Fiscal redistribution, poverty, and inequality in Botswana

by Lotte Langhoff-Roos TAYLOR - TYLLOT001

University of Cape Town

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To a *motswakwa* - a foreigner - Botswana is baffling, bewildering and beautiful. Blessed with minerals and wildlife, yet burdened by a challenging climate. Amongst Sub-Saharan countries, it is one of the most prosperous, yet its population is reportedly one of the unhappiest. Many Batswana are officially proud though privately reproachful. My studies grew from witnessing these apparent paradoxes in real life.

I am thankful to all who took the time to share their knowledge of Botswana, its economy and policies, in particular to Moffat Malepa, Zelda Okatch, Keith Jefferis, and Montshiwa Montshiwa. It has been an instructive journey, propelled by the encouragement of Professor Ingrid Woolard, Professor Murray Leibbrandt, and Maya Goldman. Along the way, I have gained great respect for those who produce good quality data, allowing for a deeper understanding of a complex world. It has taught me appreciation for those who seek the truth and readily acknowledge problems, and admiration for those who effectively turn visions, plans or strategies into reality. Finding answers to my incessant questions would not have been possible without the patient and persistent support of my husband and children; for this they have my eternal gratitude. Botswana will always have a special place of tenderness and awe in our hearts and minds.

This thesis is my own unaided work, both in concept and execution, and apart from the valuable guidance from my two supervisors, Professor Ingrid Woolard and Professor Murray Leibbrandt, I have received no assistance.

Signed by candidate

Lotte Langhoff-Roos Taylor

Rixensart, Belgium, 17 August 2023

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0 List of acronyms

AIDS	Auto-Immune Deficiency Syndrome
ARV	Anti-Retro Viral
BCWIS	Botswana Core Welfare Indicator Survey
BIDPA	Botswana Institute for Development Policy Analysis
BMTHS	Botswana Multi-Topic Household Survey
bn	billion
BURS	Botswana Unified Revenue Service
BWP	Botswana Pula (the national currency), 1 BWP = 100 thebe
CCT	Conditional Cash Transfer
CEQ	Commitment to Equity
CEQI	Commitment to Equity Institute
CHBC	Community Home Based Care
CIF	cost insurance freight
CoLi	Cost of Living index
COVID-19	Corona Virus Disease -19
CPI	Consumer Price Index
FGP	Fiscal Gains to the Poor
FGT	Foster-Greer-Thorbecke, a grouping of poverty measures
FI	Fiscal Impoverishment
FY	Fiscal Year
GDP	Gross Domestic Product
HDI	Human Development Index
HIES	Household Income and Expenditure Survey
HIV	Human Immunodeficiency Virus
ICP	International Comparison Programme
IMF	International Monetary Fund
IPL	International poverty line
ISPAAD	Integrated Support Programme for Arable Agriculture Development
LIMID	Livestock Management and Infrastructure Development
MLD	Mean Log Deviation
MLGRD	Ministry of Local Government and Rural Development
MoBE	Ministry of Basic Education
MPI	Multi-dimensional Poverty Index
NCP	Non-Contributory Pensions
NCT	Near Cash Transfer
NDP	National Development Plan
NPF	National Petroleum Fund
OAP	Old Age Pension
OVC	Orphans and Vulnerable Children
PDL	Poverty Datum Line(s)
PLHIV	People Living with HIV

PPP	Purchasing Power Parities
SACU	Southern African Customs Union
SAM	Social Accounting Matrix
SUT	Supply and Use Table
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
VAT	value-added tax
VGFP	Vulnerable Groups Feeding Programme
WW2V	World War 2 Veterans

1 Introduction

Over the past centuries, a rich economic literature has emerged on how fiscal redistribution serves efficiency and equity objectives subject to administrative constraints. In Botswana, the government has applied fiscal instruments over the past half a century with the stated intention of eliminating poverty and reducing inequality with a view to achieving prosperity for all. Nevertheless, Botswana is classified amongst the most unequal economies in the world, for instance in the World Inequality Database, and poverty remains persistently high compared to other upper-middle income countries. Publicly available estimates for poverty and inequality vary widely and show ambiguous trends. Depending on the source, the share of population living in extreme poverty is estimated to be 6%, 16% or 27%.[1] This thesis therefore builds on research to determine, according to the most recent survey, the distribution of welfare in Botswana, and how is it evolving. It seeks to establish best estimates for the magnitude and evolution of poverty and inequality, before assessing the impact of fiscal policy interventions. The analysis extends to recent and possible future adjustments of fiscal policy in view of Botswana's objectives of eradicating poverty and achieving shared prosperity.

This main data material for the thesis is the micro data of the most recent 2015/16 survey, Botswana Multi-Topic Household Survey (BMTHS), and its 2009/10 predecessor, Botswana Core Welfare Indicator Survey (BCWIS), supplemented by published administrative data.

In preparation, I provide a brief introduction to Botswana in this Chapter 1, before drawing on vast economic literature in Chapter 2 to set out the analytical framework for evaluating the impact of fiscal redistribution by measuring welfare, poverty, inequality, and analysing fiscal incidence. I refer to the relevant empirical literature and similar analyses in each of the subsequent Chapters of the thesis.

To establish the scope and nature of poverty and inequality challenges in Botswana, I examine the survey data in Chapter 3, focusing on problems encountered and proposed corrections and adjustments to welfare aggregates and official poverty lines. As documentation is not readily available for various corrections to the survey data, both by Statistics Botswana during data processing and subsequently by analysts (in the World Bank and behind the World Inequality Database), this study aims to improve the basis for evidence-based policymaking by identifying and quantifying quality and measurement bias in the data. The data does not allow for fully aligning the welfare measures of the two surveys, so the adjustments proposed rather provide a benchmark for reviewing the national measures of welfare, poverty and inequality and assessing developments going forward.

Based on official estimates and micro data, Chapter 4 examines the central propositions of official reports that (i) welfare did not decrease on average, (ii) inequality did not increase overall, and (iii) poverty has declined. Methodological errors and unexplained adjustments to the survey response data result in ambiguous poverty and inequality trends. In response, I

[1] See section 4.2.3 and Figure 13 for sources and details.

develop welfare measures and adjusted poverty lines, in particular for integrating housing consumption, as contributions to a revised, internally consistent methodology for deriving official poverty and inequality estimates.

In Chapter 5, I analyse the impact of Botswana's fiscal system on poverty and inequality to draw lessons for data-driven policies. Incidence analysis and estimated redistributive effects of fiscal instruments can inform the government in seeking allocative efficiency through distribution-sensitive tax and spending decisions. This thesis both complements and queries the few relevant published studies of the BMTHS survey (Lekobane, 2020; Mookodi, 2021; Seleka & Lekobane, 2020; Sulla et al., 2022). None of these take as comprehensive a view of the impact of both revenue and expenditure on poverty and inequality. Moreover, their findings are afflicted by the data problems analysed in Chapter 3. As a key contribution, the fiscal incidence study provides a set of estimates for the impact on poverty and inequality for 20 fiscal interventions: Direct transfers, personal income tax, indirect taxes and levies, electricity subsidy, and publicly provided health and education services. By applying the methodology developed by the CEQ Institute[2], these estimates are characterised by internal consistency and international comparability.

Since the BMTHS in 2015/16, the evolution in poverty and inequality has been impacted by the COVID-19 pandemic impact and response, and more recently by increasing energy and food commodity prices. In Chapter 6, I summarise how my findings can underpin the policy response and support the national transformational strategy as part of Botswana's Vision 2036. While a new survey will be required for determining how the poor have weathered the storms, having reliable estimates for pre-COVID-19 welfare, poverty, and inequality will be necessary for tracking the recovery and progress towards official objectives. Resulting from the experience gained during the study, recommended actions are set out alongside some reflections on the transferability of the findings.

[2] See https://commitmentoequity.org. The Commitment to Equity (CEQ) Institute at Tulane University works to reduce inequality and poverty through comprehensive and rigorous tax and benefit incidence analysis, and active engagement with the policy community. Building on the seven years of achievements of the CEQ project, the Institute was founded in May 2015 with Professor Nora Lustig as its Director.

1.1 Botswana in brief

Owing to mineral resource extraction (predominantly diamonds), Botswana has been classified as an upper-middle income country since 1997. Largely due to its stable governance, government-financed education, and efforts to contain and treat HIV, Botswana also ranks amongst the best in Sub-Saharan Africa on indices such as the Human Development Index[3] and Corruption Perception Index[4]. Peculiarly, Botswana ranks near the bottom according to the World Happiness Index, 132 of 137, based on average life evaluation over the years 2020-2022. Botswana is regularly credited with responsible macroeconomic policies and sound public finances.[5] Following its graduation to the group of upper middle-income countries, foreign assistance now plays a negligible role.

With a territory comparable to France or Texas, Botswana's population of 2.2 million is scant, relatively urbanised (2/3 live in cities, towns, and urban villages), with a recurrent influx of migrant labour from Zimbabwe. Thanks to publicly funded schooling and school feeding schemes, the enrolment rates are high, and the population is highly literate (87% of the population aged 15 and above in 2013). Public spending on education is thus high, exceeding 6% of GDP (see Section 5.2). The HIV epidemic reduced life expectancy to 50.2 years in 2002, but with successful treatments it recovered to 61.1 years in 2021.

Eradicating poverty and achieving shared prosperity through inclusive growth is the overarching vision for the Government of Botswana (*Vision 2036: Achieving Prosperity For All*), congruent with the main dimensions of the Sustainable Development Goals (SDGs) at the global level. The alignment with the SDGs implies that the authorities can draw on ample analysis and evidence gathered in the multinational development institutions and by various academics and policy institutes. As in the context of the SDGs, the national vision recognises the importance of monitoring the inputs used, the outputs delivered, and the outcomes generated and of evaluating the longer-term impacts of the interventions and the progress towards the goals.

In 2015, Botswana was on track, according to the World Bank[6], to reach its target of eradicating poverty as well as to ensure shared prosperity, while the progress in reducing inequality showed more of a mixed record. Ideally, setting reliable benchmarks, goals and performance indicators presupposes that underlying data is of an adequate quality and that the selected methods are documented and applied rigorously. As the present study shows,

[3] Botswana ranks 117 out of 191, but third in SSA, in the 2021 HDI dataset, https://hdr.undp.org/data-center/human-development-index

[4] Botswana ranked 35 of 180 in the 2022 Corruption Perceptions Index, https://www.transparency.org/en/cpi/2022

[5] In the July 2022 IMF Article IV report, the Executive Board assessed that *"Botswana's economy is one of the few in sub-Saharan Africa where output has recovered to its pre-COVID level. This performance has been underpinned by careful management of mineral resources and a track record of very strong policies and policy frameworks.*" IMF. (2022, 27 July 2022). *IMF Executive Board Concludes 2022 Article IV Consultation with Botswana* https://www.imf.org/en/Publications/CR/Issues/2022/07/25/Botswana-2022-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-521327

[6] In a research report from 2015, the World Bank projected that poverty – as measured by the international poverty line and based on trends in over the previous decade - would be eradicated in Botswana by 2030 (World Bank. (2015). *Botswana Poverty Assessment*. http://hdl.handle.net/10986/23577 p. 47).

such ideal standards are challenging to achieve in practice. Moreover, the study examines the choice of indicators and methods and discusses their underlying normative assumptions.

Given the lack of diversification, Botswana's economy is vulnerable to fluctuation in diamond prices and its agricultural sector suffers from frequent and protracted periods of droughts. This research focuses on the period around 2015-16, which was characterised by a strong contraction in mining and preceded by several years of below average seasonal rainfall. Given the low share of employment in the mining sector and limited spill-over effects (the non-mineral sectors continued to grow), the average household is unlikely to have been strongly affected directly by the slow-down in mining activity. In addition, the Government cushioned the effect of the protracted drought through its financial assistance and in-kind support to agriculture.

Out of a working age (15+) population of 1.6 million, Botswana's labour force is just under 1 million, of which 0.7 million are employed and 0.5 million hold formal sector jobs (Statistics Botswana, 2022) based on the quarterly multi-topic survey for Q4 of 2021. Reflecting a widespread lack of employment opportunities, the youth unemployment rate (amongst the 15 to 35-year-olds) exceeds 34%. Among this age group, nearly 40% are neither in education, employment, nor training (so-called "NEETs"). The state is a dominant employer, with central and local government accounting for 21% of current employment and an additional 7% within the public works scheme (*Ipelegeng*) and 3% in parastatal enterprises. Disregarding the public works scheme, estimated average earnings in the public and parastatal sectors were about 50% higher than average earnings in the private formal sector in December 2018 (Statistics Botswana, 2019).

With a relatively large public sector built up over half a decade (government final consumption averaging 29% of GDP in 2012-2021), Botswana is an interesting case for analysing fiscal redistribution. By adhering to an analytical framework striving for international comparability, the results of the analysis will also be of relevance for other countries, e.g. resource-rich economies undergoing similar structural transformations.

2 Analytical framework and underpinning economic theory

This chapter serves to set out the theoretical underpinnings and the analytical framework, applied in subsequent chapters to empirically evaluate the distribution and redistribution of welfare in Botswana by estimating poverty, measuring inequality, and assessing the impact of fiscal policies.

2.1 Measuring welfare

The difficulties in defining, measuring, and aggregating individual welfare is widely acknowledged in the economic literature (see e.g. Deaton (1997), Ravallion (2015a)). To determine how fiscal redistribution affects the well-being of citizens, I follow the tradition of welfarists, drawing on a model of rational consumers maximising their individual utility, though mindful of its limitations given heterogeneity of individuals.

In an early contribution, using individual income as a proxy for individual welfare, Simons (1938) set out the Schanz-Haig-Simons definition[7] of which elements should enter a money-metric measure for the purpose of fiscal redistribution: *"Income must be quantitative and objective. It must be measurable [...] Moreover, the arbitrary distinctions implicit in one's definition must be reduced to a minimum."* In *"making the best of available materials"*, Simons defines personal income *"as the algebraic sum of (1) the market value of rights exercised in consumption and (2) the change in the value of the store of property rights between the beginning and end of the period in question."* As pointed out by Barr (1987), such an income concept is wide enough to include non-pecuniary benefits from work, own production, imputed rent and capital gains and losses. Meanwhile, it omits many other gains from job satisfaction, non-market production (e.g. care in the home), leisure, and benefits from publicly provided goods and services. Noting that proxies can be identified, for instance for public goods and services, the selected approach for this study relies on a money-metric measure of welfare, commonly referred to as "income". Assuming interpersonal comparability, I analyse the distribution of welfare.

Following the notation of Lambert (2001), we let x_i be the income x of an income unit i amongst a population of N income units. If we assume that such income follows a continuous frequency density distribution $f(x)$ over a very large population N, the total income approaches

$$(1) \quad X = \int_0^m Nxf(x)dx$$

where m is the upper bound, interpreted as "any income level in excess of the highest one actually occurring". Mean income is then derived by $\frac{X}{N}$ as

$$(2) \quad \mu = \int_0^m xf(x)dx$$

[7] The Haig-Simons concept is predated by the work of the legal scholar Georg von Schanz. Referring rather to the Schanz-Haig-Simons concept thus gives due credit and establishes the link to the fiscal incidence debate of the 1890s, see section 2.4 (Schanz, G. (1896). Der einkommensbegriff und die einkommensteuergesetze. *FinanzArchiv/Public Finance Analysis*, *13*(H. 1), 1-87.)

If a distribution function $F(x)$ measures the proportion of income units with incomes of at most x, it can thus be defined as

$$(3) \quad F(x) = \int_0^x f(t)dt$$

Conversely, differentiation reveals the relation between the frequency density distribution and the distribution function as

$$(4) \quad f(x) = F'(x)$$

Further assuming that the income x gives rise to a level of utility $U(x)$, a social welfare function W can be defined evaluating average utility as

$$(5) \quad W = \int_0^m U(x)f(x)dx$$

On the back of the vast literature of conceptualising and measuring welfare, the ambition for practical applications of theoretically sound welfare concepts has given rise to guidelines as those by Deaton and Zaidi (2002) for the World Bank's use of money-metric measures of welfare. They favour consumption over income on account of (i) consumption being smoother and less variable, notably in rural areas reliant on agriculture, which is prone to both seasonal and catastrophic fluctuations, and (ii) consumption data being relatively easier to collect than income data in less developed countries. In favour of income-based welfare measures, the data would be less costly to obtain in industrialised countries dominated by formal employment, which could facilitate analysis of how resources accrue to the individual members of a household. Meanwhile, such resources are commonly shared within the household and the link to individual welfare is thus weak. Household surveys provide a snapshot of current consumption, which could be interpreted as the result of consumption smoothing over an expected lifetime. Relying on income alone would ignore any welfare-enhancing management of assets, whereby households rely on savings, credit, or sale of assets to prop up living standards in times of failing income. For analysis of developments and trends in money-metric poverty and inequality, any consumption-based analysis would benefit from complementary analysis of income and asset developments, notably inter-generational transfers.

As explained by Deaton and Zaidi (2002), in comparing consumption bundles, any money-metric utility measure will be sensitive to the availability of price data to account for spatial differences as well as differences in household preferences. Indeed, "a dollar is NOT a dollar" of the same value to households at different standards of living, and the utility derived could be higher, lower or the same depending on the reference prices it is evaluated at. Other theoretical and practical issues concern (i) the treatment of durable goods and housing, where the value to the user should be inferred and included in the consumption measure; (ii) household composition, whereby analysis based on individual welfare ought to rely on per capita consumption ("equivalence scales" are sometimes used, taking account of age or other demographic factors, e.g. to reflect differences in calorific needs or economies of scale for larger households); (iii) distinguishing between a household's business and its consumption of own produce.

Even though statistical measures are available for purely descriptive welfare analyses, empirical literature is rarely limited to these. For evaluating alternatives according to societal preferences, other measures are applied – explicitly or implicitly - on the basis of a social welfare function such as W aggregating the living standards of all individuals in a population. A set of requirements for such analysis is summarised by Deaton (1997) using the approach pioneered by Atkinson (1970), whereby the social welfare function (such as equation (5)) is commonly subject to the following assumptions:

- W being increasing (for Pareto efficiency) or at least non-decreasing in each of its arguments: In the latter case, focus can stay on the poor, while improvements for the non-poor are ignored.
- W being symmetric or anonymous: What matters is the distribution of welfare levels, rather than who reaches which welfare level.
- W displaying inequality aversion, giving preference to equity: Given quasi-concavity, this is the case of a standard utility function with diminishing marginal utility to the welfare level of each individual. It satisfies Dalton's transfer principle, whereby any transfer from a richer individual to a poorer one will increase social welfare, as long as the richer individual remains richer than the poorer individual.

Going beyond the narrow definitions of utilitarian welfare economics, welfare or well-being is presently often analysed following the capabilities approach of Sen (1985), evaluating poverty as a multi-dimensional deprivation of capabilities to freely function in key dimensions in life. For empirical analysis and policymaking, the capabilities approach has made way for composite measures such as the Multidimensional Poverty Index (MPI) developed by Alkire and Foster (2011) and the Human Development Index (HDI), and it underpins the setting of benchmarks and tracking progress towards the United Nations' Sustainable Development Goals (SDGs). While recognising that such measures capture more of the complexity in assessing living standards, and poverty as a lack thereof, there are several drawbacks with such "mash-up measures" (Ravallion, 2012). The aggregation of deprivation across several dimensions into a single composite index, attaching weights in an explicit but ad-hoc manner, runs the risk of arbitrarily – and unknowingly to the user – establishing implicit trade-offs, such as economic growth vs life expectancy, with large cross-country variations.[8]

Notwithstanding the merits of wider or tailored approaches, the present study focuses on the subset of money-metric measures that can be derived from household surveys, while checking against alternative or supplementary measures where appropriate.

2.2 Measuring poverty

Any distinction between who is poor and who is not has long been subject to criticism concerning its normative nature, its arbitrariness, and being prone to inaccuracies and uncertainty. Additional complications arise when attempting to measure the depth or severity of poverty, tracking developments over time, and comparing across societies (summarised comprehensively by e.g. Atkinson (1983) and Ravallion (2015a)).

[8] Ravallion (2012) calculates how the HDI (released by UNDP in 2010) implies that the value of an extra life-year spans from $0.51 in Zimbabwe to $9,000 in Qatar.

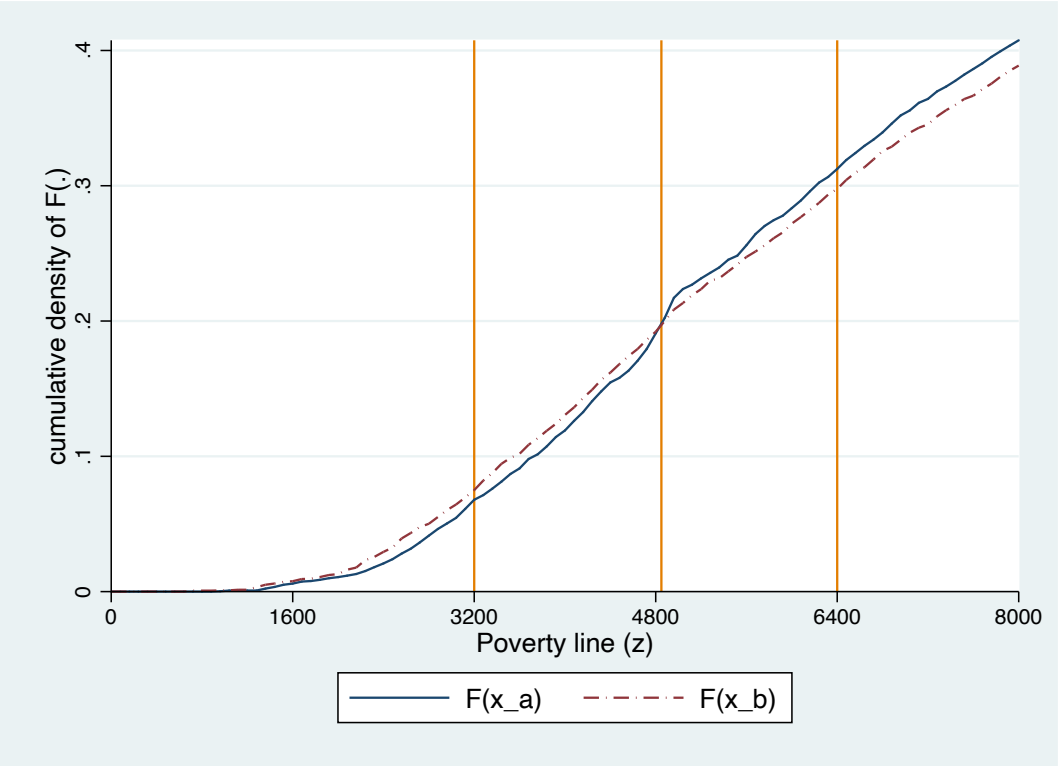
Conceptually, both the level and the structure of a poverty threshold must be determined before poverty can be measured, necessitating an assessment of the critical standard of living or basic needs to be satisfied and of the extent to which the line should be specific to the unit of analysis (individuals or households).

