finally, section 3.4 revealed that including household production impacts materially on production and consumption profiles and that this impact varies by gender and age.

Given these findings, I ask three questions related to demographic dividends:

1. How does reducing gender inequalities in labour income across the life course impact on estimates of the first demographic dividend?

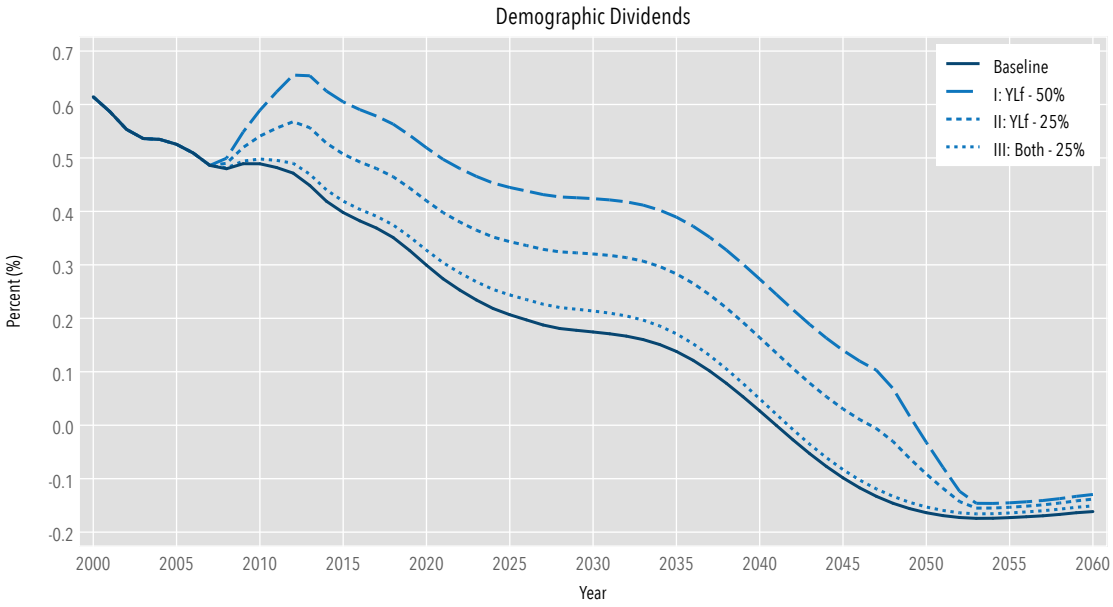
2. To what extent can demographic change in South Africa be expected to change the demand for and supply of time in productive activities within the household?

3. How does incorporation of household production and consumption into total production and consumption impact on estimates of the first demographic dividend?

To answer the first question, I run a set of simulations that narrow the gap between the labour income profiles of males and females linearly over the 2010-2050 period. Three simulations are presented. The first narrows the gap by 50 percent over the period by gradually adjusting the female labour income profile, while leaving the male profile constant. The second simulation is identical, except that it narrows the gap by 25 percent over the period. The third simulation is somewhat different in that, although the gap is still narrowed by 25 percent, both the male and female labour income profiles are adjusted over the 2010-2050 period. Since labour income for females is lower than that of males at all ages, all three simulations entail raising labour incomes for females while the third also lowers that of males. These simulations, along with the conventional NTA demographic dividend (the baseline), are presented in Figure 10.

Raising labour incomes amongst females has a non-negligible impact on the magnitude of the demographic dividend. Simulation I, which narrows the gender gap by 50 percent, has the largest impact: averaged across the full 2010-2050 period, the estimated dividend

Figure 10: Impact on the Demographic Dividend of Reducing Gender Differences in Labour Income, 2000-2060



Source: Own calculations, Statistics South Africa (2012); South African Reserve Bank (2018); United Nations (2017).