As an absolute poverty threshold, there is a long-standing tradition of defining a basket of goods required, which Allen (2013) has traced back to Sir Frederick Eden's "respectability basket" in *The State of the Poor*, 1797. Since then, the literature on how to draw such poverty lines in both theory and practice has expanded steadily, with consensus emerging in favour of the cost-of-basic-needs approach to the food-energy-intake approach, while emphasising their vulnerability to shifts in demand (Ravallion, 2015a). In a cross-country study, Ravallion et al. (2009) found that national absolute poverty lines tend to be positively correlated with (log) private consumption per capita, although for the poorest countries the relationship is initially flat.

Foster (1998) illustrated the differences between setting an absolute poverty line (with a cut-off, which is prone to becoming outdated, even if price changes are considered) and a relative poverty line (interpreting the critical standard of living as a percentage of, for example, the mean, median or some other quantile). For tracking developments in poverty and comparisons across very different standards of living, Foster hypothesised that the underlying concept is likely to be more important than the specific cut-off. To analyse the sensitivity of the poverty concept, tools such as stochastic dominance conditions can be applied to rankings from poverty lines varying over a certain range (Atkinson, 1987). To illustrate, using the same notation as above, assume two distributions $F(x^a)$ and $F(x^b)$ and a hypothetical poverty line $z \in \mathcal{Z}$. To assess whether the poverty headcount is lower in distribution $F(x^a)$ than in $F(x^b)$, Atkinson determined the restricted form of first-degree stochastic dominance condition as $F(x^a)$ being everywhere below $F(x^b)$ over a specific range of poverty lines. Figure 1 shows the cumulative density functions of $F(x^a)$ and $F(x^b)$ for the two lowest quintiles of the population, against poverty lines in the range $[0\,;\,8{,}000]$. If the set of poverty lines ranges from, for example, 3,200 to 6,400, this condition is not fulfilled as the curves cross around 4,850. Meanwhile, the first-degree stochastic dominance condition is fulfilled in the range below 4,850 and above this value. Conversely, for higher poverty lines the condition for poverty being lower in distribution $F(x^b)$ than in $F(x^a)$ is fulfilled.[9]

[9] Atkinson (1987) also sets out second-degree stochastic dominance conditions to determine whether poverty is deeper in one distribution than another.

Figure 1. Cumulative density functions illustrating stochastic dominance



To assess poverty developments at the global level, the international poverty line (IPL) is established on the basis of national lines in the poorest countries for which such lines are available (Atkinson, 2016). This has proven to be a highly controversial exercise, prone to accusations that analysts and policy advisors are "moving the goal posts" through successive revisions and updates.

The first challenge is to ensure comparability across exchange rates and prices. Through its International Comparison Program (ICP), the UN gathers data to express national currencies in international comparable dollars (taking the US$ as reference country). From 1970 to 2011, eight rounds of data collection have been carried out. A further 2017 PPP revision was completed in May 2020, based on ICP requests for nationally representative price statistics. According to the World Bank's assessment (Jolliffe et al., 2022), the ICP methodology and price data collection was found sufficiently stable, globally, compared with the 2011 revision to allay concerns of "moving the goal posts via the PPPs": (i) The revision relied on the same System of National Accounts (2008 SNA), (ii) the priced basket of goods and services is substantively unchanged, (iii) the same computational steps are used for producing global PPPs, and (iv) the country coverage is shrinking, mainly due to several small Pacific Islands dropping out, but without impacting global results. Due to a lack of documentation, the World Bank does not assess whether the spatial coverage of the nationally representative prices has changed. While the method has been stable in key respects, it is still the case that revisions result in variations which are difficult to disentangle due to the sampling of prices, the choice of goods to sample, the choice of index formula, and from the structure of relative prices in any given year (Deaton, 2016). Transparency is essential for acceptability of the PPPs: Having analysed 18 outlier countries in the 2017 revision, the World Bank documented its adjustment for eight countries, where an average of the official and an imputed PPP is used (Jolliffe et al.,

2022). The case of Nigeria illustrates the magnitude of such an adjustment, "reducing" the poverty estimate by 8 percentage points, corresponding to more than 15 million people, with implications for the regional as well as global estimated poverty head counts. As an approximation between ICP rounds, PPPs are updated using domestic price indices (relative to the numeraire, being the US). For want of a better alternative for comparing similar consumption bundles, this study relies on PPPs for international comparability of money-metric welfare measures[10], while noting the call of Deaton (2016) for humility and caution when using them in analysis and for accepting some scepticism of the measures that depend on them.

Second, the reference poverty lines must be determined. The selection of the international poverty line changed from picking the median of the lowest ten national poverty lines in 1993 to the unweighted mean of the lowest 15 out of 75 available in 2005, and updated lines from the same countries were used in 2011. The choice of approach and selection of countries was subject to continuous debate, which, beyond the critical reliance on PPPs, reflected differing judgements of adequate standards and the extent to which these reflected national preferences, as well as their sensitivity to diverging developments among the reference countries (see Pogge and Reddy (2005), Reddy and Pogge (2002), and Deaton (2010) for critique of the World Bank's approach; Ravallion (2002) and Ferreira et al. (2016), for defence). Adding further criticism that the reference lines being outdated and incomparable, Jolliffe and Prydz (2016) of the World Bank examine an alternative approach by estimating implicit national poverty lines by combining national poverty headcounts from national sources with corresponding consumption and income distributions used for international poverty estimates. Finding a median value of PPP $1.91 based on estimated national poverty lines from all low-income countries (as defined by per capita GNI), this approach provided further support for the 2011 PPP $1.90 IPL for extreme poverty. These computations were updated in February 2022 following the 2017 PPP (Jolliffe et al., 2022), drawing three updated international poverty lines at PPP $2.15, $3.65, and $6.85, based on national poverty rates reported by low-income, lower-middle-income, and upper middle-income countries, respectively. As acknowledged by Jolliffe and Prydz (2016) the approach lacks conceptual foundation and is rather a way of deducing social norms, but nevertheless provides a transparent structure for attempts to accurately measure the magnitude and development in global poverty.

Theoretically, strengths and weaknesses of poverty measures can be evaluated according to an axiomatic approach (Sen, 1976a) concerning, in particular, their *focus*, or ability to ignore any welfare changes to the non-poor; their *monotonicity*, or ability to capture whether a poor person is made worse off; their *transfer* sensitivity, reflecting a positive impact of a transfer from a poor person to an even poorer person (without changing their ranking); *scale invariance*, whereby poverty would be unaffected by a proportional increase in the poverty threshold and measured welfare; and *replication invariance*, whereby poverty would not change due to a multiplying each unit of analysis in the population by the same factor. As computability has become less of a constraint over time, practitioners have many more measures at their disposal. In policy-making, emphasis is still given to measures that offer an

[10] Due to the data availability at the time of drafting the thesis, the analysis is based on 2011 PPPs rather than 2017 PPPs.

intuitive interpretation, but practitioners would be well served by knowing about any inherent biases or sensitivities to outliers (Foster, 1994), and this is the perspective taken in this study.

Simply counting the poor may give a sense of the scale of a poverty challenge, but it would not be invariant to a doubling of the population (replication) and it fails to reflect the severity of poverty (lack of monotonicity and transfer sensitivity). Meanwhile, the headcount ratio is invariant to replication, and, despite its remaining shortfalls, it continues to be the most widespread measure of poverty, as reflected in the targets and indicators of SDG 1 of ending poverty in all its forms everywhere. The (normalised) poverty gap, measuring the mean distance to the poverty line (across the population, zero for non-poor, proportionate to the line), would capture if any of the poor become poorer (monotonicity) but not if it is due to a transfer amongst the poor (transfer sensitivity). The latter would be solved by deriving the squared poverty gap, while noting its normative nature in that this measure gives more weight to the situation of the poorest, reflecting a stronger aversion to poverty. The poverty gap can gain intuitive strength by multiplying it with the poverty line, which can be interpreted as a hypothetical snapshot of the per capita amount required to eradicate poverty, provided perfectly targeted lump-sums were available.

Foster, Greer and Thorbecke elegantly grouped the above within a class of decomposable, distribution-sensitive poverty measures (Foster et al., 1984) which include a parameter α that can be interpreted as an indicator of "poverty aversion". For the headcount, the parameter is zero, but by increasing the value of the parameter more weight is given to the distribution of poverty, hence incorporating inequality amongst the poor. The poverty gap $(\alpha = 1)$ and squared poverty gap $(\alpha = 2)$, measuring the depth and severity of poverty, are commonly used FGT measures. Being additively decomposable, the class of FGT measures' strength is that the contributions of subgroups to the overall poverty measure for a population can be disentangled. Watts (1968) had already developed an index with similar qualities, using logarithmic form, based on which one can derive intuitively pleasing estimates of time needed to eradicate poverty given certain growth assumptions.

Sen (1976a) also sought to capture the intensity of poverty in terms of the number of poor, how poor they are and how their poverty is distributed in an index, but in its initial form failed to respect the transfer principle. Through subsequent modifications by Shorrocks (1995), which Zheng (1997) noted aligned with the findings of Thon (1979), the Sen-Shorrocks-Thon (SST) index is a weighted sum of the (normalised) poverty gaps of the poor, where the weights increase with the distance from the poverty line. While acknowledging that the SST index is not additively decomposable, Xu and Osberg (1999) showed that it is multiplicatively decomposable as the product of the poverty headcount, the poverty gap, and one plus the Gini index of poverty gaps of the population (a measure of the inequality amongst the poor).

The literature on poverty measurement continues to expand, offering theoretical and practical guidance for policy makers and practitioners, including the pitfalls to be avoided. As an example, Batana et al. (2013) demonstrated how estimates of global extreme poverty (using the international poverty line proposed at PPP$1.25 per capita consumption by Ravallion et al. (2009)) imply higher poverty rates for children than adults and elderly. In consequence, they argued, the per capita approach overestimates poverty, and preference

should be given to equivalence scales to take account of diverging needs and economies of scale within each household. In response, Ravallion (2015b) shows the sensitivity of poverty measures to changes in such scales, underlining the need to spell out the reference, how a poverty line is calibrated, how it should be adjusted when comparing different scales, and proposing that such scales be determined in line with the household characteristics amongst those near the poverty line.

2.3 Measuring inequality

Distribution-sensitive poverty measures demonstrate that, conceptually, poverty and inequality are closely intertwined. As an objective measure of distribution, inequality can be described without implicit value judgements, assigning equal weights to all observations, for example by dividing the population into percentiles and comparing income shares, or deriving statistical indices such as the coefficient of variation. Graphically, the Lorenz curve, ranking all income units by welfare measure (consumption or income) and plotting their share of total income, can be considered free of value judgement in so far as relative income differentials are concerned. Again, using the notation of Lambert (2001) for a continuous distribution function $F(x)$ and letting $p \in (0,1)$ denote the position rank of a unit with income y, the Lorenz curve can be drawn as a function of the p-values

$$(6) \quad p = F(y) \Rightarrow L(p) = \int_0^y \frac{xf(x)dx}{\mu}$$

Most prominent amongst distributional measures of inequality is the Gini coefficient, a close relative of the Lorenz curve, graphically corresponding to the area between the Lorenz curve and the perfect equality line as a fraction of the total area under the perfect equality line. Expressed in terms of the Lorenz curve, the Gini coefficient is

$$(7) \quad G = 1 - 2\int_0^1 L(p)dp$$

Atkinson (1970) launched the axiomatic approach to evaluating inequality measures, making way for four main principles (also recognised in poverty analysis): (i) *anonymity*, implying that the measure is unaffected by a reshuffle of names or consumption bundles (assuming a consumption-based welfare measure for ease of reference); (ii) *scale invariance*, implying that the measure is unaffected by any constant scaling up or down of the consumption levels; (iii) *replication invariance*, whereby the measure is unchanged even if the population is cloned, doubling the distribution; (iv) the *transfer principle*, whereby the measure should capture a transfer from a rich to a poorer person, even when rankings remain unchanged, as reducing inequality. As with poverty measures, decomposability is an additional appreciated characteristic. The Gini coefficient respects the four principles but falls short on decomposability. In this sense, Gini is inferior to a class of General Entropy measures with varying weights given to distances between two points at different parts of the distribution. This class includes the Mean Log Deviation (GE0), which is more sensitive to changes in the lower end of the income/wellbeing distribution, and Theil's T-index which is more sensitive to changes in the upper end. Both measures have a lower bound of zero, indicating perfect equality, but theoretically no upper bound, and can be decomposed to identify between- and within-group inequality.

As Atkinson (1970) noted, however, the Gini attaches more weight to transfers affecting middle income classes than those at the ends of the distribution, which is not an obvious characteristic for a social welfare function. It is a common critique that the Gini coefficient fails to distinguish between inequality in wealthy and poor countries, but this follows from the principle of scale invariance. Attempts to distinguish between inequality at different levels of welfare reflect a normative aversion towards inequality in itself. Generalised Lorenz curves, scaled up by the mean of the distribution, are an example of incorporating a social welfare aspect. Similarly, Sen (1976b) proposed a social welfare measure as $W = \mu(1 - G)$, i.e. the product of the mean income and the Gini coefficient's distance from perfect inequality, combining efficiency and equity concerns.

What has become known as Atkinson's inequality index (Atkinson, 1970) measures the gap to perfect inequality from the ratio of the *equally distributed equivalent income* $\xi$to the mean income for a given distribution F, i.e.

$$(8) \quad I_F = 1 - \frac{\xi_F}{\mu_F}$$

Using the notation above, this assumes that for each income distribution F there is an income level ξ_F for which

$$(9) \quad W_F = \int U(x)\, f(x) dx = U(\xi_F), \text{ where } 0 < \xi_F < \mu_F$$

In contrast to statistical measures, Atkinson's inequality index[11] builds on a SWF which trades off mean living standards for equality in the distribution to a degree ε, representing a constant inequality aversion. The constant inequality aversion is required for the Atkinson index to respond only to relative inequality, i.e. being scale invariant. Following the notation of Lambert (2001,p. 98, Theorem 4.2 and accompanying proof): $\frac{\xi_F}{\mu_F}$ is invariant to equal proportionate changes in all incomes, for every distribution F, if and only if there exists an $\varepsilon > 0$ such that $q_U(x) = \varepsilon$ for all $x > 0$; namely if and only if $U(x) \equiv U_\varepsilon(x)$ where $U_\varepsilon(x) = a + b\frac{x^{1-\varepsilon}}{1-\varepsilon}$ if $\varepsilon \neq 1$, and $U_1(x) = a + b \ln x$ and $a, b > 0$ are constants.

A higher ε implies more weight given to inequality at the lower end of the distribution; at 0 all weights are equal, and at the limit of infinity, only the poorest individual matters. Atkinson's index can also be decomposed into between- and within-group contributions but leaves a residual.

Atkinson's SWF-based measure thus provides a tool for measuring inequality, whereby an estimate of the "social cost of inequality" stemming from an unequal distribution can be inferred for a given societal aversion to inequality.

Different approaches have been pursued to determine or estimate such inequality aversion, generating wide ranging estimates. Delving into the trade-off between efficiency and equity, Okun (2015) designed the "Leaky Bucket experiment" (first published in 1975) to reveal the

[11] As recounted by Lambert (2001), the measure was first proposed as a measure of "relative injustice per dollar of social income" by Kolm, C. S. (1969). The Optimal Production of Social Justice', in Margolis, J. and Guitton, H., eds., Public Economics, London, Macmillan.

acceptable "leakage" in achieving a more equal distribution. Respondents are requested to reveal their preferences between alternative transfer schemes, where a share of the transfer is lost (or leaked) e.g. due to administrative costs. Several experiments at individual level have followed Okun's "Leaky Bucket" approach, initially on students. Amiel et al. (1999) asked students in Australia and Israel to consider alternative transfer schemes (all above poverty levels) and derived estimates for ε of 0.1 - 0.2, significantly lower than what is commonly assumed. Carlsson et al. (2005) found estimates ten times higher using a similar questionnaire-experimental approach in Sweden, estimating individual risk aversion an inequality aversion separately. Using representative survey data instead of the experimental approach, Pirttilä and Uusitalo (2010) established that respondents evaluating alternative distributions or alternative tax/transfer schemes resulted in widely diverging estimates. "Leaky bucket" questions indicated $\varepsilon < 0.5$ while a comparison of distributions resulting from wage negotiations suggested a median $\varepsilon > 3$.

At the societal level, an implicit inequality aversion of policymakers can be inferred from the tax- or tax-and-transfer-systems in place. Studying a subset of the population in 17 countries, Bargain et al. (2014) found that implicit parameters for social inequality aversion among childless single individuals, taking account of country-specific differences in labour supply elasticity, suggested parameter values well below 1 in the USA and Southern European countries, while the estimates for Belgium, Denmark, and Sweden approached or exceeded 2.

Lambert et al. (2003) hypothesise that fiscal systems are designed to reflect the same "natural" tolerance of inequality measured by the Atkinson index, such that observed inequality - measured by the Gini coefficient - would reflect inherent differences in inequality aversion. Finding support for this hypothesis, they examine possible explanatory factors determining such differences. Higher inequality aversion is correlated with higher and stable per capita income, and better representation of women in economic activity and in government and. Meanwhile, high population growth and higher spending on public education are correlated with lower inequality aversion.

As Gaspar et al. (2017) conclude concerning inequality aversion estimates, "*the reasons why different approaches yield different coefficients are not fully understood, but may have to do with respondents' inconsistencies across different exercises, political systems' inability to deliver policies in line with citizens' preferences, or overly stringent assumptions regarding the shape of the social welfare function.*"

In the absence of a wider consensus on the specification of a global SWF and with wide-ranging estimated values for inequality aversion parameters, no single international standard has emerged for these inequality measures but rather recommendations to use several indicators across multiple dimensions. The Gini coefficient is most widely cited. It is, however, not amongst indicators selected to track progress towards SDG10 to "Reduce inequality within and among countries". Instead, for the lead Target 10.1 to " By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population that is higher than the national average", progress is tracked using "shared prosperity indicators", including "*growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population*" and "*the proportion of people living below 50 per*

cent of median income, by sex, age and persons with disabilities".[12] Fukuda-Parr (2019) researched the negotiations which led to the choice of the target and indicators. Acknowledging that progress on these fronts could lead to a more even distribution of income within a country and would create incentives to adopt policies for pro-poor growth, she stresses that they are not outcome measures of inequality or distribution of income and wealth, but respond rather to a goal for reducing poverty. Moreover, as recognised by UNSTATS and the World Bank (UNSTATS, 2023), such indicators are limited by data availability and quality: They require two reasonably comparable surveys, in terms of survey design and welfare aggregates, to be carried out within a period of around five years.

2.4 Fiscal incidence and redistribution

Fiscal incidence theory springs from the long-held notion that those who pay a tax are not necessarily the ones who bear the burden, and the beneficiaries of public expenditure are not necessarily those who were intended to be. Musgrave (1985) traces fiscal incidence discussions back to the 17th century and reviews how the view of the Physiocrats (claiming that the burden of any tax would fall on landowners) was replaced by classical incidence analysis of Smith and Ricardo, refined by Jenkin and Walras, to reveal the complexity of determining incidence depending on the conditions of demand and supply in specific markets. As an early example of interest in distributional effects, quoted by Atkinson and Stiglitz (2015), Roseveare (1973) reported on an early assessment by W.S. Jevons in 1876, comparing the impact of taxes on typical families. The estimated tax-to-expenditure shares revealed a higher effective average tax rate for low-expenditure families than for high-expenditure families.

From around 1880, Austrian, French, German, Swedish and Italian writers engaged in a debate of how best to allocate resources between the private sector and the state, along with mechanisms to raise the corresponding funds. Wicksell's "Finanztheoretische Untersuchungen" (Inquiries in Public Finance) contained a first part on tax incidence, "Zur Lehre von der Steuerincidenz", first published in 1895 (Wicksell, 1895). It summarized the work of contemporary economists (notably Marshall and Cournot) and set out a coherent analytical framework (for economies with monopoly rents, free competition, factor incomes including land rent, free trade, and differentiated taxation) as foundations for "A New Principle on Just Taxation", its second part, published in 1896. Amongst Wicksell's propositions was the analytical separation of public expenditure from the sources of funding, by which the incidence of alternative taxes, raising the same amount of revenue, should be compared for a set budget, which would reflect the provision of public goods, maximising individual satisfaction. His proposition for a decision-rule was to determine public finances by unanimity, or as close to it as feasible, voting across bundles of options combining a complete set of budgets and tax shares.

During the same period, writers in the English tradition set aside the question of determining public expenditure and focused on how to practically design taxation according to a principle of ability-to-pay (Musgrave & Peacock, 1967), more specifically the relative merits of regressive, proportional, or progressive taxation. Optimal taxation theory evolved with key contributions of Pigou in 1920 (Pigou & Aslanbeigui, 2017) conceptualising externality-

[12] https://sdg-tracker.org/inequality

correcting taxes or subsidies, Ramsey (1927) providing efficiency arguments against uniform tax rates, further developed by Harberger (1962) by expanding the analysis from partial to a general equilibrium context.