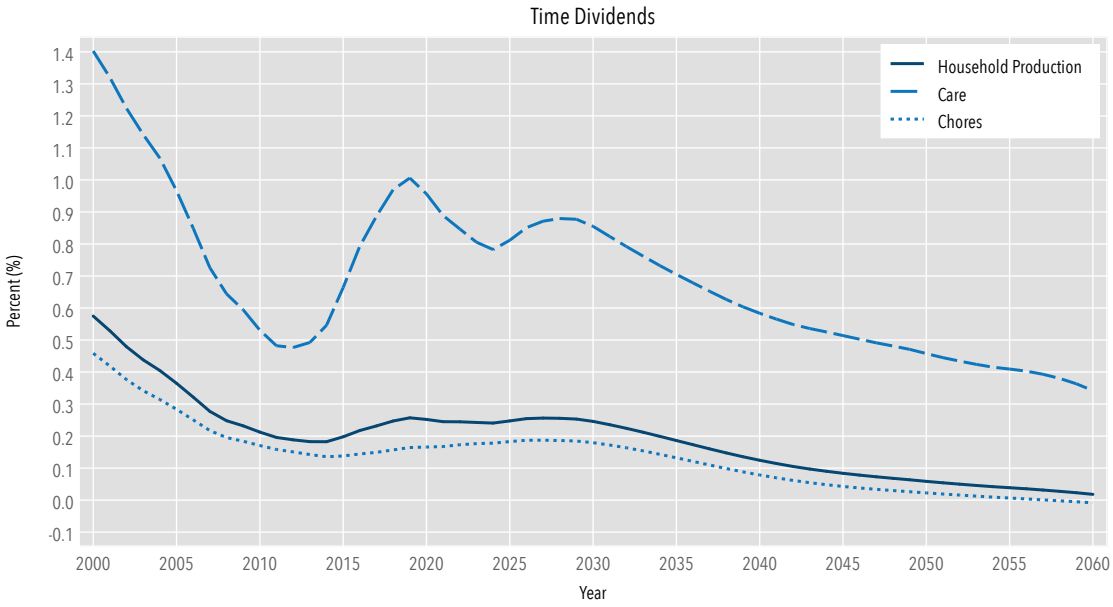
is 0.22 percentage points higher than the baseline dividend. The estimates suggest that demographic change, on its own, will raise consumption per capita by 6.4 percent over the 2010-2050 period. Narrowing the labour income gender gap by 50 percent will instead raise per capita consumption by 16.5 percent by 2050, a difference of more than ten percentage points. Narrowing the labour income gender gap by 25 percent has a somewhat weaker impact on per capita consumption, raising it by 12.0 percent by 2050.

If improvements in female labour income come at the cost of male labour income–i.e. the gender gap is narrowed by raising female labour income and lowering male labour income– the impact in terms of the demographic dividend is much more muted. The estimated demographic dividend over the 2010-2050 period is only marginally higher than the baseline dividend; the result is that consumption per capita is projected to rise by 7.6 percent under scenario III, just 1.2 percentage points more than the increase projected for the baseline.

The second question refers to the time support ratio (TSR), which relates the time-denominated total production to the total consumption of non-market services over time. Where estimated total production rises relative to total consumption as the population structure changes, the TSR rises and there is demographic dividend, referred to here as a time dividend. Figure 11 presents estimates of the time dividend with respect to total household production, as well as for its main components namely care and chores.

The estimated time dividend for total household production is positive for the entire period between 2000 and 2060. The dividend is highest at the start of the period (0.57 percent in 2000) and falls quite rapidly to below 0.2 percent in 2011. However, the dividend

Figure 11: Impact on the Demographic Dividend of Demography-Induced Changes in Demand for and Supply of Household Production, 2000-2060



Source: Own calculations, Statistics South Africa (2014); United Nations (2017).

ranges between 0.21 percent and 0.26 percent for almost two decades from the late 2010s to the early 2030s before gradually drifting downwards for the remainder of the period. Due to the dominance of chores within total household production, the time dividend related to chores follows a very similar path to that of total household production, albeit at a slightly lower level. The dividend begins the period at 0.46 percent in 2000, and is projected to fall slightly below zero in 2058.