In response to the growing literature on taxation, Samuelson (1954) quipped with "The pure theory of public expenditure", harking back to Wicksell's concern about "free-riders" which would prevent even a community of persons *"indoctrinated to behave like a "parametric decentralized bureaucrat""* from determining the optimal provision of public goods and services. Revealed preferences, Samuelson argued, be it in questionnaires or through other devices, would be overruled by selfish interests, leaving *"the problem raised by public expenditure"* for political economy and related domains. Nevertheless, based on Lindahl's distributive mechanism (Lindahl, 1958), Bergstrom (1970) maintained that a "Scandinavian Consensus" solution for efficient income distribution among non-malevolent consumers exists, yet *"the informational requirements for the operation of such a mechanism would be truly formidable".*

Diamond and Mirrlees brought together the theories of taxation, public production, and welfare economics, deriving conditions under which production efficiency is desirable followed by optimality rules for public consumption and taxes on goods and income (Diamond & Mirrlees, 1971a, 1971b). In the rapidly growing public finance literature, the Lectures on Public Finance of Atkinson and Stiglitz (2015) first published in 1980 still provide a solid basis for analysing fiscal redistribution, while acknowledging - as in the 2015 introduction by the authors - the exploding research in empirical public finance, driven by data and computing capability, as well as the theoretical advances and empirical findings concerning inequality and redistribution since its first edition.[13] In examining the relationship between vertical equity (based on the ability-to-pay or equal-sacrifice principles) and horizontal equity (individuals who are identical - in all relevant senses - should be treated identically), several constraints apply to the range of government instruments, leaving policy design as a choice amongst instruments in a second-best setting. In recognition of such constraints, much of the economic literature on normative analysis shifted focus from optimizing social welfare to analysing welfare improvements attainable through redistribution.

Reynolds and Smolensky (1977) relied on the Gini coefficient for their index in analysing tax-induced shifts in distributions over time, while duly noting outstanding statistical and measurement issues and sensitivity to incidence assumptions. In the notation of Lambert (2001), the Reynolds-Smolensky index - in the absence of reranking - is derived as

$$(10) \quad \Pi^{RS} = 2\int_0^1 [L_{X-T}(p) - L_X(p)]\mathrm{d}p = G_X - C_{X-T}$$

where L_X, L_{X-T} are the Lorenz curves of pre- and post-tax income, respectively, and C_{X-T} is the concentration coefficient for post-tax income. The absence of re-ranking presupposes that the application of a tax does not change the ordering of the taxable units, as is the case for lump-sum, linear or piecewise linear taxes, but not for schemes with elements that introduce horizontal inequity, e.g. where the taxation of a household depends on marital status or the number of children. This measure of redistributive power across an entire

[13] The empirical fiscal incidence study pursued here draws notably on Lectures 6-7, 9 and 12-14 of Atkinson and Stiglitz (1980).

population, can be decomposed into two components of progressivity and size, and into single tax components in the case of several taxes. Without re-ranking, the Reynold-Smolensky index can illustrate that the redistributive effect of a progressive tax can be increased by raising its tax ratio or by making it more progressive. In the case of a regressive tax, either making the tax less regressive or lowering the tax ratio will make its effect less unequalizing.

Kakwani (1977) proposed to measure effective progressivity in terms of deviation from a proportional tax. With the Lorenz curve of a flat tax being congruent with the Lorenz curve of pre-tax income, L_X, Kakwani's index measures (twice) the difference between the Lorenz curves of a tax and its equal-yield flat tax, namely

$$(11) \quad \Pi^K = 2\int_0^1 [L_X(p) - L_T(p)]\mathrm{d}p = C_T - G_X$$

Further, he illustrated how, Π_{RS} can be decomposed into a rate component and the Kakwani index, in the absence of re-ranking

$$(12) \quad \Pi_{RS} = \frac{g}{1-g}\Pi_K$$

where $g = \frac{T}{X}$ is the total tax ratio, which can be interpreted as the *"policy parameter"*.

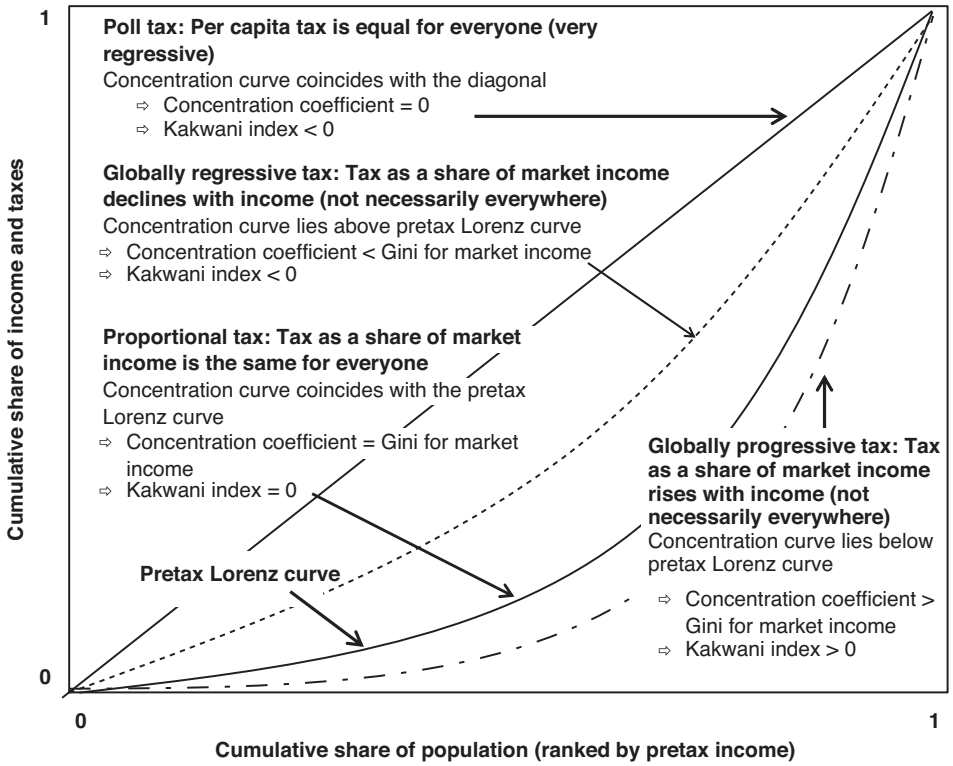
Moreover, Kakwani (1986) was the first to derive the necessary correction to these indices in the presence of re-ranking, i.e. when a tax system is characterised by horizontal inequity implying different tax burdens for people with identical pre-tax income.

$$(13) \quad \Pi_{RS} = \frac{g}{1-g}\Pi_K + R$$

where the re-ranking correction $R = G_{X-T} - C_{X-T} \geq 0$ measures the difference between the Gini and concentration coefficient of post-tax income.

Figure 2 summarises graphically how concentration curves of regressive, proportional, or progressive taxes differ from the pre-tax Lorenz curve along with their corresponding concentration coefficients and Kakwani indices.

Figure 2. Lorenz and concentration curves, Kakwani index



Source: As presented by Enami et al. (2018) in Lustig (2018)

For evaluating the redistribution generated in a fiscal system comprising both taxes and benefits, this study relies on the definitions by Lambert (2001) of its net redistributive effect. Characterised by Lustig (2018), as the "fundamental equation of the redistributive effect" of a fiscal system:

$$(14) \quad RE_n = \frac{(1-g)RE_t + (1+b)RE_b}{1-g+b}$$

where $g = \frac{T}{X}$, $b = \frac{B}{X}$ are the ratios of total taxes and benefits to total pre-fiscal income and $RE_t, RE_b\ RE_n$ are the redistributive effects for taxes, benefits, and the net fiscal system, respectively. In Lambert's notation above, the redistributive effects measured by the Reynolds-Smolensky indices, in the absence of horizontal inequity (reranking), reduces to the weighted average of the differences in Gini coefficients the respective pre- and post-fiscal interventions. It allows for simultaneously evaluating multiple taxes and benefits, going beyond the singular impact of a specific fiscal instrument, whether progressive, neutral, or regressive.

Enami et al. (2018) draw on Lambert (2001) and Duclos and Araar (2006) to examine the characteristics of fiscal instruments within a fiscal system which reduces income inequality. Rearranging the equation to find the condition for a positive net redistributive effect of a fiscal system it appears that

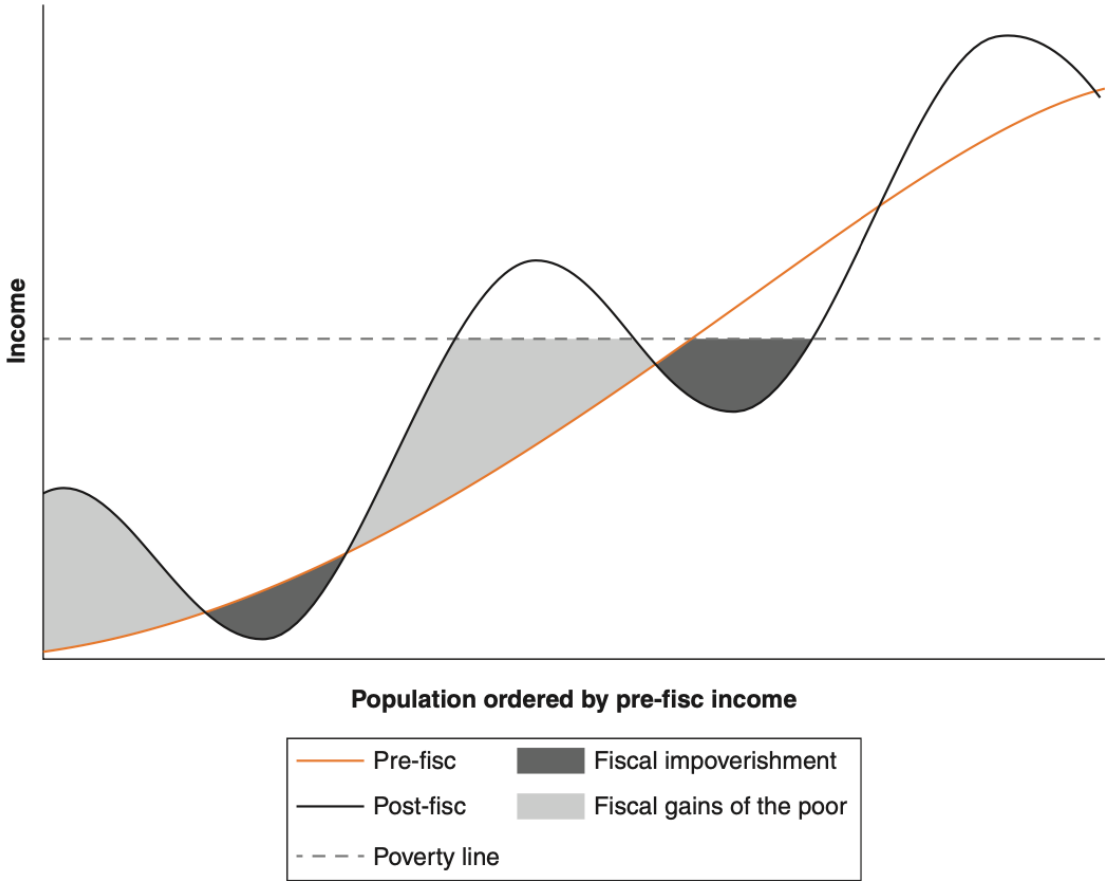
$$(15) \quad RE_n > 0 \Leftrightarrow RE_t > -\frac{1+b}{1-g} RE_b$$

A fiscal system can thus be equalising even when taxes lead to higher inequality ($RE_t < 0$), provided the equalising effect of transfers, for given tax and benefit ratios, outweigh the impact of such taxes ($RE_b > -\frac{1-g}{1+b} RE_t$).

If there is reranking, the link between the progressivity and size of a tax and its redistributive effect is no longer straightforward, and thus comparisons are no longer straightforward either. Moreover, when more than one fiscal instrument is in use, the relation between the size and progressivity of a fiscal intervention and its redistributive effect becomes more complex, at times running counter to common intuition. The so-called *Lambert's conundrum* (Lambert, 2001, p. 278) depicts how a fiscal system that includes a regressive tax can be more equalizing than a system that excludes it. As Lambert illustrates with a hypothetical example, if taxes are regressive in relation to the original income, but progressive with respect to the less unequally distributed post-transfers (and subsidies) income, regressive taxes exert an equalizing effect over and above the effect of progressive transfers. Empirically, this proves particularly relevant when evaluating indirect taxes: Enami et al. (2022) find that roughly 25 percent of their sample (of 87 studies covering 39 countries) show sign-inconsistency in the sense that regressive indirect taxes, based on the Kakwani index, are equalizing (measured by their positive marginal contribution to reducing inequality).

In addition to those falling into poverty due to the fiscal impact (that is, pre-fiscal non-poor becoming post-fiscal poor), some poor may become poorer as they pay more in taxes than they receive in transfers and subsidies. Conversely, some pre-fiscal poor may remain post-fiscal poor but have received more in transfers and subsidies than they have paid in taxes. To assess such movements, Higgins and Lustig (2016) derive a set of axiomatic measures for Fiscal Impoverishment (FI) and Fiscal Gains to the Poor (FGP), which complement existing measures of poverty, horizontal equity and progressivity. Using the same notation as above, an individual who is fiscally impoverished, for a given poverty line $z \in \mathcal{Z}$, is characterised by post-fiscal and pre-fiscal income (x_i^1, x_i^0), where $x_i^1 < x_i^0 \; and \; x_i^1 < z$. A fiscal system is then characterised by fiscal impoverishment if this is the case for some individual $i \in \mathrm{N}$. Fiscal gains to the poor occur if where $x_i^0 < x_i^1 \; and \; x_i^0 < z$ for some individual $i \in \mathrm{N}$, which reflects that the poor individual main gain although not being lifted out of poverty. The intuitive interpretation of these concepts is helped by a stylised, visual representation in Figure 3 below, where z is the dashed line, x^0 is the vector of pre-fiscal income.

Figure 3. Illustration of fiscal impoverishment and fiscal gains to the poor



Source: Higgins and Lustig (2016)

The extent of FI and FGP can be illustrated by the share of impoverished or gaining individuals of the entire population or of the post-fiscal poor as well as the value of gains and losses in per capita terms, normalised by the poverty line. For comparison across countries or over time, the combined losses and gains can be evaluated by expressing FI in % of FGP.

Recent and ongoing work serves to refine measures of redistributive efficiency, benefiting from the increasing availability and completeness of microdata, notably amongst upper and upper-middle income countries (e.g. Mantovani (2018)).

In practice, fiscal incidence analysis compounds the challenges in measuring welfare (be it by income or consumption) by the difficulties of allocating taxes and benefits according to their incidence. The Commitment to Equity (CEQ) Institute have set out a detailed methodology to facilitate international and intertemporal comparative analysis of government interventions impacting poverty and inequality. With grant funding and through collaboration with the World Bank, IMF and others, a comprehensive handbook (Lustig, 2018), tools, analyses, and data are made available via a website (http://www.commitmentoequity.org/). The methodology follows an accounting approach, using micro data (household surveys or similar) and administrative data (national accounts and other administrative documentation) to account for the impact on a population of government fiscal interventions such as transfers (cash or in-kind), subsidies, direct and indirect taxes, benefits of public health and education services and more. The aim is to shed light on fiscal policy questions concerning the extent of

income redistribution and poverty reduction being accomplished through fiscal policy, the equalizing and pro-poor impact of specific taxes and categories of government spending, and the effectiveness of taxes and government spending in reducing inequality and poverty. The methodology also offers tools to evaluate the impact of fiscal reforms that change the size and/or progressivity of a particular tax or benefit. The CEQ methodology provides structure (and hence rigour) to fiscal incidence analysis, paying special attention to prevailing issues in low- and middle-income countries.

To evaluate the impact of fiscal policy – in total and for specific interventions – the CEQ approach is to work out how welfare is distributed across the population using income concepts that take no, some, or as many fiscal interventions as possible into account. Depending on the data available, these concepts can be derived using income or consumption as point of departure. For an income-based approach, the distribution of market income is considered the pre-fiscal income, and the other income concepts are derived by subtracting direct taxes (for net market income), adding direct transfers (for gross income), combining direct taxes and transfers (for disposable income), subtracting indirect taxes, and adding subsidies (for consumable income), and ending up by adding the value of in-kind benefits for the final income concept.

In countries with contributory social security pension schemes, an important distinction must be made in considering such pension benefits as either government transfers (in which case pension contributions are considered along with direct taxes) or as deferred income (in which case the pre-fiscal income includes benefits, part of market income, while pension contributions are deducted) explained in detail in the CEQ Handbook (Lustig, 2018).

Several limitations of the CEQ approach are easily identified. In taking a static view, behavioural responses and intertemporal effects (such as return on investment in public education) are not captured, thus ignoring the distribution of initial endowments as well as life-time and intergenerational redistribution. All spending and revenue cannot be accounted for, as certain categories of taxes and spending cannot be meaningfully allocated to individuals or households. In consequence, public spending on notably infrastructure, national security and justice systems is excluded, along with revenue from corporate sources. The quality of the analysis depends on the quality of the data available, whereby indirect effects of indirect taxes on fiscal incidence and the role of the informal sector are particularly challenging systemic features to take account of. Similarly, data is often inadequate to factor in differences in the quality of public services (in education, health care) and effectiveness of the public administration to reflect the value reaching the beneficiary in the end.

By convention, the CEQ approach uses per capita values (without applying adult equivalence scales), thus focusing on "an average member" of each household, determined by household size but generally ignoring intra-household redistribution. As the methodology has been continuously finetuned in response to findings, the CEQ handbook and the CEQ Data Centre offer a more complete view of the merits and limitations of the approach.

2.5 The methodological approach of the thesis

For examining fiscal redistribution in Botswana, the analytical framework of this thesis consists of analysing a money-metric welfare distribution, approximated by responses to the most recent household survey, using the established measures and tools presented above.

Based on a specified welfare concept, the welfare distribution is evaluated by comparing Lorenz curves. Applying national and international poverty lines, poverty is measured using Foster-Greer-Thorbecke, Watts, and Sen-Shorrocks-Thon indices. To evaluate inequality, I focus on the Gini coefficient and the Atkinson index, complemented by the Theil index and Mean Log Deviation.

Fiscal redistribution is subsequently analysed empirically by accounting for the incidence of taxes, transfers and benefits using the CEQ methodology, aiming for international comparability of estimates. This allows for evaluating distributions according to several income concepts, considering a single fiscal tool or several, to assess the impact of fiscal interventions on poverty and inequality, measured by their estimated poverty-reducing or -increasing impact on poverty rates and inequality-reducing or -increasing impact on Gini coefficients. Estimates are also derived for fiscal impoverishment and fiscal gains of the poor.

As the specification of the welfare concept is the analytical starting point, the empirical data is reviewed in Chapter 3 ahead of the evaluation of poverty and inequality depending on this concept.

3 Addressing Botswana's survey-based data challenges

Updated estimates for poverty and inequality are useful for tracking progress towards objectives, and policy makers as well as poor and vulnerable groups in the population are keen to track changes in poverty, notably whether population groups are escaping or falling (back) into poverty. In this context, policy makers may need to be reminded that the choice of concepts and measures can change the policy conclusions drawn, and thus necessitates debate of both data quality and methodology, including characterisation of the underlying social welfare function. Both aspects were examined by the World Bank initiated Commission on Global Poverty, chaired by Sir Anthony Atkinson, resulting in a report on *Monitoring Global Poverty* (Atkinson, 2016). Across the 21 recommendations for improved monitoring, is a general call for establishing a robust methodology, keeping it relatively stable over time to ensure maximum comparability, while taking account of local developments, and acknowledging the margin of error that surrounds any estimate.

Much of the work in determining the impact of fiscal policy on inequality and poverty in Botswana lies in gathering and examining the necessary data. In the process, some significant data problems have been detected, notably in the treatment of food and housing consumption as well as in-kind transfers and in the poverty lines applied. Some data anomalies can be of minor importance, but in unfortunate cases, errors can affect the poverty profile and thus alter policy implications significantly. For an internally consistent methodology, the following subsections outline some corrections and adjustments to establish benchmarks to help track developments over time.

Botswana's statistical authorities conducted surveys of household income and expenditure (HIES) in 1985/86, 1993/94, and 2002/03, before expanding to encompass core welfare indicators (BCWIS) in 2009/10 and most recently, in 2015/16, a multi-topic household survey (BMTHS).[14] Table 1 presents the two most recent surveys from which the micro data has been used for this thesis.[15]

[14] Statistics Botswana aims to make the microdata of the surveys accessible via their website (http://botswana.microdatahub.com/index.php/catalog), but in my case the data was shared physically via USB keys. The data was shared based on the research permit granted (and extended) by the Office of the President for the purposes of studying fiscal redistribution in Botswana.

[15] Those surveys relied on previous censuses for defining the enumeration areas. The most recent preliminary 2022 census data is not used in the analysis.

Table 1. Overview of the surveys used

	Botswana Core Welfare Indicator Survey	Botswana Multi-Topic Household Survey
Survey period	April 2009 - March 2010	November 2015 - October 2016
Acronym	BCWIS	BMTHS
Sampled households	7,732	7,060
Sampled members	27,219	24,720
Population estimate	1,874,865	2,073,675
Household consumption data sources (*)	Diary data (for one month, own produce for one week) and expenditure (major) for past 12 months, regular monthly payments	Diary data (14 days) and expenditure questionnaire for past 7 days and 12 months

Source: Main reports, questionnaires and survey data (Statistics Botswana, 2013, 2018b)
Note: For BCWIS, data processing was partly outsourced to Partly outsourced to RPC Data Ltd., including design of data capturing system, supervision of data entry, consolidation of data sets and production of key tables upon completion of data cleaning.