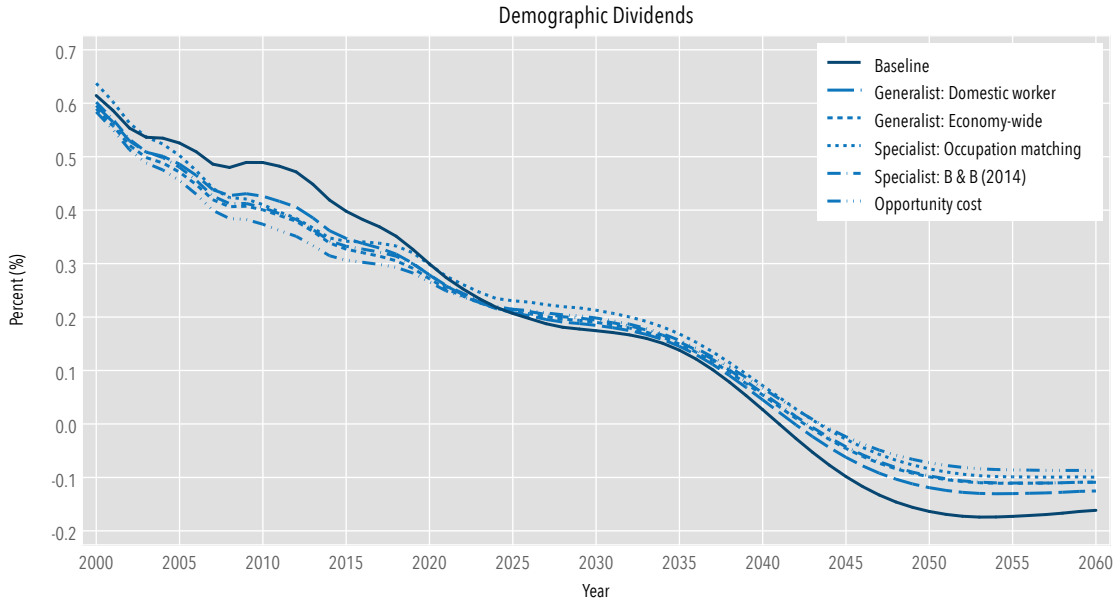
For care, however, the projected time dividend is substantially larger, even though it follows a broadly similar path over the period. The time dividend for care is estimated to have been 1.40 percent in 2000, but by 2010 was less than half that (0.53 percent). It is projected to rebound sharply during the mid-2010s, ranging between 0.70 percent and 1.01 percent for 20 years from 2016 onwards. Even by the end of the period in 2060, the time dividend for care is projected to be relatively large at 0.34 percent.

The data suggests that, holding the profiles of household production and consumption constant, total production of unpaid work will rise over the period relative to total consumption. This is particularly the case for care: the vast majority of the care measured in the survey data is childcare and the period will see the most rapid rates of population growth amongst producers of childcare rather than amongst consumers of childcare. This means that behaviour at the household level will change over time: household members will be able to consume more household production, raising the per capita consumption of non-market work; they will be able to reduce the time spent in household production, thereby lowering the the NTTA production profiles over time; or they may opt for a combination of the two. The latter two options would essentially free up time for producers of non-market work,

enabling them to either increase the time allocated to leisure and self-care activities or to increase time allocated to market work. Given women's specialisation in non-market work, to the extent that individuals allocate more time to market work, this represents an important opportunity to increase women's participation in the labour market over the coming decades, with relatively little direct disruption of patterns of household production.

The third question revolves around the nature of the full support ratio (FSR), and the extent to which it may differ from the conventional NTA support ratio (SR). Since the FSR will be sensitive to the choice of wage rates used to value household production, five FSRs are calculated that correspond to the five sets of wage rates presented in Table 1. The demographic dividends calculated on the basis of these FSRs are presented in Figure 12.

Figure 12: Impact on the Demographic Dividend of Including Household Production in Estimates of Total Production, 2000-2060



Source: Own calculations, Statistics South Africa (2011, 2012, 2014); South African Reserve Bank (2018); United Nations (2017).

There are two key points to note from the figure. First, even though the wage rates used to value time in household production vary significantly and yield large differences in the total value of household production relative to GDP (Table 5), they have only a small impact on the estimated magnitude of the FSR-based demographic dividend. Across the five estimates, the range of demographic dividend values in each year remained within 0.05 percent.

Second, although the FSR-based demographic dividend is quite similar to the conventional NTA demographic dividend over the period, the former follows a slightly flatter path between 2000 and 2060. The FSR-based dividends are initially typically lower than the NTA demographic dividend, but during the latter half of the period are typically higher. Thus, for example, the NTA demographic dividend is projected to fall below zero in 2041, one or two

years sooner than the FSR-based dividends. The net effect, though, is that the FSR-based dividends do not differ materially from the NTA demographic dividend: in 2050, total (market and non-market) consumption per capita is between 6.4 percent and 7.3 percent higher than in 2010, depending on the wage rates used, compared to 6.4 percent for the baseline (NTA) dividend.

4 Conclusion

National Transfer Accounts characterise the generational economy within a given country, describing how societies produce, consume, share and save across the lifecycle. However, disaggregating NTAs by gender reveals substantial differences in the patterns of production between males and females. This is true in the case of South Africa, where the gap in labour income is particularly large between the ages of 40 and 60 years. This requires one to accept either that these differences are a true reflection of reality where males substantially outproduce females for most of adulthood, or that these differences are the result of the measure of 'production' being incomplete in some way. The position taken in National Time Transfer Accounts is the latter due to the exclusion of unpaid services from the SNA definition of production.