Statistics Botswana proceeded to use the BMTHS and other data sources for rebasing GDP to 2016 (Statistics Botswana, 2021). Of relevance to this study, the exercise downsized Botswana's GDP, notably household consumption expenditure, and established the first Supply and Use Table to ensure consistency of more detailed sectoral national accounts estimates, and between the output and expenditure approaches to the calculation of GDP. Government output and expenditure now account for larger shares than previously estimated, underlining the dominant role of the public sector as employer and service provider.

While survey data on income is collected and analysed by Statistics Botswana, a consumption aggregate is favoured by both the Government of Botswana and international organisations (e.g. World Bank, UNDP, IMF) based on the argument that income data is less reliable and systematically underreported notably at the top-end of the scale. Meanwhile, consumption surveys are burdensome for the respondents, and some may underreport in the hope that it can trigger social benefits. Warning flags were raised already during the collection of the BMTHS data, as Statistics Botswana hosted a press conference (22/03/2016) highlighting setbacks in the form of *"refusals, particularly in high income neighbourhoods"; "underreporting of income, expenditure and consumption"*; and *"households do not report consumption of food provided at work"* (Statistics Botswana, 2016). Notwithstanding the data collection difficulties, it has also not been possible to access sufficiently detailed documentation of the methods used to derive Statistics Botswana's consumption welfare aggregate.[16]

[16] In addition to the micro data, Statistics Botswana shared the BMTHS questionnaire and the Classification of Individual Consumption according to Purpose (COICOP) codes, but no codebook, list of variables or similar. I was not informed of any consultants being involved, but the World Bank is thanked for providing technical support during the different phases of the survey (Statistics Botswana. (2018b). *Botswana Multi-Topic Household Survey Report 2016/16*.

Based on the development in economic activity, both BCWIS and BMTHS were carried out in periods of volatility, reflecting developments in mining. For BCWIS, the global financial crisis weakened the diamond market leading to a severe contraction in GDP by -7.7% in 2009, recovering to 8.6% the following year. Similarly, for BMTHS, a contraction was recorded in 2015 (-5.7%) due to a severe slump in mining activities, followed by a rebound in 2016 (7.0%). Statistics Botswana released updated, rebased GDP statistics on 21 July 2021 covering the period 2014-2020. Rebased figures for previous years are expected to follow. The GDP growth figures for 2009-10 are thus not directly comparable with figures for 2015-16. Based on the historic data (with 2006 as base year), annual growth in GDP per capita averaged 2.8% over the period of the two surveys. However, as formal sector employment was increasing throughout the survey period (Statistics Botswana, 2019), the volatility in GDP growth is unlikely to have been reflected strongly at the level of the household. The macroeconomic context is therefore assumed not to have affected the representative qualities of the survey data. Data analysis shows, however, that data collection and processing has been challenging and that the data sets give rise to several questions affecting the estimates of welfare, poverty, and inequality.

From figures in its most recent publications, the World Bank refers to the same surveys (BMTHS and BCWIS) but use an amended welfare aggregate, different from the official one.[17] Statistics Botswana, meanwhile, continue to refer to estimates based on the original official aggregates. The alternative welfare aggregate elaborated in Section 3.1 below is a contribution to ongoing or future revisions of the official welfare aggregate and aims to support policy makers in reviewing the implications thereof. In consequence, the detailed analysis of fiscal tools in Chapter 5 will focus on the alternative aggregate for international comparability.

3.1 Botswana's welfare aggregate

Botswana's consumption aggregate is unchanged according to the survey reports (Statistics Botswana, 2013, 2018b), and *total consumption* is thus derived by adding *total consumption expenditure* (cash and in-kind), *aid* (goods received under Government programmes and from other institutions), *wages in kind* (goods received in lieu of wages and costs of goods, services, utilities paid by the employer), *gifts received* net of *gifts given out, own produce consumed* (including goods acquired by hunting, fishing, gathering and rearing, and services generated and used), and *school meals* (from the Government's school feeding programme in primary and secondary schools). The consumption aggregate is thus wider than what the survey recorded through diaries and questionnaires as consumption expenditure. The World Bank (2015) recommended that Botswana applies a standard Deaton and Zaidi (2002) methodology for consumption aggregation. During the research, attempts were made to solicit documentation from Statistics Botswana concerning the consumption aggregate, but this was not made available and no referral was offered to any consultants that may have been involved. Hence, it is difficult to verify to what extent the methodology was applied. Documentation would be useful in particular concerning the calculation of housing costs, own

[17] This amended welfare aggregate, or the code to derive it, has not been made available. The World Bank senior poverty economist Carolina Diaz-Bonilla confirmed via e-mail (2022/05/22) that Statistics Botswana had accepted a revised consumption aggregate which the World Bank team had prepared.

produce, gifts, car purchases, prices (notably accounting for spatial differences), and any omissions/imputations/predictions, e.g. correction for top-incomes.

Table 2 below summarizes the consumption-based welfare measures reported in the two surveys. For comparability, the BCWIS data is inflated to 2016 price levels using the Consumer Price Index (CPI). During these studies, Statistics Botswana revised its Consumer Price Index based on a basket of 400 items derived from the BMTHS responses, but the time series have not yet been released covering the full period from 2009-16, so the CPI reported to IMF is used. Average annual growth rates compare the BMTHS data with the BCWIS (CPI) over the six-year period between the two surveys.

Table 2. Survey consumption aggregates and averages

	BCWIS (2009/10)	BCWIS (new CPI, 2016)	BMTHS (2015/16)	Average annual change
Annual totals, million BWP				
Total consumption	25,428	34,740	30,360	-2.2%
- of which				
Total cash expenditure	19,798	27,049	27,757	0.4%
Wages in kind	626	855	262	-17.9%
Own produce consumed	2,063	2,819	480	-25.5%
Food gifts received	1,832	2,503	584	-21.5%
School meals	836	1,143	668	-8.6%
Government aid in kind	272	372	328	-2.1%
Government and private aid, education	-		240	-
Total aid	272	372	568	7.3%
Average consumption, BWP per month				
Total consumption per household	3,912	5,345	4,290	-3.6%
Total consumption per capita	1,835	2,507	1,879	-4.7%
Cash expenditure per household	3,046	4,161	3,927	-1.0%
Cash expenditure per capita	1,421	1,942	1,759	-1.6%

Notes: Own produce consumed includes livestock and crops. The CPI reported to IMF for 2016 is 136.62 with 2010=100. Annual average change calculated as the geometric growth rate over the six-year period.

The survey data suggest that consumption has become more market-based, with households recording a slight real increase in cash expenditure, whereas in-kind consumption is much lower. Meanwhile, the average Motswana appears to have lower consumption in real terms, even in terms of cash expenditure.

Survey-based consumption aggregates are commonly not congruent with household consumption as reported in National Accounts for multiple reasons (Deaton, 2005), including limitations in the coverage of the surveys (non-response by richer households, omitting institutions and certain geographical areas) and differences in definitions and imputation

methods (e.g. for rents). For Botswana, comparison over time is further complicated by the update and rebasing of national accounts: For the BMTHS survey period (2015Q4-2016Q3), the revision adjusted total household final consumption by -16.9% and GDP by -4.1%. Statistics Botswana have not released revised data for the BCWIS survey period but based on the data in the World Bank Development Indicators database, real growth in household final consumption per capita averaged 2.5% between 2010 and 2016.

The total consumption aggregate in the BMTHS 2015/16 is estimated at BWP 30 bn, i.e. merely 45% of total household final consumption (BWP 66 bn in 2015Q4-2016Q3). The share captured in the survey was significantly higher in BCWIS, reported as BWP 25 bn (or 68%) compared to the national accounts record of BWP 37 bn during the BCWIS survey period.[18]

This discrepancy vis-à-vis national accounts is much larger than in average surveys, in particular compared with other surveys in Sub-Saharan Africa (see Deaton (2005)). For comparison over time, the deviations in the aggregates the two sets of survey data thus raise some concerns.[19]

3.1.1 Food

Based on households' cash expenditure in BCWIS 2009/10 and BMTHS 2015/16, Statistics Botswana report that average expenditure on food, alcohol, and tobacco as well as the corresponding expenditure shares have decreased, nationally, and in all strata (Statistics Botswana, 2018b, p. 83). Food purchases accounting for 12.8% of consumer expenditure (and 3.6% spent on alcohol and tobacco) would indicate that Botswana has the lowest food share in Africa (well below South Africa at 19%), on par with high-income countries in Europe.[20] From the BMTHS data, it appears that consumption expenditure collected in diaries have not regularly been scaled up to monthly amounts, in which case food consumption is underestimated by 54% (with 14 days representing 46% of the average month (365/12)). Moreover, irrespective of the diary data recorded and the composition of the household, from reviewing the micro data it appears that food consumption is "bottom-coded", i.e., recorded at a fixed minimum value, although varying across locations. This leads to a standardisation of the value of food consumption, independent of household size, for more than 60% of households (4,266 out of 7,060).

In consequence, the food sub-aggregate appears to be underestimated and more evenly distributed than the data reported in the survey would suggest. Comparing Statistics Botswana's values for food consumption in the data set with the national poverty datum lines, the method of bottom-coding excludes, by definition, poverty for more than 15% of sampled households (1,128 out of 7,060) and food poverty for more than 25% of sampled households

[18] Using 95% confidence intervals for the survey-based consumption data estimates are BCWIS [BWP 20 bn ; BWP 31 bn] and BMTHS [BWP 27 bn; BWP 33 bn].

[19] By contrast, the World Bank (2015) carried out consistency checks on data from 2002/03 and 2009/10 surveys with the conclusion that "*The survey data have been found to be generally good for comparisons over time, although some income-related indicators were inconsistent.*"

[20] https://ourworldindata.org/grapher/share-of-consumer-expenditure-spent-on-food

(1,888 out of 7,060). For these - typically small - households, the standardised value assigned exceeds the national poverty datum line. [21]

While bottom-coding can offer a pragmatic solution in the absence of reliable data, the BMTHS survey micro data does include information to support more robust estimates. Statistics Botswana did not report any correction or assessment that diary data is deemed inadequate. Even if it were to be the case, a better method would include information about the composition of the household, rather than allocating food expenditure irrespective of e.g. household size.

To address these shortcomings due to bottom-coding, the food component can be specified by using the value of food consumption from the two-week diaries and convert it to annual food consumption. To avoid double-counting in the total aggregate, I subtract the value of food gifts and own produce consumed, as these are estimated as separate sub-aggregates by Statistics Botswana.

For 184 households, there is no diary value available. I reviewed these responses, notably concerning consumption of food outside the household, own produce, and non-food consumption, as well as levels of incomes reported and how complete their survey response is. On this basis, I drop 85 households for which the lack of responses is problematic for analysing the welfare distribution and fiscal incidence. For the remaining 99, I predict the household food consumption to match with the percentile average that corresponds to its place in the income distribution. Specifically, the per capita food consumption expenditure is set equal to the mean value for the corresponding per capita disposable income percentile to households ranking them according to Statistics Botswana's variable for per capita disposable income in each strata (cities & towns, urban villages, rural areas). The impact of the adjustment is analysed in Section 3.1.3 below.

3.1.2 Housing

Botswana applies the international System of National Accounts, according to which every house owner is treated as an unincorporated business leasing the house to the occupying household (Statistics Botswana, 2021, p. 12). Meanwhile, the technique selected in the practical implementation is not specified, and published national account data does not provide the break-down between owner-occupied housing and other real estate activities.

Housing is included in Botswana's Poverty Datum Lines as a component dependent on the geographical location and size of each household. In its Poverty Assessment, the World Bank (2015) lists averages across regions in in 2002/03 and 2009/10, with housing components in 2009/10 ranging from BWP 16.9 in rural areas to BWP 181.6 in cities and towns, making up 2% to 21% of the household PDL. Details of the PDLs for 2015/16 are not publicly available, and the World Bank makes no recent reference to them.

According to the BMTHS survey data, the housing share of consumption ranges from 7-9% in the bottom nine deciles; only the top decile records a share of 25%. Looking at the data

[21] The poverty status of the other bottom-coded households depends on whether other consumption sub-aggregates bring total consumption above the household-specific national poverty datum lines.

underlying the consumption sub-aggregate, this can be explained by the omission of rents paid and imputed rents, which underestimates consumption, and the inclusion of expenditure on building materials, which overestimate consumption. Like purchases of dwellings, the purchase of such materials is equivalent to purchase of durable goods, from which the use contributes to welfare. Estimating the value of such use remains a challenge for Statistics Botswana (World Bank, 2015).

Acknowledging the multi-faceted challenge it involves, Deaton and Zaidi (2002) provide guidance for incorporating durable and public goods in the consumption aggregate for studying welfare. When determining welfare or living standards, the dwelling of a household contributes positively by generating an accommodation service, regardless of whether the dwelling is owned, rented, or provided free of charge. Specifically, *"even if the dwelling is owned by the household or received free of charge, an estimate of the annual rental equivalent must be included in the consumption aggregate"*.

Balcázar et al. (2017) review methodologies and empirical findings about rent imputation for welfare measurement, noting that practices for imputing rents vary across countries, which impedes international comparison. Lidia Ceriani et al. (2019) proceed to demonstrate that the distributional impact of including housing in the welfare aggregate cannot be predicted from theory, and scant empirical evidence suggests the impact is context and method specific. Recalling that housing is likely to be increasingly important in growing economies, they argue – in line with Olson Lanjouw and Lanjouw (2001) – that omitting imputed rents in the consumption aggregate will result in a noisier welfare indicator, and, in turn, in less precise poverty profiles. Meanwhile, referring to an unpublished World Bank data base of 69 surveyed aggregates underlying official poverty estimates, they caution that only in 28 cases was it possible to determine whether observed and imputed rents are included.

BMTHS survey data provides the basis for estimating housing consumption based on a method of imputation. Depending on the household's terms of occupancy, housing consumption can be imputed using the survey responses for monthly rent paid by tenants, subjectively estimated market value of owner-occupied housing ("*If someone wanted to rent this dwelling today how much money would they have to pay per month?*"), or similarly estimated value of rent-free housing. The BCWIS questionnaire did not include these questions, so comparison across the surveys is not possible.

Housing consumption is here widely defined - in line with the recommendations of Deaton and Zaidi (2002) - to include rent paid or the imputed value of the dwelling used as well as utility payments (electricity, water, fuel, firewood) and – in line with Statistics Botswana's approach - certain other costs reported in the survey (building insurance, mortgage protection policy, Council rates for renovation services, any service levy paid by an owner of a house under the SHHA scheme).

As noted by Deaton and Zaidi (2002, p. 37), rental value from self-assessment "*must be treated with caution and carefully inspected prior to use*" as respondents might not sufficiently informed to assess the market value of their dwelling. The reliability of the self-assessment method hinges on owners being able to correctly estimate the value of their dwelling, for which they need sufficient knowledge of a hypothetical tenants' willingness to

pay for a comparable dwelling. Incorrect assessment can thus be explained by lack of comparable dwellings or of hypothetical tenants, e.g. in sparsely populated areas. Some empirical analyses confirm that self-assessed home values are prone to misestimation with upward bias (e.g. Haurin et al. (2018), on US data; Liang and Gao (2021), for China). Lidia Ceriani et al. (2019) note that 15 of the 28 surveyed cases include home-owners' self-assessed rental values without any (at least documented) assessment on whether there is a bias or not.

According to the BMTHS, half of the households in Botswana owned their dwelling, one third rented it, and the remaining sixth lived rent free (9% provided by relatives, 6% provided by employer). Home ownership is more prevalent in rural areas (two in three households) than in the cities and towns (one in four). Conversely, a larger share of households rent in cities and towns (59%) and urban villages (38%) than in rural areas (9%). Employers provided rent-free accommodation in cities and towns (7%) and rural areas (10%), whereas this is rarely reported in urban villages (1%).

Table 3. BMTHS reported or self-assessed, imputed monthly rent by strata

	Reported rent			**Self-assessed, imputed rent**					
	Paid	*Std err*	*Obs*	Owner-occupied	*Std err*	*Obs*	Provided for free	*Std err*	*Obs*
Cities/Towns	1,080.79	*104.55*	*1,030*	7,075.29	*1,682.86*	*386*	3,111.17	*291.51*	*267*
Urban Villages	733.85	*41.64*	*917*	3,303.71	*264.50*	*1312*	3,963.28	*1,290.17*	*356*
Rural areas	426.92	*57.54*	*220*	1,845.67	*412.75*	*1723*	1,296.98	*247.58*	*638*
			2,167			*3,421*			*1,261*

Notes: BWP monthly rent paid or self-assessed (as responded by household head). Owners and those whose dwelling was provided for free were asked "If someone wanted to rent this dwelling today, how much would they have to pay per month?". BMTHS micro data applying Statistics Botswana's survey weights

Having dropped the 85 households with inadequate food consumption data, paid or imputed rent is unavailable for only 121 of the responding households. Following the same approach as for food, I set the per capita housing consumption for those households equal to the mean value for the corresponding per capita disposable income percentile in each strata.[22]

Table 3 summarises reported rent and imputed rent based on the self-assessment by respondents. To limit the impact of upward bias and outliers[23], I cap the self-assessed owner-occupied rental value per room to the maximum paid rental value in the region, distinguishing between dwellings with and without access to quality sanitation (flush toilet) and electricity. This approach may, however, underestimate inequality where the rent-equivalent market value of owner-occupied housing is higher than the maximum actual rents paid by the sampled households.

[22] The corresponding STATA code with explanations is available upon request.

[23] In the region of the poverty line, the sample is particularly small in Francistown, and impacted by a couple of "overenthusiastic" self-assessments.

3.1.3 Impact of adjusted food and housing consumption

To gauge the impact of the data assumptions, Table 4 presents an overview of how the adjustments to take account of missing or wrongly specified data affect the consumption welfare aggregate. The concentration coefficient is used to evaluate the distribution, where a value closer to zero reflects a more equal distribution. Bringing food consumption in line with diary values increases total consumption, corresponding to 1.6 percentage point of GDP, equal to an increase of 8.2% in Statistics Botswana's total consumption aggregate and a food consumption share of 20.9%. However, the total aggregate remains below half of the total private consumption (by households and non-private institutions serving households) in national accounts. The adjustment of food consumption implies that per capita consumption becomes more unevenly distributed, with a concentration coefficient of 0.43 rather than 0.38.

Table 4. Composition of welfare aggregate with adjusted food and housing consumption

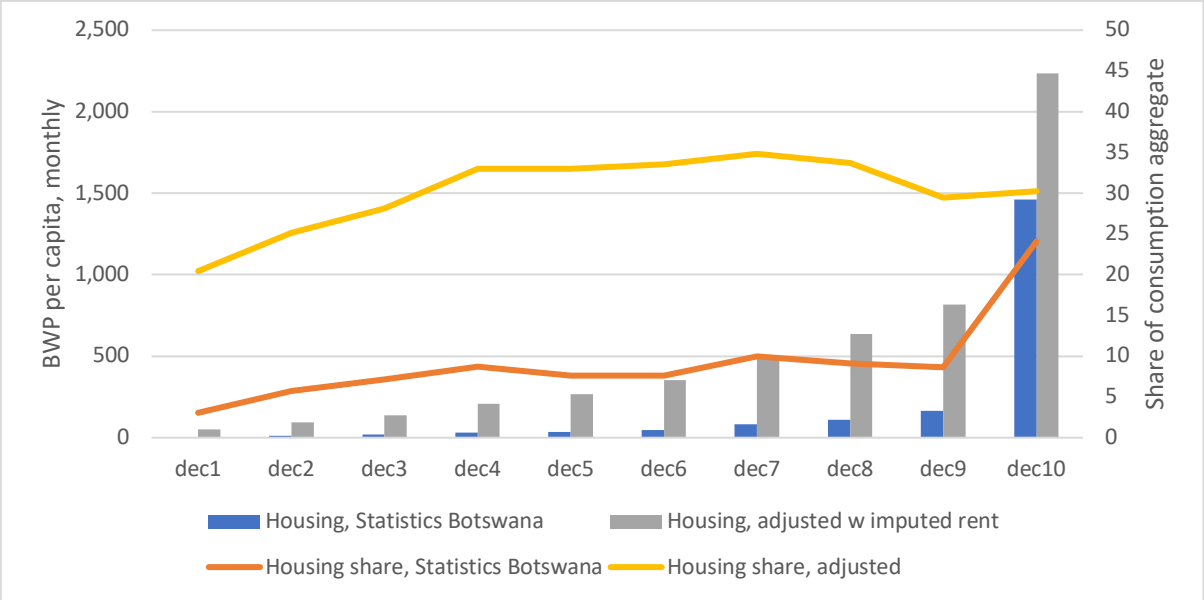
		Food	Housing	Other exp	Gov benefits	Other cons	Total cons	Total share of GDP	Total share of Consumption HH&NPISH
StatsBots	million BWP	3,521	4,865	19,032	1,135	1,419	29,972		
	Share	11.7	16.2	63.5	3.8	4.7	100	19.3	45.3
	CC	0.38	0.90	0.69	0.79	0.78			
Adjusted food		***5,974***	***i.e. an increase of 70%***				***32,425***		
	Share	18.4	15.0	58.7	3.5	4.4	100	20.9	49.0
	CC	0.43							
Adjusted food & housing			***13,011***	***i.e. an increase of 167%***			***40,571***		
	Share	14.7	32.1	46.9	2.8	3.5	100	26.2	61.3
	CC		0.68						

Notes: CC = concentration coefficient. Other exp is cash expenditure other than for food and housing. Government-funded in-kind direct transfers. Other consumption includes own produce, food gifts, wages in-kind, and private education aid. Consumption of Households and Non-Profit Institutions Serving Households (HH&NPISH) from National Accounts.

Adjusting the housing component in line with paid rents and self-assessed rental values of subsidised housing more than doubles the value of housing consumption, bringing the total aggregate above 61% of total private consumption. Such a major adjustment in the data must be duly justified and assessed against alternative approaches. In Botswana's national accounts, the real estate activities in the survey period contributed around 5% of Gross Value-Added, which would imply that the estimated value of owner-occupied housing in national accounts is significantly lower than this estimate. However, there are several potential sources of divergences, including (i) the housing mass considered as owner-occupied, (ii) the valuation method, (iii) the treatment of rent-free accommodation provided by relatives, (iv) the treatment of rent-free accommodation provided by employers, which is ranges from low value, e.g. among farmworkers, to high value for civil servants.

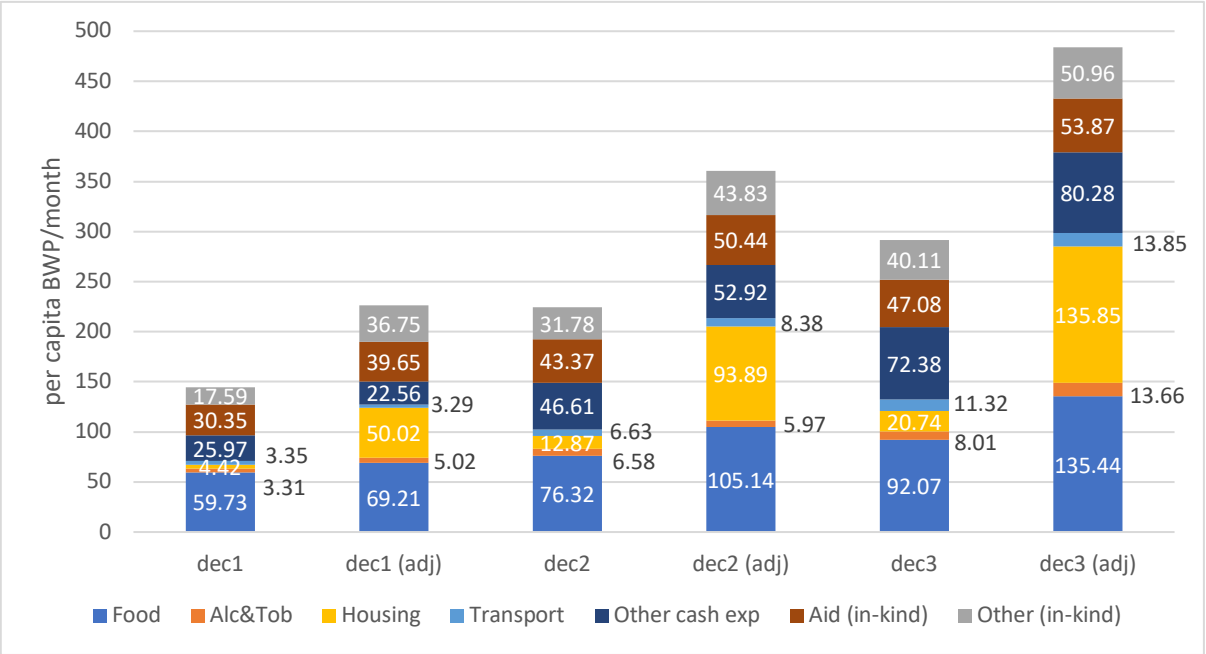
As Statistics Botswana's housing sub-aggregate ignores rent paid, and rather takes account only of utility payments, purchase of housing construction material and selected housing-related regular payments, the distribution is tilted to the top (Figure 4). The bottom six decile averages are less than BWP 50 per capita monthly, and only the top decile average exceeds BWP 200. The underestimation of the welfare derived from the dwelling affects both the welfare aggregate and the housing consumption share, which - at less than 10% for all except the top decile - is very low compared with other middle-income countries.

Figure 4. Housing consumption by decile, before and after adjustment



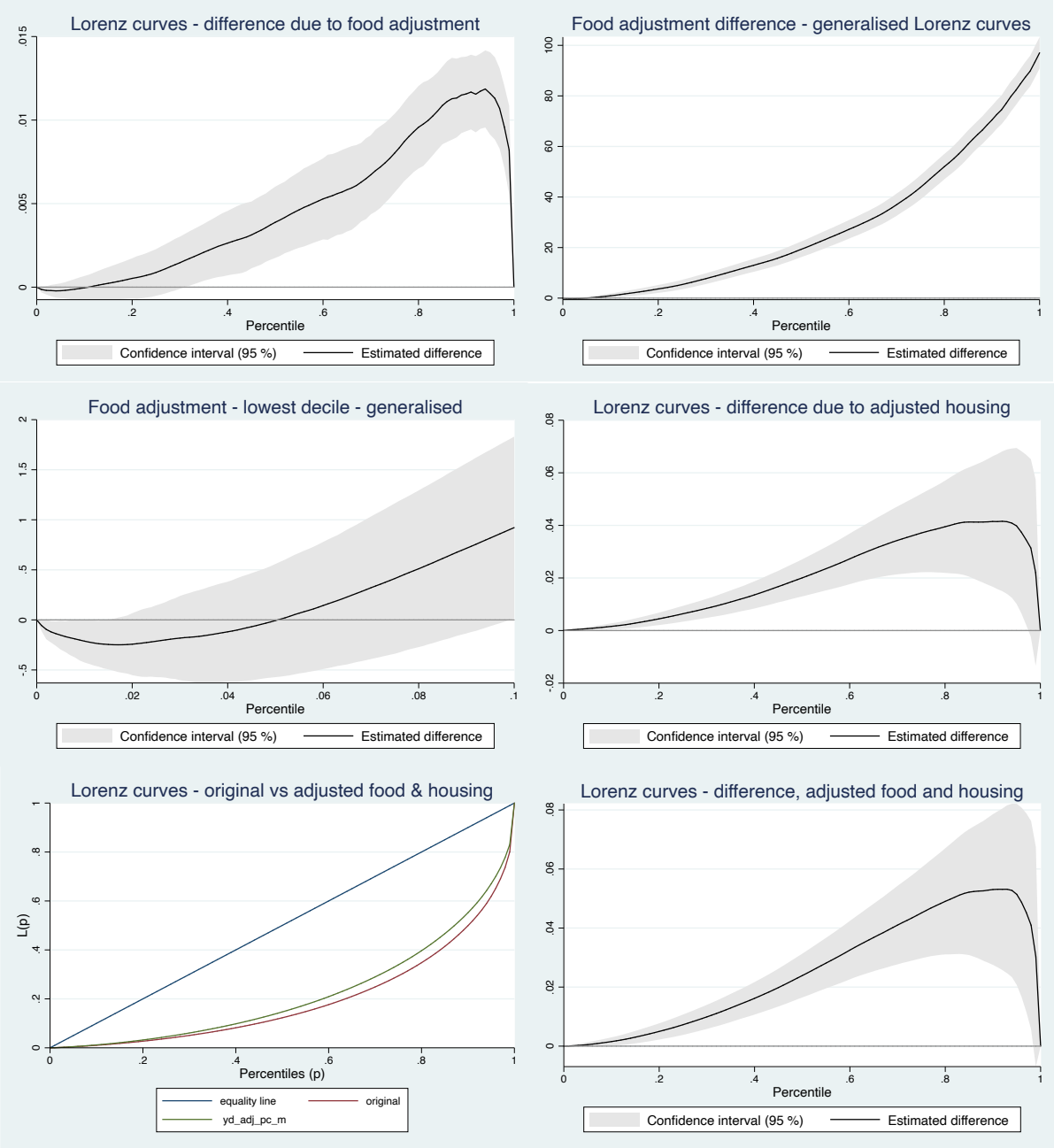
The adjusted housing, based on the survey data for paid rent or self-assessed value of accommodation results in shares of the total consumption aggregate which are high compared with the four countries studied by Lidia Ceriani et al. (2019). For a more robust method for estimating housing consumption, it would be necessary to compare with Statistics Botswana's method to estimate owner-occupied housing in national accounts, consider alternative imputation methods (such as the log-linear hedonic model employed by Balcázar et al. (2017)), and reconsider the survey design or complement it with independent expert assessment or administrative cadastral data. Meanwhile, for the purpose of analysing the distribution of welfare, the adjustment illustrates well the importance of a well-specified welfare aggregate, underpinned by a rent-imputation method, specified to capture the welfare-enhancing service of accommodation and ideally coherent with the approach used for national accounts. As argued by Lidia Ceriani et al. (2019), the accuracy of household survey based estimates of rental values could be improved by enabling comparison between homeowner and tenant dwellings which exhibit similar characteristics. Analysing developments across surveys would moreover require methodological consistency over time, for which Botswana's new, more frequent multi-topic household surveys could prove useful.

Figure 5. Impact of food and housing adjustment on consumption in the lowest deciles



Changes in a welfare aggregate that affect the lowest deciles can alter the poverty profiles with implication for policy design. In the present case, food and housing consumption is higher in the lowest deciles as a result of the adjustment (Figure 5). The impact of the different data assumptions can be visualised from comparing the Lorenz curves for the original and adjusted consumption aggregates. In Figure 6, by firstly adjusting food, in top left, the lowest decile accounts for a lower share when using diary values for food, which follows from abolishing the bottom-coding (Statistics Botswana's assumption of a minimum value for household food consumption). The generalised Lorenz curves in the top right and middle left figures show the impact of the higher mean value of adjusted food consumption (BWP monthly per capita). The generalised Lorenz curves cross at 5%, so the central estimate leaves the lowest ventile “worse off” in the adjusted distribution, but only marginally. Secondly, adjusted housing is more evenly distributed. In combination, the adjusted aggregate is more evenly distributed across the whole population.

Figure 6. Impact of adjustments on Lorenz curves



The effect of each adjustment across the distribution of the consumption aggregate and the combined impact is set out in Table 5. The monthly amount is the average for the household members in the national decile across the three strata.

Table 5. Original and adjusted decile averages of per capita consumption across strata

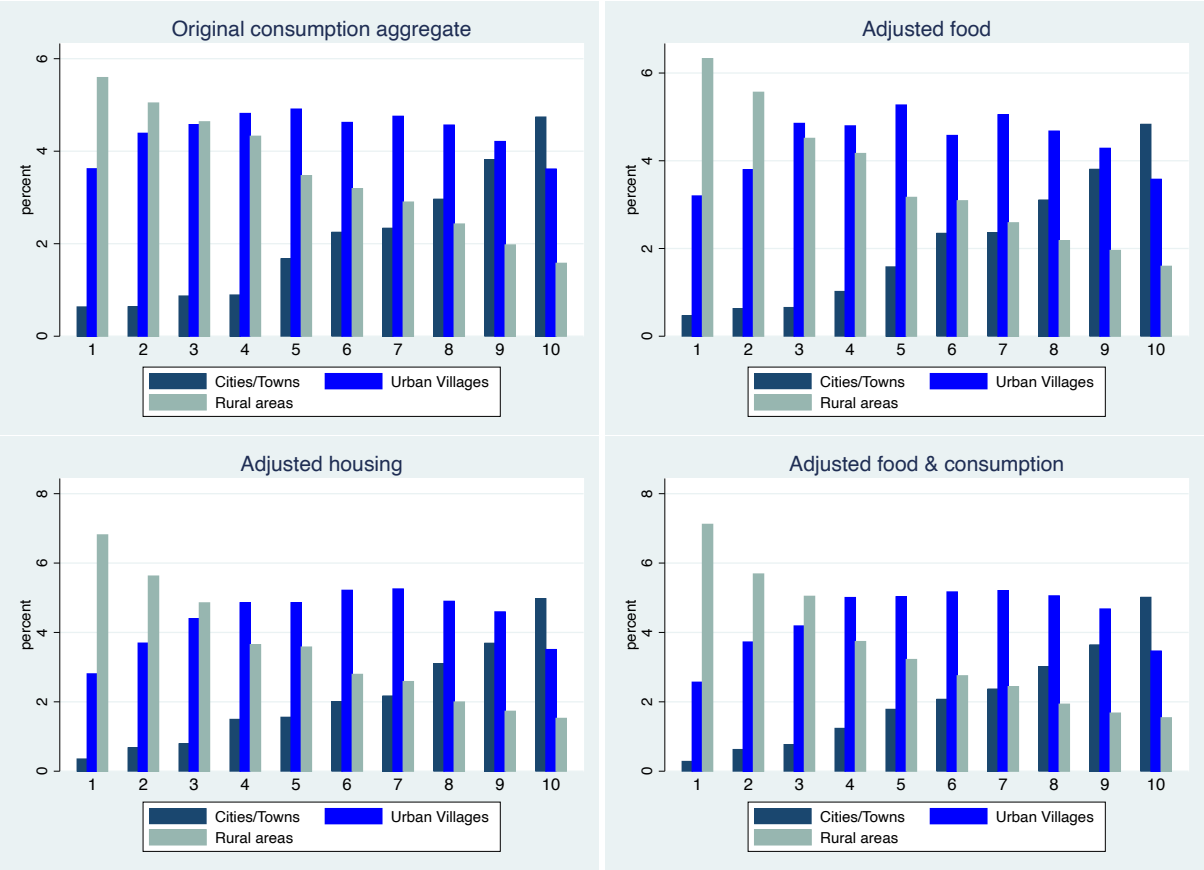
	1	2	3	4	5	6	7	8	9	10	Mean
National	**145**	**224**	**292**	**371**	**473**	**622**	**846**	**1,215**	**1,922**	**6,078**	**1,217**
Adjusted food	160	256	335	429	550	709	956	1,346	2,097	6,321	1,317
Adj. housing	213	330	438	569	719	947	1,260	1,735	2,553	6,708	1,548
Food & housing	227	361	484	630	800	1,042	1,370	1,875	2,736	6,934	1,648
Cities & towns	**145**	**227**	**294**	**369**	**471**	**627**	**854**	**1,233**	**1,930**	**5,784**	**2,100**
Adjusted food	139	251	336	436	550	719	957	1,365	2,117	6,017	2,262
Adj. housing	239	337	436	567	730	953	1,270	1,733	2,579	6,284	2,569
Food & housing	246	363	508	641	813	1,052	1,399	1,895	2,781	6,502	2,732
Urban villages	**144**	**225**	**291**	**371**	**475**	**618**	**845**	**1,209**	**1,913**	**6,183**	**1,130**
Adjusted food	163	259	336	429	551	706	956	1,341	2,094	6,466	1,237
Adj. housing	219	329	437	570	714	944	1,259	1,738	2,550	6,896	1,496
Food & housing	238	366	487	627	795	1,047	1,363	1,866	2,725	7,152	1,605
Rural areas	**144**	**222**	**291**	**370**	**470**	**623**	**839**	**1,199**	**1,911**	**6,732**	**804**
Adjusted food	160	255	334	428	549	706	954	1,328	2,066	6,919	856
Adj. housing	210	331	440	568	722	947	1,254	1,730	2,509	7,660	1,007
Food & housing	222	357	478	630	799	1,026	1,357	1,866	2,667	7,848	1,060

Notes: Population across deciles at national level; for each strata the average value across the households in each the national decile. BWP per month using BMTHS original and adjusted data.

In the original data, decile average per capita consumption is remarkably similar across strata, notably in the lower half. Adjusting food consumption leads to lower averages in the first decile average in cities and towns (13% below the national average for the first decile). For all others in the bottom eight deciles, mean consumption is 11-16% higher. After adjustment of both food and housing, the bottom eight deciles see averages increase by 40-72%, while the top decile average grows by 12-17%.

In Figure 7, the population shares across strata are set out, ranked according to the original and adjusted data. With the adjustment of food and housing consumption, the rural population shares is higher in the lowest deciles and lower in the highest deciles. The housing adjustment shifts the urban population (in urban villages, cities, and towns) towards the middle and top deciles.

Figure 7. Population shares by decile and strata, based on original and adjusted data



Notes: Population ranked according to consumption aggregate, (i) in the original data from Statistics Botswana, (ii) with adjusted food consumption, (iii) with adjusted housing consumption, (iv) with both adjusted food and housing consumption.

The combined adjustment brings about considerable reranking of households. Nearly half of those originally in the lowest deciles are shifted upwards (45%). In the second decile, nearly a third are shifted down, a third stay, and a third are shifted upward. In deciles 3-8, three quarters of households stay within the decile or shifted to the one above or below (see Annex Table 1 for details).

3.1.4 In-kind public transfers

For assessing fiscal policy instruments, the survey data concerning government funded transfers is essential. At first glance, Botswana's school feeding programme seems to be an important policy instrument for tackling poverty as the World Bank found BCWIS 2009/10 data indicating that "almost 90 percent of the population lives in a household where at least one child receives school meals" (World Bank, 2015, p. 149). Looking more closely at the micro data, the allocation of school meals in BCWIS is flawed, as 40% of the school meals are allocated to households with no children at all. Moreover, the total allocated value of school meals bears no resemblance to the cost (more than BWP 800 million whereas BIDPA estimated annual costs of BWP 219 million in Financial Year 2009/10 for primary schools) and ranges from BWP 0 to BWP 1,800 per child per month for families with children (compared

with cost-based estimate of BWP 77/month). On this basis, one cannot draw robust conclusions about the benefit incidence of school meals.

Based on the BCWIS survey data for individuals, cost-based benefits of school meals can be estimated and allocated to beneficiaries.[24] The value of school meal benefits allocated to just over 420,000 beneficiaries would then correspond to an annual budget of P389 million. This estimate approaches the estimate for 2012/13, when the total cost of primary and secondary school feeding was BWP 484.7 million, benefiting 430,690 students (Tesliuc et al., 2013). Using this allocation there are beneficiaries in 38% of all households. Amongst the households assessed as poor according to the national poverty datum lines in 2009/10, the share is 73%. School feeding is thus an important instrument in tackling poverty, and its impact should be evaluated alongside other instruments, as in Chapter 5 below, while noting the cost-effectiveness concerns raised by the authors from the World Bank and BIDPA (Tesliuc et al., 2013).[25]

In the BMTHS micro data, school feeding benefits are allocated using a cost-value estimate. I therefore make only minor adjustments to remove benefits erroneously allocated to private schools. In replicating Statistics Botswana's welfare aggregate in BMTHS 2015/16, total consumption appears to include only few transfers beyond school feeding. For a full-fledged fiscal incidence analysis, allocating taxes and transfers appropriately requires a welfare aggregate that takes the relevant transfers adequately into account. In preparation, I therefore identify the near-cash transfers to be included in the analysis based on data availability and whether such transfers have a "well-defined market value and are close substitutes for cash" (Lustig, 2018, p. 248). Hence, I assign the cost-value of such in-kind benefits, namely the schemes for Destitute Persons, Orphans and Vulnerable Children, Needy Students, Vulnerable Group Feeding Programme, and Community Home Based Care.[26] In addition, I include the value of government-funded sponsorships covering tuition costs.

3.1.5 Other consumption sub-aggregates

The comparability of the BCWIS and BMTHS surveys is inhibited by other divergent methodologies in determining the consumption welfare aggregate. In the BCWIS (2009/10) data, another anomaly concerns the allocation of net gifts received, which is non-negative throughout the sample, and often matches Statistics Botswana's school meal variable (for 1 in 4 households). Similarly, the sub-aggregates labelled to represent wages in kind and own produce consumed do not resemble the survey data variables. An alternative BCWIS aggregate is generated to marginally adjust for these anomalies, yet a complete review would require additional data.[27]

[24] Eligible household members are identified using the BCWIS variables for enrolment, grade, and type of school (PE04_ENROLLED, PE13_GRADE_CUR, PE15_KIND_SCHOOL). The cost estimate of BWP 5 per day and 185 school days per year is based on BIDPA's 2013 report on school feeding. BIDPA. (2013). *Botswana National Primary School Feeding Programme: A Case Study*. BIDPA.

[25] In the BMTHS data, school meals are unit-cost-based at BWP 115 per pupil per month. The estimated sum of school meal benefits is P668 million, suggesting that the average cost of a meal has increased by 50%.

[26] See the detailed description of the schemes in section 5.2.1.

[27] For the alternative consumption aggregate, Statistics Botswana's survey aggregates are used, where TOTEXP=Consexp (consumption expenditure), adding net wages in kind, net gifts received, own produce consumed, aid and the corrected school meal variable: BCWIS_A_cons = TOTEXP + (UNSWNKD + FDWNKD +

When revising its Consumer Price Index in 2018 based on the BMTHS Survey (Statistics Botswana, 2018c, p. 14), Statistics Botswana explained that: *"While the Household Income and Expenditure module provided detailed expenditure data on various items, there are some items whose nature is such that their expenditure will always be underreported especially alcohol and tobacco. The expenditure data on alcohol and tobacco as recorded in the 2015/16 BMTHS, were below the combined level of local production and imports of alcoholic beverages and tobacco. Subsequently, the expenditure figures (not only for alcohol but for other affected items as well) were adjusted using the local production and imports figures."*

From the data, it appears that alcohol consumption expenditure is an aggregate of estimated expenditure over a 14-day period (diary for non-food purchases) plus reported purchases over a 7-day recall period, scaled up by a factor of 2.2392. Effectively, self-reporting drinkers are assumed to underreport in direct proportion to their reported consumption by 55%. Statistics Botswana's claim of inevitable underreporting is, however, not explained further. Stockwell et al (2016) observed biases in surveys across four English-speaking countries and detected both substantial underestimates of drinking frequencies by those who claim to be infrequent drinkers and significant overestimates among self-professed daily or almost daily drinkers. Both biases could apply simultaneously: It is possible that expenditure is underreported while consumption is overreported in population groups where high alcohol consumption is a sign of affluence and success.

Even after the adjustment by Statistics Botswana, the average monthly household expenditure on alcohol and tobacco is estimated to have dropped by half in cash terms reducing the share of household consumption expenditure from 9.0% to 3.6% (Statistics Botswana, 2018b, p. 83). While recalling that the BMTHS accounts for a lower share than the BCWIS of total aggregate consumption in national accounts, the macro control of the magnitude of alcohol and tobacco consumption could be supported by VAT data if available. Due to a lack of supporting data, I make no adjustments to the BMTHS data for alcohol and tobacco consumption. Meanwhile, with adequate data, Botswana's alcohol levy would be a particularly interesting case to study in more detail over time, examining the effect of levy adjustments, estimating the price elasticity of consumption and the impact of the levy on overall consumption.[28] Provided a consistent methodology is applied in estimating consumption and expenditure, micro-data from successive surveys would enable a more complete assessment of the incidence of the levy and its impact on consumption patterns.