This research has aimed to describe patterns of time-use, and productive time use in particular, across the lifecycle and by gender using data from the 2010 Time Use Survey. Between the ages of 20 and 60 years, time allocated to market work peaks, while time allocated to housework does not vary as substantially by age, and time allocated to care peaks during the twenties and thirties. The NTTA estimates reveal that males account for more than three-fifths of total time allocated to market work and spend more time in market work at virtually every age. Conversely, females spend more time in non-market work at every age than males: females are therefore responsible for more than 71 percent of all time allocated to non-market work.

Using a specialist replacement wage, aggregate household production is valued at R749.9 billion in 2010, or 27.3 percent of GDP. To put this into context, labour income is estimated at 51.1 percent of GDP. Females account for 73.8 percent of the aggregate value of household production, while the cohorts aged 18 to 39 years account for almost 57 percent of the total.

In terms of housework, time allocations follow relatively similar patterns for males and females, while differing significantly in terms of their levels. For females, time allocated to housework rises rapidly during the teens and early twenties, remaining relatively stable from the late twenties to the early sixties after which it declines. Two local peaks—one around age 30 and the other around age 60—are discernible. For males, the local peaks are far more distinct and occur respectively sooner and later than the two female peaks. For care, time allocations for women are highest during their twenties and thirties. Males, though, spend little time in care activities at any age—their peak allocation is observed during their seventies. This is evidenced in the fact that males account for less than one-fifth of all the time allocated to care, and just 11.2 percent of care for household members.

Consumption of unpaid household production is highest for infants due to the care that they receive. While consumption of care falls rapidly with age so that by the teenage years it is only a couple minutes per day on average, consumption of housework generally increases with age until around age 70, after which it declines. Valuing this time, however, widens the gap between the consumption of infants and young children on the one hand, and older cohorts on the other. Consumption of non-market production is estimated at 75 percent of peak labour income for infants, falling to around one-third of peak labour income at age five.

Adding the NTTA estimate to the NTA estimates makes a substantial difference to the gender-specific patterns of production and consumption over the lifecycle. Per capita consumption is boosted at all ages, with consumption increasing by between 20 and 30 percent of peak labour income for most cohorts. The biggest difference, though, is observed for infants and young children: at age zero, consumption is more than tripled from 35 percent to almost 111 percent of peak labour income, and even at age 10 consumption is increased by two-fifths from 50 percent of peak labour income to 70 percent. The NTTA results therefore reveal the substantial 'hidden costs' of young children. This is an important result given its implications for policies related to encouraging women's greater economic participation.

On the production side, the gender-gap is substantially narrowed with the effect that women are found to produce a substantial lifecycle surplus for almost 40 years from age 20 onwards. Importantly, whereas males outproduced females at all ages in terms of labour income, once non-market production is included females outproduce males in per capita terms in all cohorts up to age 41 and in all cohorts aged 72 years and older.

Two key results emerge from the demographic dividend analysis. First, narrowing the gender gap in per capita labour income profiles has the ability to boost the demographic dividend in terms of both the magnitude of the dividend in a given year, and in terms of the duration of the period during which the dividend remains positive. Importantly, from a policy perspective, the methodology is not prescriptive in terms of how this narrowed gap is to be achieved: it might be the result of greater employment rates for women, longer hours of work for women, higher wages for women in their current jobs, or shifts in female employment towards more skilled and higher paying occupations. Second, it is clear that demographic change is likely to result in less time pressure on women, *ceteris paribus*. This will be driven primarily by declining demands placed on women's time by their care responsibilities; for housework or chores the gain is marginal. This 'freed up' time may be reallocated in various ways, including increasing allocations to care for smaller numbers of children, increasing time allocated to employment, or enabling more time for leisure and self-care.

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A Data Cleaning

A.1 Time Use Data

The TUS distinguishes between care for household members and care for non-household members, and separates care for children from care for adults. There are, however, childless households that report spending time in intra-household care (i.e. care for household members under 18 years) and, as a result, this production of childcare cannot be allocated for consumption. I take the position that the respondent was indeed engaging in childcare, but that the recipient of the care is in fact not a household member. Thus, all intra-household childcare that took place in childless households is converted to care of children outside the household. Out of 50 754 respondents who report engaging in intra-household childcare, this affects 308 who spent, on average, 98 minutes on the activity. There are also a few instances of child respondents who claim to have cared for other child members of the household, but who are the only child in their household; in these instances, intra-household childcare is converted to care of children outside the household. This affects 9 observations, who average 32 minutes on the activity.