3.1.6 An alternative welfare aggregate

To strike a balance of comparability with the official aggregate while correcting significant anomalies, this analysis relies on the same data as the official aggregate for own production, private education aid (received for education from a relative, employer, or other non-government sources), food gifts, wages in kind, and most consumption (cash expenditure, other than food and housing). In summary, an alternative welfare aggregate is derived with adjusted food and housing consumption and inclusion of the government funded near-cash

OTWNKD - WINKTDOM) + (GIFTREC - FDGFTGO - OGFTGO - UNGFTGO) + (FDOWPC + OTOWPC) + (AID) + bcwis_schf_hh

[28] The alcohol levy is described in detail in section 5.2.2.

transfers including in-kind benefits and student tuition sponsorships.[29] While it cannot be excluded that some in-kind benefits (such as food supplements) are recorded in the diaries and could therefore be double-counted in some instances, this would be counterbalanced by the tendency of underreporting. Larger near-cash transfers such as tuition sponsorship is not reported as consumption by respondents. Consumption of alcohol and tobacco relies on Statistics Botswana's adjusted estimates without further adjustments.

[29] By including the near-cash transfers in the aggregate, there are fewer zero-net-market-income households, which are largely capturing households benefitting from cash transfers with low food diary consumption. These cases could reflect a mismatch of the timing of diary records and the availability of the cash transfer or the type of underreporting of consumption that Statistics Botswana warned the public against.

3.2 Poverty lines

3.2.1 Botswana's national poverty lines

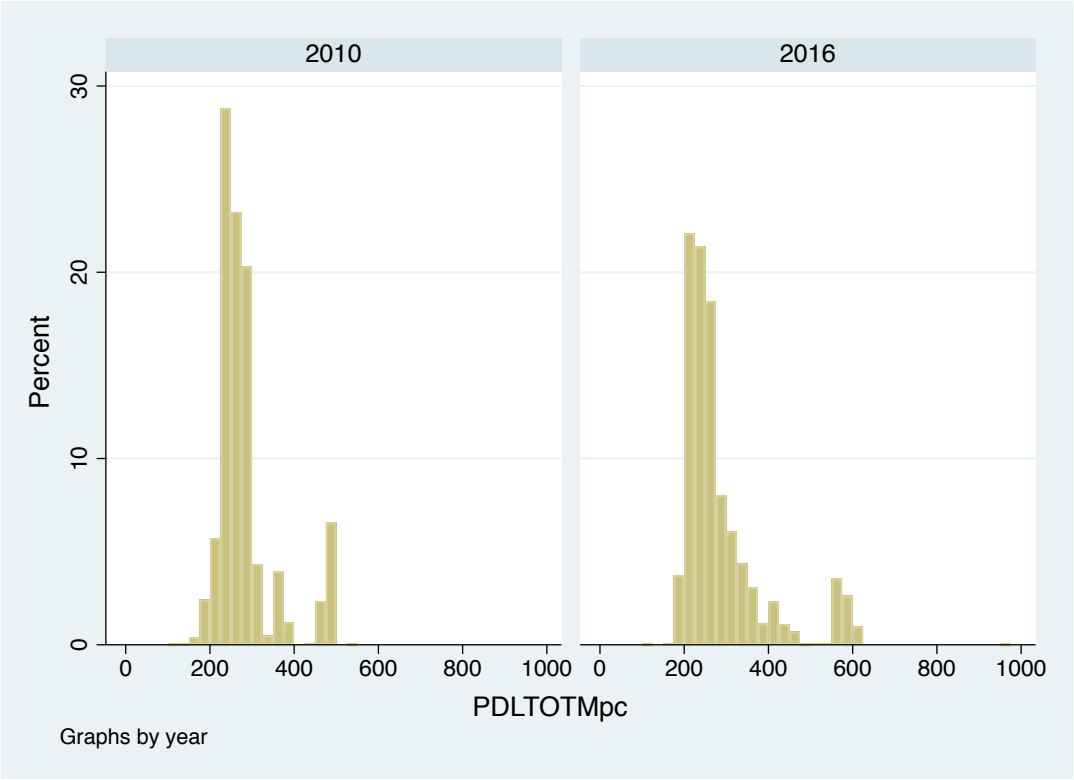
Botswana applies an absolute, cost of basic needs poverty measure. Rather than a single poverty line, Botswana's Poverty Datum Line (PDL) approach involves calculation of a set of poverty lines based on age- and gender-specific needs of household members, taking account of geographical price-differences (see World Bank (2015) Annexes A-E, for details and analysis of implications based on BCWIS 2009/10 data). The poverty measure is thus determined by a nutrition-based food basket, gender- and age-specific clothing and personal items (all priced at minimum prices), household goods (using regional prices) and a geographically determined allowance for housing. Food quantities are identical for both genders until the age of 15, after which the required amounts of meat for males are slightly higher (0.1kg) per month, and from the age of 20 males require more meal (1.1-1.2 kg). While clothing requirements are higher for boys than girls in the age group 2-6 years, older girls and women require more pieces of clothing than males. Concretely, the approach most recently resulted in 3,382 unique poverty lines being applied (based on the BMTHS data). There are merits and drawbacks of such a PDL approach: on the one hand, if well-specified, these lines come closer to capturing the "lived" minimum needs, taking account of economies of scale and geographical variations in prices and living conditions; on the other hand, the specification is prone to becoming outdated. This approach of setting household-specific poverty lines can lead to odd (nonmonotonic) behaviour of the poverty line as family size changes (Foster, 1998; Ruggles, 1990). Adding the spatial dimension, the poverty line (or rather set of lines) is bound to evolve with demographic developments (composition of households and relocations) and in accordance with the survey sample.

Botswana set its first PDLs in 1974 for rural areas, in 1976 for urban areas, even before its first nation-wide HIES survey in 1985/86 (United Nations Development Programme & BIDPA, 2005). Due to the time gap, the PDLs were inadequate for providing reliable poverty estimates. Revised PDLs, completed in 1989, were used for poverty estimates for both 1985/86 and 1993/94, adjusting for price changes (using the Cost of Living index, CoLi). A methodology for deriving PDLs was finalised in 2004, and the revised PDLs were used for estimating poverty based on the 2002/03 HIES and later updated for the 2009/10 BCWIS. While the PDLs remain central to Statistics Botswana reporting on poverty incidence[30], the World Bank makes no reference to the PDLs in recent publications.

[30] From the BMTHS Main Report: *Poverty incidence is determined by computing the Poverty Datum Line (PDL) based on the cost of a basket of goods and services assessed to be necessary to meet basic needs of household members. The assessment of basic needs is based on the requirements for food, clothing, personal items, household goods & services and shelter. The daily/monthly requirements for PDL basket components differ according to sex and age, consequently the household composition.*
The cost of the basket is then compared with the observed total consumption expenditure for the household. The total consumption (welfare aggregate) of the household is then determined by adding up the total Consumption Expenditure, Aid, Wages in-kind, Gifts Received, School Meals and Unearned Income in-kind. When the estimated/expected PDL for the household is higher than its observed total consumption, the household is defined as poor. This means that the household is living below the estimated basic needs (living below the PDL) for a household of its size and composition, all its household members are considered to be poor.

The micro data includes (only) the PDL specific to each household, not to each member, so Figure 8 compares the frequency distribution of the sampled household members across baskets of their PDL per capita i.e., as simple averages across household members.

Figure 8. Comparison of poverty datum lines in monthly per capita terms across surveys



Notes: PDLTOTM is Statistics Botswana's variable for the poverty datum line (moderate). Here it is presented in per capita terms, in BWP monthly. Frequency is reported across baskets of BWP 25. Hence, in the 2009/10 BCWIS data, just over 20% % of the sampled household members are assigned a PDL, which in per capita terms falls in the basket BWP 275-300. In the 2015/16 BMTHS data, 8% of the sampled household members are assigned PDLs of that value.

With the PDLs assigned to the sampled households in BCWIS, the national poverty definition would draw the line for per capita consumption between BWP 200-300 for more than 70% of the sampled individuals. In the BMTHS sample, the share in this bracket is smaller, and cluster of individuals is assigned poverty lines exceeding BWP 550.

Within the wide variation, the mean PDL per capita in current prices has remained unchanged at around BWP285 per month. In the study by United Nations Development Programme and BIDPA (2005), the challenge of rendering poverty estimates comparable over survey periods despite apparently diverging prices led the authors to apply the assumption that the most recent PDL (then 2004) correctly reflected the minimum standard of living, and that the official CoLi correctly captured price changes. In the present case, deflating the 2015/16 PDLs to 2009/10 price levels (using the CPI) would imply an average PDL per capita of BWP208 per month in current prices, i.e. 27% lower.[31]

[31] The trend is similar in terms of adult equivalents.

Only significant adjustments to the PDL basket or strongly divergent basket price developments from the CPI could explain the nominally stagnant PDLs. Even with the proliferation of retailers across the country, it is hardly likely that they have lowered the costs of food, clothing, personal items, and household goods for the poor to such an extent.[32] It rather appears that the PDLs were not adjusted in line with inflation or evolving living standards. Neither the micro data nor the reporting indicates that Statistics Botswana deflated the consumption aggregate to match the 2010-values of the PDLs, and no explanations are provided in Statistics Botswana's reporting.

3.2.2 International poverty lines

An international poverty line for Botswana, using the "$1.00-a-day" approach, was first drawn based on a conversion factor of 1.388 (1993 PPP), implying that BWP 45.4 per month would have bought the same basket of goods in Botswana as $30.4 in the US. By 2011, the ICP conversion factor for private consumption was determined to be P4.44 per international $. At the same time, the international poverty line $-amount for extreme poverty was adjusted first to $1.25 in 2005 and further to $1.90 in 2011. The combined effect of changing the international poverty line from $1.25 in 2005 to $1.90 in 2011 and updating the PPP conversion factors almost doubled the daily Pula-amount from BWP 4.23 in 2005 to BWP 8.10 in 2011, see Figure 9. In monthly terms, a household would be considered poor if spending less than BWP 129 per capita in 2005, rising to P246 in 2011.

Botswana fell in line with the general trend for African countries (contrary to the Asian trend, see Ferreira et al. (2016)), as the PPP adjustment of the 2011 ICP increased the poverty line by less than what an indexation according to the domestic consumer price inflation (measured by the Cost of Living Index) would have implied (bringing it to BWP 7.14 in 2011).[33] In other words, inflation was higher in Botswana than in the 15 reference countries determining the updated IPL. Had the IPL remained at $1.25, while updating the PPP conversion factors, the IPL would have increased only to BWP 5.33. Conversely, if (i) applying the 2011 conversion factor, (ii) keeping the IPL at $1.25, and (iii) taking account of domestic inflation, the 2005-line would have been at 3.64, i.e. 14% lower than the BWP 4.23 per day. According to the 2011 ICP, the 2005 ICP thus overestimated the cost of living in Botswana; applying the extrapolated conversion factors from 2011 would therefore reduce historical poverty estimates.

[32] Official price statistics published in the government's "Daily News" suggest that supermarket chains apply fixed pricing policy on many items, limiting the geographical variation.

[33] Comparing Botswana's national poverty line (PDLs) to the 15 poverty lines determining the international poverty line would be interesting, but Allen (2013) warns that it is not possible to obtain information on the poverty line baskets of each of these countries.

Figure 9. Evolution in the International Poverty Line in Botswana

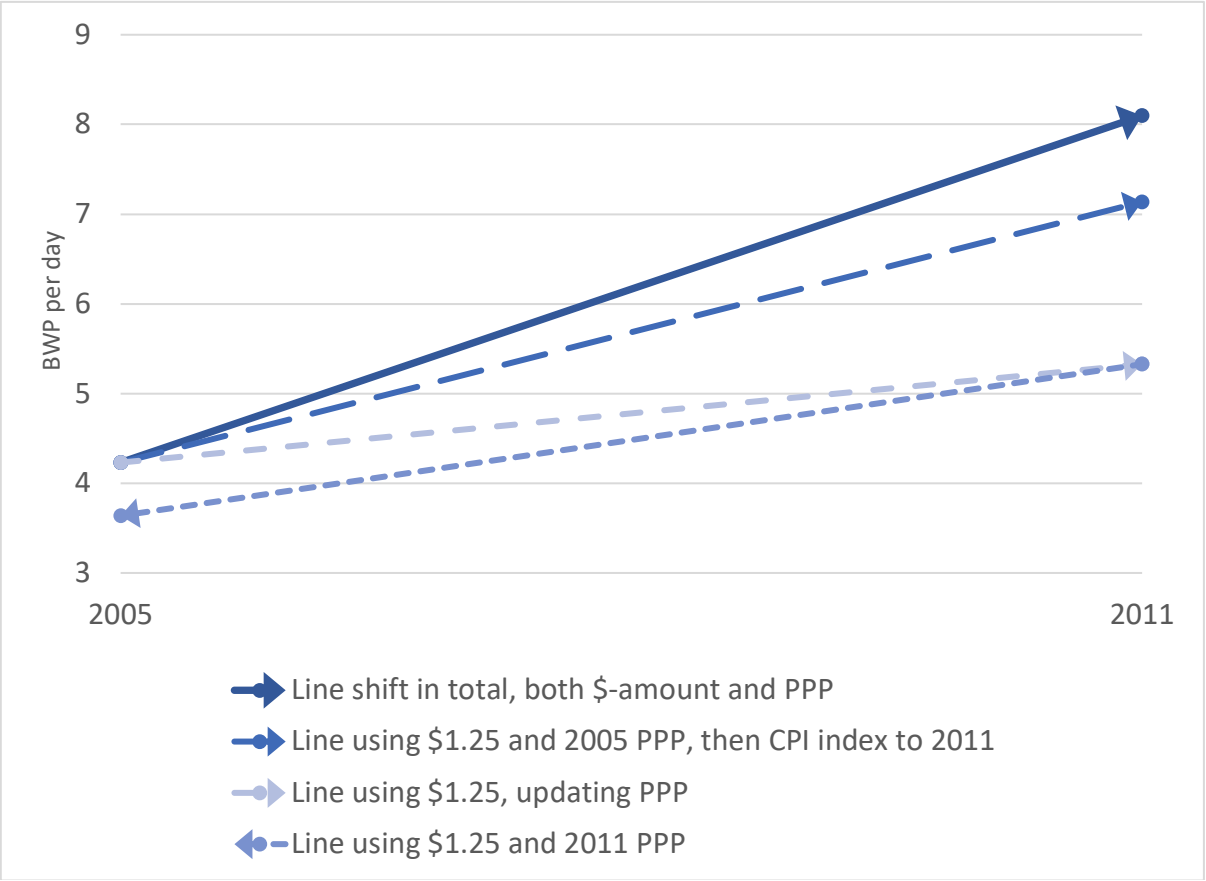


Table 6 sets out the alternative poverty lines derived using the assumptions of Statistics Botswana and reported by the World Bank (in the POVCALNET database[34]) vis-à-vis calculations based on the principles outlined by the Atkinson Commission (Atkinson, 2016) for international comparability.

[34] The POVCALNET database was an online tool to support analysis of poverty and inequality in a cross-country comparable framework, offering detailed summary data of income/consumption distributions and poverty estimates based on household surveys, allowing users to replicate the calculations of World Bank researchers. During the examination period, the POVCALNET database was discontinued and the link http://iresearch.worldbank.org/PovcalNet/index.htm is now redirected. Instead, the World Bank has launched the Poverty and Inequality Platform (https://pip.worldbank.org/country-profiles/BWA for Botswana), which reports only on PPP 2011 and PPP 2017 international poverty lines and does not include national poverty estimates. As stated in the methodological notes on the website: "*As a result of revisions in PPP exchange rates, poverty rates for individual countries cannot be compared with poverty rates reported in earlier editions.*"

Table 6. Comparison of international poverty lines (IPLs) for Botswana, current prices

BWP/month per capita	2002/03	2009/10	2015/16
StatsBots IPL (under revision)	104.1	135.3	154.7
IPL POVCALNET $1.90 PPP 2011	120.7	216.0	309.0
IPL prior to revision ($1.25 PPP2005) using CPI	109.2	190.4	272.2
IPL $1.90 PPP 2011	153.7	234.3	281.8
StatsBots national PDL, average per capita	571.6*	284.1	284.6

*Notes: * per household, calculated by World Bank (2015). Average household size was 4.14.*
Source: Statistics Botswana, UNDP & BIDPA (2005), World Bank POVCALNET database (as accessed 07/08/2022) and author's calculations on 2002/03 HIES, 2009/10 BCWIS, 2015/16 BMTHS data

The strong divergence in the international poverty lines for successive surveys (up to 97%) is caused by several differing or erroneous assumptions or conventions. The main explanatory factor relates to the use of PPP conversion factors: Statistics Botswana applies the factor for GDP rather than for private consumption. The latter is generally applied where household consumption (per capita) is the chosen measure for well-being. As a result, Statistics Botswana reported lines that were significantly lower as the factors used were 18% and 40% lower for the 2009/10 and 2015/16 surveys, respectively. A second factor stems from the correction for inflation between ICP years (2005/2011) and survey years. Contrary to the choice of conversion factor, Statistics Botswana did not use the GDP deflator but rather the (old) Cost of Living index (CoLi), which would be consistent with using the private consumption conversion factor. The average annual inflation according to the CoLi is significantly higher than the corresponding change in the PPP conversion factor, so Statistics Botswana's methodology leads to a lower poverty line than the line using extrapolated PPP factors. A third, minor factor stems from Statistics Botswana's assumption that there are slightly fewer than 365/12 days in an average month. As the Government of Botswana continues to quote their nationally calculated "international dollar-a-day" line rather than that of the World Bank (Government of Botswana, 2016a; Statistics Botswana, 2018a), the ambiguities in poverty lines generate divergent poverty concepts. The implications of the divergences on poverty estimates are analysed in Chapter 4.

Most recently, in the second half of 2022, the International Comparison Programme was presented updated PPP factors as well as poverty lines. The IPL $1.90 PPP 2011 is now succeeded by the IPL $2.15 PPP 2017, which in the case of Botswana has minor impact on the value of this lowest international line (Jolliffe et al., 2022).

3.3 Unsolved data issues

A money metric welfare measure, comparing consumption bundles across households and over time, ought to incorporate price data to account for spatial differences, differences in household preferences and inflation (see Section 2.1 above). This is currently not possible for Botswana for several reasons.

The available documentation does not include information on the prices or unit values used. Meanwhile, the PDL values vary geographically, implicitly taking account of spatial differences in a way that the international poverty lines - in the absence of a spatial deflator - cannot. An implicit spatial price index could be derived from the PDLs (as attempted in World Bank (2015)), comparing prices for the various elements adding up to the poverty datum line. However, these elements make up a limited share of the goods and services within the wider consumption aggregate and would therefore not be suitable as an index for analysis beyond the group around the poverty datum lines, and hence not appropriate for analysis of inequality or fiscal incidence across the entire distribution.

Unfortunately, the data shared does not include information on place of purchase, which complicates any assessment of the role of the informal sector in households' consumption patterns, including of alcohol and tobacco. This shortcoming has implications for the fiscal incidence analysis, where the place of purchase is useful to gauge the extent to which households are directly or indirectly affected by indirect taxation.

Documentation is also lacking for Statistics Botswana's treatment of durable goods. Depending on whether purchases of e.g. vehicles are included rather than their "rental equivalent", transport expenditure will exhibit a different profile. Purchases of building materials are included in Statistics Botswana's consumption expenditure aggregate, whereas they ought to be treated as investments. For this reason, building materials are excluded in the adjusted housing consumption developed above.

3.4 Setting solid standards for measuring progress

At the aggregate level, Botswana's economic progress is undisputed according to its (re-based, revised) national accounts: Average annual growth rates in the period 2012-2017 (constant prices) showed real GDP per capita (disregarding mining activities) increasing by 3% and household final consumption by 3.5% (Bank of Botswana, 2023).

The difficulties in reconciling these trends with survey data for the same period demonstrate the need for internally consistent concepts and methodologies. As described above, the official household consumption aggregate shows a decreasing trend, partly owing to underestimated and bottom-coded food consumption (Section 3.1.1). Alcohol and tobacco consumption expenditure is scaled up without checking against consumption patterns. Survey housing consumption omits rents paid and imputed rents, which underestimates consumption, while it includes expenditure on building materials, which overestimate consumption.

Interpersonal welfare comparisons depend on agreed definitions of the welfare concept, which tend to evolve with the structural transformation of an economy (besides section 2.2, see Osberg and Xu (2008), for a study of how poverty measures keep up with rapid changes). Botswana's method for setting poverty datum lines takes account of geographical and demographic differences but has clearly fallen behind economic developments. A review would merit a wider discussion of the underlying poverty concepts, in terms of minimum needs for food, shelter, and other types of consumption as well as their gender-, age- and geographical specificity. In the meantime, the international poverty lines provide benchmarks

allowing for international comparison. However, the references made by the Government of Botswana to the international poverty line does not coincide with that of the World Bank. This ambiguity gives rise to deviating poverty concepts which are neither explained nor justified.

To address the shortcomings of the data, the alternative welfare aggregate developed here serves to provide a more solid basis for measuring poverty and inequality going forward, ensuring a better alignment with the revised national accounts. While several data issues remain to be addressed, the clearer specification of non-monetary elements, in particular near-cash transfers, makes the alternative welfare aggregate apt for fiscal analyses to guide fiscal policy making.

In line with the analytical framework summarised in section 2.5, the welfare distributions stemming from the specified welfare concepts (official, adjusted, or alternative) and national and international poverty lines examined in this Chapter are next used for assessing the magnitude and evolution of poverty and inequality in Botswana.

4 Tracing welfare, poverty, and inequality developments in Botswana

After half a century of independence, during which mineral extraction generated high economic growth, large investments were made in infrastructure and in providing access to free education and health services, Botswana did not achieve its objective of eradicating poverty in 2016 but remains committed to doing so (Government of Botswana, 2016a, 2016b). To determine drivers and obstacles, the development in welfare, inequality and poverty has been the object of continuous studies, often by academics and experts in international organisations upon request by Botswana's government.

In a historical perspective, cattle, diamonds, and institutions have been the main economic development drivers in Botswana since 1850 (Hillbom, 2014). Bolt and Hillbom (2016) compile social tables from colonial Botswana (Bechuanaland Protectorate) to study long-term trends in economic inequality. Most recently, Hillbom et al. (2021) expand and harmonise the approach to trace African inequality trajectories during the 20th century, particularly the colonial era, for six countries including Botswana. The authors postulate that changes in inequality were driven primarily by export-oriented commercialisation mediated by expatriate settlement and colonial institutions, which, in the case of Botswana, prior to the diamond era, reflect the impact of monetising cattle rearing and expanding export. In the period 1920 to 1974, their evidence shows Botswana's inequality rise steeply, from being the lowest at the start to one of the highest at the end.

The United Nations Development Programme and BIDPA (2005) published a "Poverty Status Report for Botswana: Incidence, Trends, and Dynamics" to determine the dynamics of poverty and inequality in Botswana. Based on the preceding surveys (HIES 1985/86, 1993/94, 2002/03), the findings suggested that while the headcount measure of poverty had decreased, the severity had first decreased, then increased, and poverty had similarly become shallower and then deeper. Based on the same surveys, Mogotsi (2007) finds that inequality (measured by the Gini coefficient) declined in cities and towns, while remaining high, and possibly rising, at national level and in rural areas. [35]

HIES 2002/03 and BCWIS 2009/10 data have served to investigate household determinants of welfare, poverty, and inequality. While noting data challenges[36], the authors of the 2015 World Bank Poverty Assessment document a large decrease in poverty across the surveys, accompanied by a significant decline in both the depth and severity of poverty, as well as declining inequality and strongly pro-poor growth leading to improved shared prosperity

[35] In 2002/03, goats and cattle were widely owned (37-38% of households) but remained unequally distributed. The study does not include statistical estimates, but the author argues that the correlation between the distribution of such wealth and disposable income was not clear. According to BCWIS data, 36% of households still owned livestock, 24% owned cattle. Even in cities and towns, 14% of households reported owning cattle. The BMTHS data obtained excluded the variable for cattle/livestock ownership.

[36] When preparing input for the Poverty Assessment based on HIES 2002/03 and BCWIS 2009/10, Lay and Schotte found that per capita consumption even falls for the rich, especially in urban areas, despite high income growth, which they considered "*may indicate important measurement problems*". Lay, J., & Schotte, S. (2015). *Assessing distributional and poverty trajectories under different policy and growth scenarios: A microsimulation model for Botswana* [Draft for the 6th meeting of the Society for the Study of Economic Inequality (ECINEQ)]. GIGA German Institute of Global and Area Studies.

(World Bank, 2015). The reduction in poverty is attributed to a combination of increasing agricultural incomes, including subsidies, and demographic changes.

Education level and employment status of the household head as well as rural residency are among the key determinants of household welfare and poverty (Lekobane & Seleka, 2017). Beyond these factors, inequality is driven by demographic aspects such as the number of children and working adults in the household, and age of household head (Okatch, 2015).

The BCWIS and BMTHS surveys have already served to deepen the analysis of inequality drivers further (see Martorano et al. (2021), commissioned by UNDP Botswana, and Sulla et al. (2022) of the World Bank reporting on inequality in the SACU region).

Based on the data findings in Chapter 3, I apply the proposed adjustments to analyse the development in welfare (measured by the consumption aggregate), poverty, and inequality across the BCWIS and BMTHS survey considering the official vision and targets. After determining the unit of analysis, I examine three central propositions of official reports that (i) welfare did not decrease on average, (ii) inequality did not increase overall, (iii) poverty has declined.

4.1 Unit of analysis

As the following review of poverty and inequality measures demonstrates, there is an implicit ambiguity as to whose welfare is measured and compared, whether it is the average Motswana (assuming welfare is shared equally within the household), a weighted average of the specific members in the household (taking account of the composition of the household, reflecting economies of scale), or the household as a single unit of analysis (regardless of its size or composition). In the survey context, the notion of a "*household*" is most often (and certainly within the United Nations organisations) defined as "*a group of people who live and eat together*". Bolt and Bird (2003) set out several possible decision-making models within a household illustrating the problematic generalisation of an institution that is specific to the culture and location of society and whose composition changes over time. Moreover, the growing literature on intra-household inequalities (beyond Bolt and Bird (2003), see Vijaya et al. (2014); Kanbur (2016); and, for Botswana, Lekobane (2020)) highlight how *inter alia* gender, the nature of kinship (marital status, biological or adopted children and their birth order), and health status influence the distribution of welfare within a household. As Kanbur (2016) warns, ignoring these factors could lead to flawed design of fiscal policies aimed at reducing inequality and poverty.

In reporting on poverty, Statistics Botswana uses both the individual and the household as unit of analysis. In terms of income and consumption inequality, only households are reported on, which is a source of divergence in conclusions on the level of inequality, and potentially on any changes in inequality. As the information is readily available, the choice of households rather than per capita averages (as a rough proxy for the individual as unit of analysis) could reflect tradition, a culturally or politically motivated focus on households as an institution. If larger households tend to have lower per capita income and higher income households have fewer members on average, shifting from household to per capita income is likely to indicate higher inequality. For Botswana, analysis by Martorano et al. (2021) is limited to household inequality only and thus overlooks the impact of differing household sizes.

In the design of the national poverty lines (PDLs), Statistics Botswana opts for adjusting the poverty measure to the household composition (and related economies of scale) and its location rather than adjusting the welfare measure for the wider population. This corresponds to partially applying equivalence scales. Seleka and Lekobane (2020) rely on these implicit equivalence scales in defining a welfare aggregate, adjusting Statistics Botswana's total consumption aggregate for each household by assigning adult equivalent weights, normalising the food poverty datum line (FPDL) for each individual in the household by the FPDL for an adult male residing in the city of Francistown.

Botswana's current approach, applying both national PDLs and per capita international poverty lines, thus fails to clearly define the relevant unit of analysis (the individual, the household, or the weighted average of household members) for identifying the poor, and takes account of economies of scale and geographical variations only when applying the national measure. The Botswana authorities could continue to use both the national PDL and international poverty lines with enhanced methodological consistency by developing deflators to account for geographical differences in living costs. To reflect the economies of scale due to the composition of the household, an adult equivalent scale could be applied to the official welfare aggregate. Meanwhile, international comparisons commonly adhere to per capita as standard measure.

Lekobane (2020) made a first attempt to estimate a nationally relevant and context-specific multidimensional poverty index (MPI) for Botswana using the individual as a unit of analysis. More recently, however, when launching their pilot MPI, the Government of Botswana settled for using the household as unit of analysis, deriving headcounts assuming "*that all individuals in a household are deprived based on household's deprivation of the weighted indicators*" (Montshiwa et al., 2021). Both are based on BMTHS data, from a survey which was not designed for this purpose. In consequence, Lekobane relies on individual-level indicators only for nutritional status indicators for children (not available for adults aged 18+), chronic illness, school attendance/achievement and literacy.

For international comparability, this study follows the common practice of focusing on the individual, measuring inequality in household per capita consumption (or income), without applying adult equivalence scales. Unless household structures develop rapidly over time, the choice of the unit of analysis matters more for the level of the inequality measure than the trend. However, rapid demographical changes were caused by the HIV/AIDS epidemic and the COVID-19 pandemic may again have changed the composition of households in ways which would merit tracking inequality at individual (or per capita) level, rather than only at household level as is the current practice for Statistics Botswana.

4.2 Across surveys

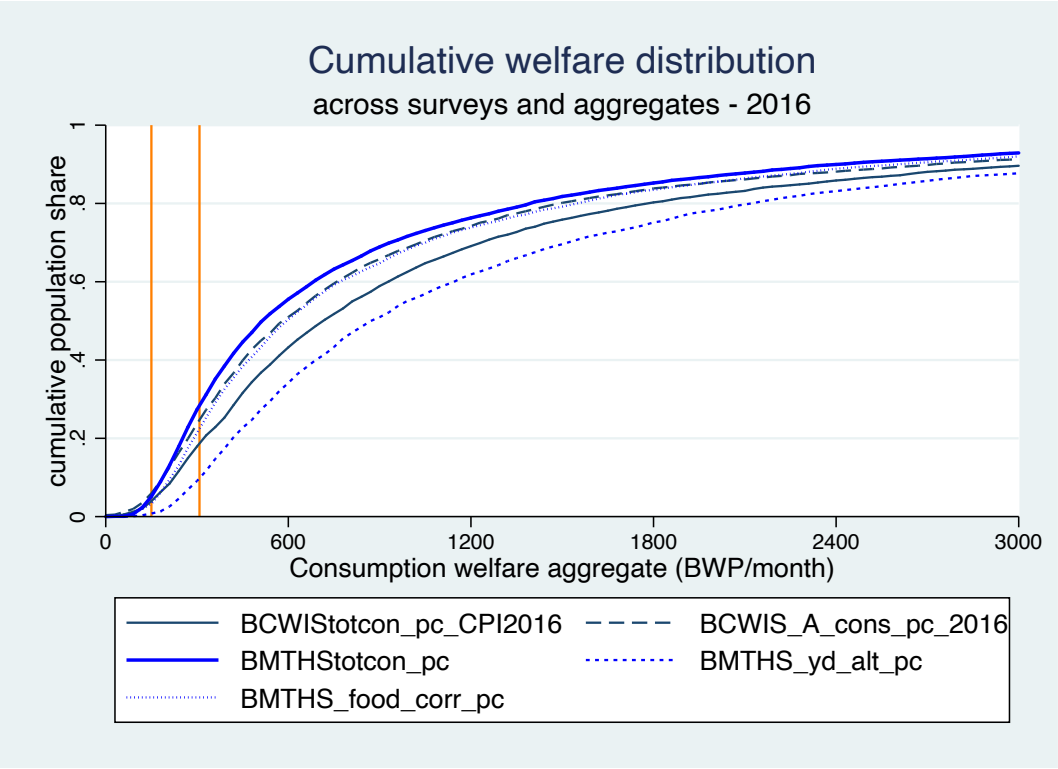
In its Vision 2036, the Government of Botswana set an ambitious target for reducing inequality, as measured by the Gini coefficient, from 0.60 to 0.45 (Government of Botswana, 2016b). Meanwhile, a poverty target remained to be determined. In its baseline for the Sustainable Development Goals (Statistics Botswana, 2018a), Botswana identified benchmarks indicators based on BMTHS, claiming that the proportion of the population below the international poverty line was 5.8% in 2015/16 (down from 6.4% in 2009/10), while

the headcount according to the national definition of poverty was recorded 16.3% (reduced from 19.3 in 2009/10).[37] By contrast, no benchmark value was indicated for shared prosperity defined by the growth rates of household expenditure or income per capita among the bottom 40% of the population and the total population.

4.2.1 Welfare

Using the Consumer Price Index (CPI) as deflator is admittedly a rough tool for intertemporal comparison of surveys (see Section 3.3). Meanwhile, when Martorano et al. (2021) erroneously assess that the average per capita consumption has increased between the BCWIS and BMTHS surveys, this stems from inflating rather than deflating BMTHS data by the CPI index. In Figure 10 below, BCWIS data is inflated using the CPI to compare the distribution of welfare in cumulative distribution functions.

Figure 10. Cumulative welfare distributions across surveys and aggregates



Notes: BCWIStotcon_pc_CPI2016 is Statistics Botswana's consumption aggregate from the BCWIS data per capita inflated by CPI. In BCWIS A_cons_pc_2016 the aggregate is adjusted for school meals, wages in kind, own produce consumed, net gifts received in kind). BMTHStotcon_pc is Statistics Botswana's consumption aggregate from the BMTHS data per capita. In BMTHS_food_corr_pc, the food sub-aggregate is adjusted as outlined in Section 3.1.1. In BMTHS_yd_alt_pc, the aggregate relies on adjusted food and housing sub-aggregates and adjustments of government funded in-kind transfers. The vertical lines indicate the range of international poverty lines, see Table 5

[37] For the baseline (and the subsequent update in July 2023), Statistics Botswana compiles the most recent available data for the indicators tracking progress towards the 17 goals. Further to the BMTHS, Statistics Botswana carries out more frequent Quarterly Multi-Topic Household Surveys (QMTHS), but these have so far not had an impact on the poverty or inequality indicators.

The solid curves represent the distribution of the official welfare aggregates, shifting left, consistent with the decreasing total and average consumption per capita in Table 2.

Data constraints prevent a complete review of the BCWIS consumption aggregate in this study. However, an alternative BCWIS aggregate can be created using the data from the survey rather than those that appear to be afflicted by anomalies (school meals, wages in kind, own produce consumed, net gifts received in kind, see Sections 3.1.4 and 3.1.5). With such a point of departure (BCWIS_A), curves cross at around BWP 250, suggesting that consumption at the lowest ventile of the distribution had increased (with the BMTHS curve shifting right), but decreased for the rest (where the BMTHS curve is to the left).

Correcting the food consumption in BMTHS in line with diary data (as outlined in section 3.1.1) results in a distribution very close to the alternative BCWIS measure. Linking the consumption aggregate more closely to survey data would thus suggest that consumption has kept up with average consumer price inflation, in support the proposition of non-decreasing welfare.

With adjusted housing consumption (BMTHS_yd_alt_pc), the welfare aggregate is expanded, and hence not comparable with the BCWIS aggregate.

4.2.2 Inequality

Using the official BCWIS and BMTHS aggregates for household per capita consumption, the Lorenz curves in Figure 11 are near congruent, but crossing, so we cannot conclude on this basis whether per capita consumption is more or less equally distributed. While consumption shares appear to have shifted slightly from the higher to lower deciles, this cannot be concluded within the confidence interval. This is in apparent contradiction to the conclusion of increasing inequality drawn by Statistics Botswana as well as Martorano et al. (2021), and also to the strongly decreasing inequality reported by Sulla et al. (2022), which merits explanation.

Using the data shared for the official consumption aggregate (Statistics Botswana), the per capita Gini coefficient is 0.611 while the Gini coefficient for household consumption is 0.554, well above Statistics Botswana's reported household Gini coefficient of 0.522. While the data does not allow for replicating Statistics Botswana's reported value, it matches that of Martorano et al. (2021). The remaining difference may reflect that Statistics Botswana weighted household inequality by household size (in error), in which case the survey data shared indicates a Gini coefficient of 0.518.

Figure 11. Lorenz curves - official aggregates

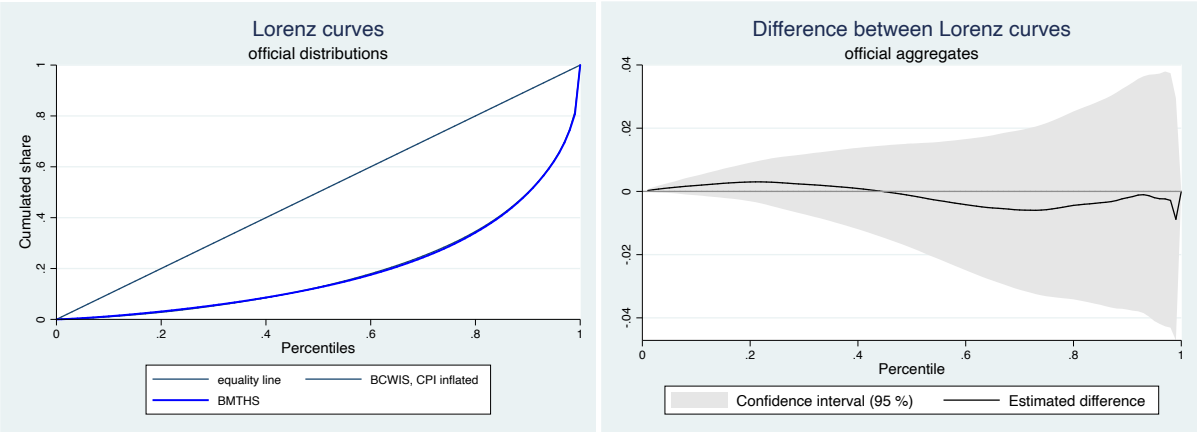


Table 7 summarises the development in official aggregates using a range of inequality measures. These estimates should, however, be interpreted with care as the changes are statistically significant at the 5% level only in a few cases.

Table 7. Inequality measure estimates across official welfare aggregates

	MLD	Theil	CVI	Gini
BCWIS	0.668	0.822	2.531	0.608
BMTHS	0.592	0.795	3.135	0.611
diff.	-0.076*	-0.027	0.604	0.003
	Atkinson 0.1	**Atkinson 0.5**	**Atkinson 1.0**	**Atkinson 1.5**
BCWIS	0.077	0.308	0.487	0.604
BMTHS	0.074	0.287	0.447	0.547
diff.	-0.003	-0.021	-0.041*	-0.057*

*Notes: MLD - Mean Log Deviation, CVI - Coefficient of Variation Index, diff. * - statistically significantly different from zero at 5% level of significance*

Measured by the mean log deviation (MLD) in per capita consumption, inequality has decreased at the national level, with significant reductions in urban villages and rural areas (see Annex Table 2). When decomposed, the reduction is purely within each strata, as the between-strata inequality is unchanged. The reductions registered by the Theil index are not significant, suggesting that the differences occur at the lower end of the distribution, which MLD is more sensitive to.

The Gini coefficient and the Coefficient of Variation Index have increased slightly, but the changes are not statistically significant. A slight increase is reported also by Statistics Botswana based on household consumption (see Section 4.1), but the microdata suggests is not statistically significant.

Measured by the Atkinson index, setting the inequality aversion parameter to 1, inequality has declined at national and urban levels (the decline in rural areas is near significant at the 5% level). Intuitively, assuming unchanged aversion, the Atkinson index indicates that the evolution in the distribution between the two surveys has reduced the "societal cost of

inequality": Whereas in 2009/10, 51.3% of the welfare aggregate (1-0.487) would be required to be equally distributed to ensure the same level of social welfare, the official 2015/16 survey data suggests that it would now require distributing 55.3% equally. While recalling that the change in Gini is not significantly different from zero, the opposite trends in the Gini coefficient and the Atkinson index are possible given the differing sensitivity to different parts of the consumption distribution.

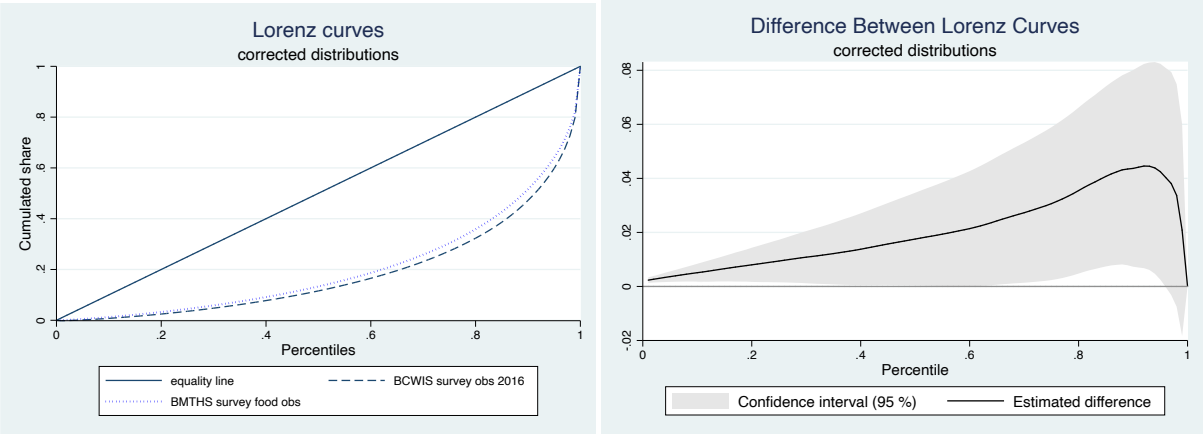
Looking at the three strata – cities/towns, urban villages, and rural areas – the estimated Gini indices (see Annex Table 2) suggest reduced inequality in the cities, but higher inequality in urban villages and rural areas, but all changes are too small to be considered statistically significant.

A decomposition of the Theil index shows that 92% of the inequality is within the strata, while the between-strata contribution is 8%. Further decomposition of the inequality measures lies beyond the scope of this study and the data challenges encountered raise questions about the findings of the few studies available (see Okatch (2015) for a decomposition of inequality changes in Botswana between 1993/1994 and 2009/10, based on adult equivalent consumption, Martorano et al. (2021) for household consumption, Mookodi (2021) for household consumption expenditure on heavily truncated datasets).

Most recently, when the World Bank reports that the Gini coefficient for per capita consumption inequality has fallen by 1.85 percentage points per year between the two surveys (Sulla et al., 2022, p. 13), the study appears to be based on a welfare aggregate different from the official. The inequality reduction is explained by strongly pro-poor urban growth in consumption expenditure, which is not recognised in the survey data obtained from Statistics Botswana.

The curves in Figure 12 show the BMTHS aggregate with corrected food consumption and the adjusted BCWIS aggregate based on survey observations. Contrary to the official aggregates, the aggregates more closely aligned with survey data indicate that per capita welfare has become more equally distributed, corresponding to a reduction in the Gini coefficient by three points, from 0.636 to 0.603.