Similar problems exist for intra-household care of adults in households with either no adults or with no other adults apart from the adult respondent reporting intra-household care of adults. Here, the numbers are significantly smaller: only one child respondent reports intra-household adultcare (30 minutes) despite the fact that there are no adults in the household; and 27 adult respondents report intra-household adultcare (average of 85 minutes) but are the only adults within their households. As with childcare, these times are converted to care of adults outside the household.

Finally, it is possible to report caring for household members but not specifying whether the recipient is a child or an adult. Here, where the respondent is the only member of the household, there is again nobody to whom can be allocated the production of care for consumption. This is the case for four respondents (out of 45 283), who average 60 minutes in care for unspecified household members, and the time is recategorised as volunteering/community work.

A.2 Wage Data

The TUS 2010 asks respondents about their individual monthly income totalled across all sources, requiring them to answer in income bands. Since it is impossible to extract the value of salaries and wages from this aggregate, the analysis relies on wage data from the Labour Market Dynamics Survey (LMDS). This dataset combines the four Quarterly Labour Force Surveys (QLFS) from a given calendar year and includes the wage data that is collected, but not released, in the QLFSs. This gives this nationally representative dataset a sample size of over 340 000 individuals in 2010.

The QLFS collects earnings data from the employed related to their main job by asking first for a point estimate and, if the individual refuses to provide the information, they are asked to identify the relevant income band. Statistics South Africa has imputed wages

for individuals reporting income bands so that all individuals who were willing to provide information on earnings have a point estimate. Using data on the usual number of hours worked per week in the main job, monthly earnings are converted into hourly earnings (weekly hours are converted to monthly hours by multiplying by 52 weeks and dividing by 12 months).

The resulting hourly earnings variable has a number of extreme outliers. Outlier values are identified as those above a cutoff of three standard deviations above the mean (R1 262 in 2010 Rands) and are set to missing. This affects 45 observations with hourly rates of between R1 269 and R54 945. The impact of removing these outliers is illustrated in Table 3 and is substantial. Mean hourly earnings falls by 15 percent from R39.08 to R33.39, while the standard deviation is much reduced.

Table 3: Hourly wage rates from LMDS 2010 with and without outliers

Variable	**Obs**	**Weight**	**Mean**	**Std.Dev.**	**Min**	**Max**
hourlyrate_orig	81 088	13 676 091	39.082	407.836	0	54 945.05
hourlyrate	81 043	13 667 170	33.390	58.651	0	1 260.00

Source: Own calculations, Statistics South Africa (2011).

B Heckman Two-Stage Results for Opportunity Cost Wages

Table 4: Heckman Two-Stage Estimates of Mincerian Wage Equation, 2010

	Selection Equation (1)			**Wage Equation (2)**		
Dependent Variable:	Employed			*ln*(Hourly Wage)		
Coloured				0.207	***	-0.013
Asian				0.600	***	-0.022
White				0.704	***	-0.013
Age	0.004	***	0.000	0.022	***	-0.002
Age squared				0.000	***	0.000
Incomplete Secondary	0.127	***	-0.010	0.207	***	-0.012
Complete Secondary	0.537	***	-0.011	0.491	***	-0.014
Certificate/Diploma	1.087	***	-0.017	0.930	***	-0.020
Degree	1.086	***	-0.022	1.139	***	-0.023
Other Education	0.449	***	-0.042	0.069		-0.043
Western Cape				-0.091	***	-0.014
Eastern Cape				-0.144	***	-0.015
Northern Cape				-0.140	***	-0.016
Free State				-0.309	***	-0.014
KwaZulu-Natal				-0.095	***	-0.013
North West				0.070	***	-0.015
Mpumalanga				-0.018		-0.015
Limpopo				-0.192	***	-0.017
Urban	0.321	***	-0.008	0.150	***	-0.011
No. of children under 15 in household	-0.019	***	-0.001			
Female	-0.404	***	-0.007			
Married or living with partner	0.545	***	-0.008			
Constant	-0.887	***	-0.015	2.180	***	-0.056
/athrho	-0.725					
/lnsigma	-0.0125					
rho	-0.62					
sigma	0.988					
lambda	-0.612					
Observations	234					
	136					
Wald χ^2	9884					
Prob $< \chi^2$	0.000					

Robust standard errors in parentheses; maximum likelihood estimates. Asterisks denote statistical significance: *** p<0.01, ** p<0.05, * p<0.10. Referrent categories are: African, primary education, Gauteng, rural, male, not married. Due to very small sample sizes at old ages, the age variable is recoded to equal 75 for all individuals over the age of 75 years. The age-squared variable is calculated from this new variable.

Source: Own calculations, Statistics South Africa (2011).

C Value of Aggregate Household Production, 2010

Table 5: Value of Aggregate Household Production relative to GDP, 2010

	Under 18 yrs	18-29 yrs	30-49 yrs	50-59 yrs	60 yrs plus	Male	Female	TOTAL
Total Time (millions of hours per annum)								
Housework	4 755	12 084	12 782	4 055	3 678	11 213	26 140	37 353
Care	327	2 001	1 915	369	322	927	4 008	4 934
For HH members	253	1 696	1 462	218	207	429	3 407	3 835
For non-members	74	305	454	151	115	498	601	1 099
Household Production	5 082	14 085	14 697	4 423	3 999	12 140	30 148	42 287
Market Production	899	11 882	22 384	5 367	2 014	26 443	16 103	42 546
Total	5 981	25 967	37 081	9 790	6 014	38 583	46 250	84 833
Share of Time (%)								
Housework	12.7	32.4	34.2	10.9	9.8	30.0	70.0	100.0
Care	6.6	40.6	38.8	7.5	6.5	18.8	81.2	100.0
For HH members	6.6	44.2	38.1	5.7	5.4	11.2	88.8	100.0
For non-members	6.7	27.8	41.3	13.7	10.5	45.3	54.7	100.0
Household Production	12.0	33.3	34.8	10.5	9.5	28.7	71.3	100.0
Market Production	2.1	27.9	52.6	12.6	4.7	62.2	37.8	100.0
Total	7.0	30.6	43.7	11.5	7.1	45.5	54.5	100.0
Total Value (Rs billions per annum)								
Housework	70.8	182.2	195.4	61.6	55.3	169.5	395.8	565.3
Care	12.0	79.1	70.5	12.3	10.7	27.3	157.3	184.6
For HH members	10.5	71.4	61.0	8.9	8.0	16.9	142.8	159.7
For non-members	1.6	7.6	9.5	3.4	2.7	10.4	14.4	24.8
Household Production	82.9	261.3	265.9	73.9	66.0	196.8	553.1	749.9
Labour Income	1.3	317.6	771.0	241.4	73.7	783.4	621.8	1 405.2
Total	84.2	578.9	1 036.9	315.3	139.7	980.1	1 174.9	2 155.0
Share of Value (%)								
Housework	12.5	32.2	34.6	10.9	9.8	30.0	70.0	100.0
Care	6.5	42.8	38.2	6.6	5.8	14.8	85.2	100.0
For HH members	6.5	44.7	38.2	5.6	5.0	10.6	89.4	100.0
For non-members	6.3	30.7	38.4	13.6	11.0	41.9	58.1	100.0
Household Production	11.0	34.8	35.5	9.9	8.8	26.2	73.8	100.0
Labour Income	0.1	22.6	54.9	17.2	5.2	55.7	44.3	100.0
Total	3.9	26.9	48.1	14.6	6.5	45.5	54.5	100.0
Value Relative to GDP (% of GDP)								
Housework	2.6	6.6	7.1	2.2	2.0	6.2	14.4	20.6
Care	0.4	2.9	2.6	0.4	0.4	1.0	5.7	6.7
For HH members	0.4	2.6	2.2	0.3	0.3	0.6	5.2	5.8
For non-members	0.1	0.3	0.3	0.1	0.1	0.4	0.5	0.9
Household Production	3.0	9.5	9.7	2.7	2.4	7.2	20.1	27.3
Labour Income	0.0	11.6	28.1	8.8	2.7	28.5	22.6	51.1
Population share (%)	*36.4*	*23.4*	*25.4*	*7.6*	*7.2*	*49.1*	*50.9*	*100.0*

Source: Own calculations, based on Statistics South Africa (2011, 2012, 2014); South African Reserve Bank (2018); United Nations (2017).

Note: Figures expressed as share of GDP, which was R946.3 billion in 2000 current prices. Rand values of household production are in 2000 current prices. For household production activities, the age group "Under 18 yrs" refers to 10 to 18 year olds; for market production and population shares, it refers to 0 to 18 year olds.

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