Figure 12. Lorenz curves - corrected aggregates



4.2.3 Poverty

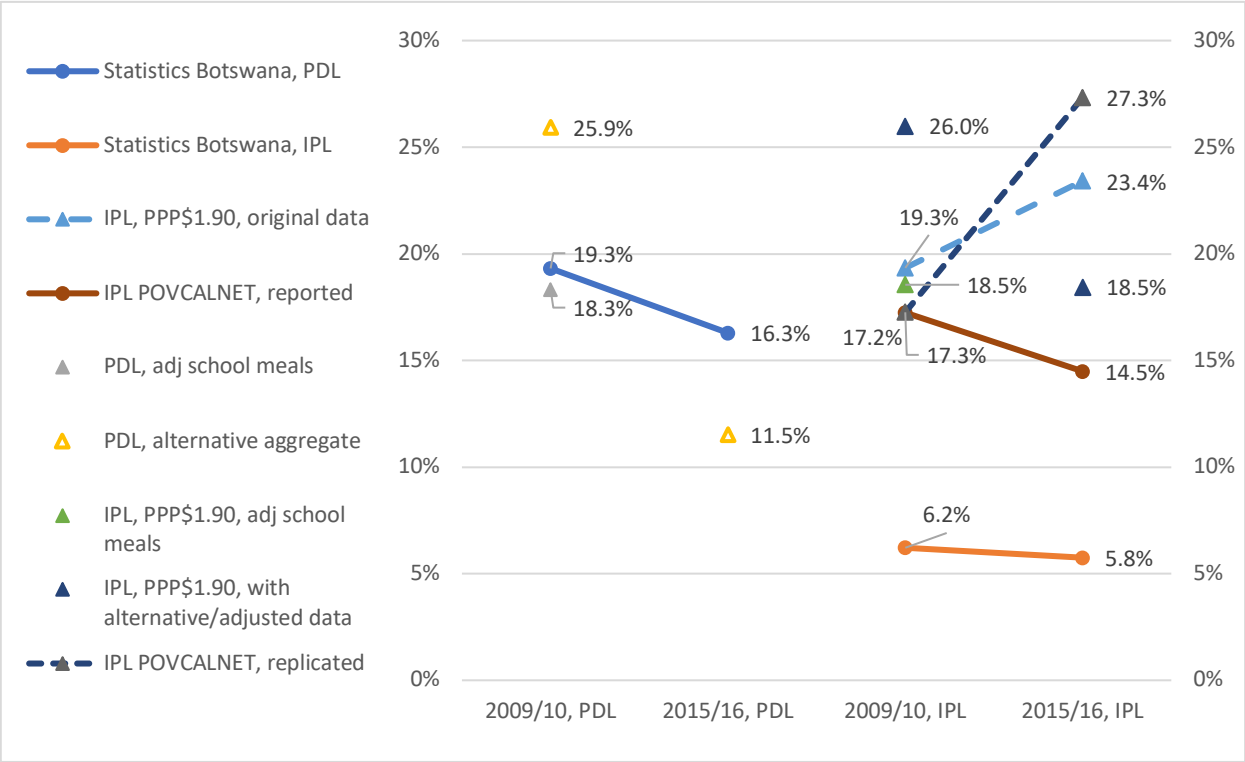
When the BMTHS Main Report 2015/16 was published in 2018, Statistics Botswana noted that: "*Results on the dollar a day poverty incidence are not included in this report as a more comprehensive review on these are continuing*". Nevertheless, also in December 2018, a poverty rate of 5.8% was set as benchmark value for the proportion of the population living below the international poverty line in Botswana's "Domesticated Sustainable Development Goals Indicators Baseline" (Statistics Botswana, 2018a). While rounded to 6% in the July 2023 update(Statistics Botswana, 2023), this rate continues to be widely quoted, also at highest level, as recently as in President Masisi's address in September 2021 in a side-event at the UN General Assembly (OPHIOxford, 2021) and in the "*Pilot National Multi-dimensional Poverty Index for Botswana Report 2021*" (Montshiwa et al., 2021).

When the poverty line is drawn at a level where the cumulative distribution function is dense (see Figure 10), poverty estimates become highly sensitive to variations in the line. To an individual poor or non-poor, the precise location of a poverty line is not as important as the chance moving out of poverty or risk of falling back into it. Such movements can only be studied over time, necessitating a stable, consistent, and coherent methodological approach.

Presented with the poverty headcount estimates in Figure 13 below, it is difficult to establish a firm benchmark and thus to detect clear trends. Statistics Botswana reports declining poverty measured by their national PDL. Their interpretation of the IPL (currently under revision) also shows a downward trend, but at a much lower level.[38] The most recent poverty headcount estimates reported by the World Bank (see IPL, POVCALNET reported) the trend is a parallel reduction.

[38] It is noteworthy that the monthly value of school meals (BWP 115) corresponds to 75% of the poverty line (BWP 154), even though such meals are only distributed during school days (185 out of 365 day per year).

Figure 13. Poverty headcount estimates across surveys



Notes: Statistics Botswana - using official aggregates; IPL POVCALNET - headcount reported on the website or replicated applying the reported poverty line to the survey data; triangles indicate replicated values or estimates using adjusted data. For 2009/10 using BCWIS aggregates adjusted for school meals only or the alternative aggregate derived based on the survey micro data (school meals as well as the sub-aggregates for wages in kind, own produce consumed, and net gifts received in kind). For 2015/16, the alternative aggregate is BMTHS data with adjusted food consumption in line with survey data.

Attempting to replicate the World Bank estimates, using the reported value of the IPL (BWP 309 per month per capita) on the official welfare aggregate, results in a much higher poverty headcount. By comparison, applying the IPL derived based on the principles outlined by the Atkinson Commission (Atkinson, 2016) to the official welfare aggregate, the poverty headcount increases less steeply, from 19.3% (similar to the national poverty estimate) to 23.4%.

Based on the adjustments to the data explained in Section 3.1 and the poverty lines set out in Section 3.2, additional estimates are derived (depicted with triangular markers). As the adjustment of housing consumption cannot be done for BCWIS data, the marginal adjustments considered here concern (i) school meals in BCWIS data, (ii) the alternative aggregate for BCWIS correcting for school meals and other anomalies, and (iii) adjusted food consumption for BMTHS.

In consequence, for 2009/10, poverty estimates range from 6% to 26%, depending on the method and consumption aggregate used. For 2009/10, correcting the school meals generates a slightly lower poverty rate, while using the alternative consumption aggregate (relying on survey observations) gives the highest "starting point".

The World Bank reported drop in the headcount to 14.5% in 2015/16 reflects that the estimate has been derived based on a different consumption aggregate from Statistics Botswana's BMTHS aggregate. The BMTHS aggregate with corrected food consumption (triangular data points) corresponds to a headcount of 18.5%, in the middle of the range. Evaluated against the national PDLs, reflecting a narrower poverty concept due to their nominally stagnant mean value, the poor make up 11.5% of the population. By contrast, the World Bank now shifts focus to estimated poverty in Botswana using the higher poverty lines for lower- and middle-income countries.[39]

Poverty measures are prone to multiple sources of uncertainty, which should be kept in mind when drawing conclusions about poverty trends and policy implications. Comparing the statistical estimates (detailed in Annex Table 3) can lead to a variety of "poverty narratives", based on which policymakers can motivate their interventions. Based on the official BCWIS and BMTHS data, the reduction in the national poverty measure is statistically significant and the severity and depth of poverty has been reduced, but it is worth recalling that this implicitly keeps the mean poverty line nominally unchanged, implying a narrowing of the poverty concept in real terms by 27%. By contrast, applying the international poverty line (PPP$1.90) to the official consumption aggregates, the increase in the poverty headcount is statistically significant, while the increase in depth and severity is not significant. Using the alternative indices of Watts and Sen-Shorrocks-Thon, the increase is not significantly different from zero.[40]

Considering alternative points of departure, first with the correction for school meals, there is a significant increase in incidence and depth of the poverty (using the three FGT measures), corroborated in the Watts and Sen-Shorrocks-Thon indices. Meanwhile, had the BCWIS consumption aggregate taken account of the survey data for outgoing in-kind private interhousehold transfers (gifts and wages) and the corrected school meals, the trend would generally have been reversed; although the 2-percentage point reduction in the headcount would not be statistically significantly different from zero, all other indicators would point to decreasing poverty.

At the very low poverty line initially applied by Statistics Botswana to represent its international poverty line (currently under revision), the poverty headcount, poverty gap, and squared poverty gaps have not decreased enough to represent significant reductions in the depth and severity of poverty. However, in this case, the choice of poverty measure matters: By an alternative poverty measure, either Watts or the Sen-Shorrocks-Thon index, the poverty reduction is significant.

[39] According to the World Bank Poverty and Inequality Platform (https://pip.worldbank.org/#home), the poverty rate at $3.65 (PPP2017) increased from 36.7% to 38.0% across the two surveys. At the upper-middle income poverty line of $6.85 increased from 60.4% to 63.5%.

[40] Applying instead the International Poverty Line in POVCALNET, where $1.90 PPP2011 is reported as P235 in 2009/10 and P309 in 2015/16, the poverty headcount has increased significantly along with the poverty gap (table A.1). The increase in severity is not significant. However, both the Watts measure and the SST index capture the significant increase in poverty.

In addition to the sampling error stemming from the survey, Atkinson (2016) assembled a checklist of potential sources of non-sampling errors to check for, including incomplete measurement of consumption, use of income vs consumption, population missing from sampling frame, survey differential nonresponse, inaccurate or out-of-date population totals, errors in the determination of the poverty line, standard error of PPP indices to calculate baseline local currency poverty line, surveys not comparable over time, extrapolation of out-of-date survey data, bias in domestic CPI to update local currency poverty line, differential inflation for the poor, rural/urban and other geographical differences, and the use of equivalence scale in place of per capita calculation.

In reporting on the surveys, Statistics Botswana's authors refer to several potential sources of error, including the incomplete coverage (population residing in institutions or in the reserve areas – Central Kalahari Game Reserve and Okavango Delta - are not covered). Although the poverty incidence is likely to be high in these groups, this is not likely to affect the overall estimate much due to the low population.[41] Meanwhile, in terms of data processing, 112 households from the BCWIS sample are omitted as non-consuming, which adds to the uncertainty of the reported estimate of household poverty incidence (based on a sample of 857 households assessed as poor according to the national PDL).

Other survey indicators related to self-assessed poverty and food insecurity suggest a rising trend in poverty. An increasing share of the population lives on less than what they consider they would need as an absolute minimum "to make ends meet": From 46.1% in BCWIS to 61.6% in BMTHS, with higher shares in rural areas (rising from 53.5% to 68.1%). Meanwhile, the microdata reveal that average "minimum standards" have increased: Between surveys, the self-assessed "absolute minimum" more than doubled from P895 per capita per month as a national average in BCWIS to P1,890 in BMTHS, with similar increases across strata. As consumer prices increased by 37% between surveys, the "self-assessed poverty line" has thus increased by more than 60%. Food insecurity can be chronic, seasonal, or temporary, and responses may therefore depend on the timing of the recall period of four weeks. This uncertainty is mitigated by the fact that the surveys were collected over a full year. The trend is again mixed: The share of households that worry about not having enough food has generally declined (remaining at 50% in rural areas) but those who did worry, worried more frequently.

Preliminary poverty estimates using the global multidimensional poverty index (Montshiwa et al., 2021), identify 17.2% of Batswana as poor, and 3.9% as living in severe poverty, or 20.8% and 3.4%, respectively, using a national pilot MPI. The two indices differ in which indicators are included and with which weight to evaluate deprivation in the dimensions of poverty, education, health and living standards. In addition, the national pilot index includes a social inclusion dimension (with indicators of employment and civil registration). The selection of indicators, their weights, and thresholds for determining deprivations were "developed taking cognizance of the poverty dynamics in the country" as well as the availability of robust data. Given the very different approaches, the fact that these MPI

[41] According to preliminary results of Statistics Botswana's 2022 Census, the population of the Central Kgalagadi Game Reserve was 84 households (with 488 members). In the Okavango Delta, 198 households were registered with 2,849 members). Together these remotely located census districts thus cover 0.1% of the updated population estimate.

poverty estimates are of similar magnitude to the official estimates using monetary measures may be purely incidental or could reflect a selection which matches a perceived notion of the share of the population living in poverty.

Considering the possible sampling and non-sampling errors above, any poverty narrative for Botswana ought to be accompanied by a report considering its robustness, to which the present study serves as a contribution.

4.3 Recalibrating the poverty line for the alternative consumption aggregate

A widening of the consumption aggregate without adjusting the poverty line would trivially reduce headcount poverty and would compromise the internal consistency of a methodology for measuring poverty (see Section 2.2, where Ravallion (2015b) cautioned against adjusting one part of the method - reference demographics - in isolation). Olson Lanjouw and Lanjouw (2001) outline a "robustness" approach for setting the poverty line which, under a given set of assumptions about expenditure patterns, will yield non-varying estimates of the incidence of poverty when different definitions of consumption are applied. Poverty measures that are sensitive to the depth are likely to increase as the consumption definition expands.

For Botswana, poverty headcount estimates for 2015/16 vary between 14.5% (WB POVCALNET), 16.3% (national PDL), and 23.5% (PPP$1.90), with significantly higher poverty incidence in rural areas and urban villages than in cities and towns. Botswana's Poverty Datum Line approach relies on the assumption that needs vary across regions, with baskets including an element for shelter of either P164 or P271 per month (independent of household size) for cities and towns and four categorical values in the range P12-50 per month in rural areas. Reported values exhibit large variations within and across regions, highest in and around the capital, but the shelter component of PDL is only a small fraction thereof, even for those classified as poor according to the national poverty line.

Assuming a poverty line drawn at the 20th percentile using the official welfare aggregate per capita, with adjusted food consumption, I examine how the line should be recalibrated to take account of the inclusion of paid and imputed rent in the welfare aggregate. Focusing, like Ravallion (2015b), on people living near the poverty threshold, I use the (food-adjusted) consumption aggregate to find average per capita food consumption (adjusted) and non-food consumption around the poverty line in each PDL region. Following Olson Lanjouw and Lanjouw (2001), for both food and non-food consumption, I calculate five average values for brackets around the poverty line percentile (that is, p20 +/- 1,2,3,4,5, or similarly for p16) and use the mean thereof to determine region-specific per capita poverty lines. With the housing adjusted consumption aggregate, I recalculate the mean of the five bracket averages for non-food consumption for those around the initial poverty line. A set of lines are then drawn. Table 8 summarises two sets of region-specific recalibrated poverty lines at p20 and p16 (corresponding to the national PDL estimated headcount).

Table 8. Recalibrated poverty lines by region

	Gabo-rone	Francis-town	Other Towns	South East	North East	North West	South West	National
Population (1,000)	*229*	*91*	*107*	*650*	*630*	*193*	*152*	*2,052*
p20 poverty line (BWP per month per capita)								
Food	134	144	188	122	115	101	109	123
Non-Food	154	156	99	170	174	192	182	168
Initial poverty line	289	300	287	292	289	293	291	291
Non-food w rents	655	524	746	406	348	336	353	429
Adj. poverty line	790	668	934	527	464	436	462	551
p16 poverty line (BWP per month per capita)								
Food	106	113	132	110	103	94	84	105
Non-Food	153	140	126	150	158	167	175	154
Initial poverty line	259	252	258	260	260	262	259	260
Non-food w rents	488	378	559	354	294	287	309	353
Adj. poverty line	594	491	691	464	397	382	393	458

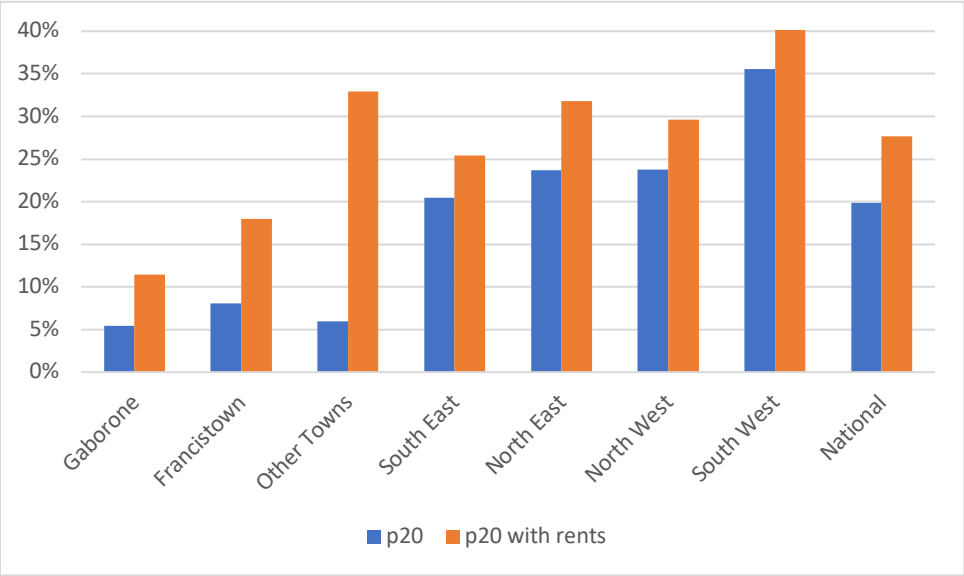
Note: The regions are those used for determining the poverty datum lines.

In both examples, adding rents to the non-food components has a large impact on the poverty lines, with increases of around 50% in the northern and western PDL regions (which are more rural), whereas it doubles or even triples in urban regions (Gaborone, Francistown and Other Towns). At national level, the average poverty lines increase by around 90% at the p20 level (76% at p16 level). The large increase in "Other Towns" is partly explained by a limited number of observations in the bands where the poverty line is recalibrated, partly by the rental market being shallow and widely varying.

Identifying the poor according to these housing-inclusive poverty lines would raise the poverty headcount from 20 to 28% or, alternatively, from 16 to 21%.[42] In the first instance, these estimates serve to illustrate that a widening of the welfare concept alongside a review of the poverty concept can alter the scope and composition of the population considered poor. Ensuring comparable data from subsequent surveys would allow for analysing the development over time, in light of urban and rural demographic and economic developments as well as government policies.

[42] Both increases different from zero at 1% significance level.

Figure 14. Poverty headcounts with recalibrated poverty line



Besides the changes to the regional poverty profile (Figure 14), the adjustment would alter the age- and household-profile of those classified as poor. Statistics Botswana's bottom-coding of food spending effectively ruled out single member households from poverty. Applying the recalibrated poverty line with rents to the adjusted aggregate (Table 9) indicates that poverty is a risk also amongst the smaller households with one or two members (of which 2% and 7%, respectively, are poor). An estimated 41% of the population live in households with 3-5 members, of which the poor in the original lowest quintile made up 11%. The adjustments here increase that share to 18%. Hence, if poverty initiatives were to target only larger households, a large sub-population group (exceeding 65,000) would risk being omitted.

Table 9. Poverty incidence across household size

	p20, head count	pop share	p20 wr, head count	pop share
1	0.0	0.0	1.6	0.1
2	2.1	0.2	7.4	0.7
3-5	11.4	4.6	17.7	7.2
6-8	27.0	6.6	38.2	9.4
9-11	41.4	4.2	52.6	5.4
12+	58.0	4.2	67.7	4.9
Total	19.9	19.9	27.7	27.7

Notes: P20 is the lowest quintile using the original aggregate; P20wr are poor using the adjusted aggregate and recalibrated poverty line; pop share is their share of the total population.

The age-profile of the poor does not change as noticeably (Table 10). With the adjustment, poverty incidence increases in all age groups, and more so amongst adults and children (+42-44%) than amongst pensioners (+30%). However, the composition of households also matters. A scheme with a narrow focus on households with young children (aged 0-14), would leave out 5% of the population who are poor according to the original aggregate. With the adjusted aggregate and recalibrated poverty line, the poor population falling outside the target group would exceed 7% of the population.

Table 10. Poverty incidence across age groups and households with or without children

	p20	p20 wr	BMTHS	BCWIS*
Children 0-14	26.3	37.3	20.7	26.4
Youth 15 - 35	17.6	23.7	15.1	17.7
Adults 36-64	13.7	19.8	11.8	14.3
Pensioners 65+	21.6	28.0	15.8	17.5
National	19.9	27.7	16.3	19.3
Poverty incidence in households…				
Without children	5.2	7.4		
With children	24.3	33.8		

*Notes: p20 and p20wr as above. BMTHS and BCWIS poverty incidence using the national Poverty Datum Lines. *In BCWIS children are aged 0-11, youth 12-35, hence not fully comparable with BMTHS.*

As in Section 3.2 above, more robust estimates could be derived by reviewing the regional disaggregation (here relying on the PDL regions reported by Statistics Botswana) and testing alternative methods for rent-imputation and self-assessment bias correction. Another caveat concerns the use of the official aggregate as point of departure for recalibrating given the lack of information about the underlying assumptions and methods applied.

4.4 Best estimates and the case for careful and nuanced assessments

Due to insufficient documentation and checks of data quality (as established in Chapter 3), caution is warranted in comparisons between the BCWIS and BMTHS surveys and tracking developments over time.

The trends in official estimates for poverty and inequality are ambiguous: Poverty is reportedly falling while inequality is increasing, notably in rural areas and between rural and urban areas. Upon closer inspection, the negative trends in real consumption according to the surveys cannot be reconciled with falling poverty without a narrowing of the poverty concept. Applying the lowest international poverty line (at PPP$1.90) to the official aggregates indicate increasing poverty. Measured by the Gini coefficient, official aggregates show unchanged inequality in per capita terms in contrast with increasing inequality at household level, calling for a clearer definition of the relevant unit of analysis.

Considering instead the aggregates more closely aligned with survey data, the trend in both poverty and inequality (per capita) would be declining, which raises the question why official aggregates differ from the survey data. Setting out a stable, coherent approach for determining the welfare aggregate, documenting assumptions and adjustments to the sub-aggregates, would prevent misinterpretations.

Botswana's national poverty measure includes a location-specific element for shelter, yet the official welfare measure does not account for accommodation, whether paid for or provided for free. Although shelter is also considered an essential element in international measures, many official welfare measures do not take account of paid or imputed rent of owned or

provided accommodation, even when international standards for national accounts, including imputed housing consumption, are adhered to (Balcázar et al., 2017).

Defining the lowest quintile, measured by the official aggregate with food consumption adjusted in line with the survey data, as poor, the value of their shelter varies significantly across the country. By recalibrating the poverty line in each region based on a welfare aggregate with paid or imputed rent (based on the self-assessment in the survey responses), the poverty headcount would be significantly higher. As adjustments to the poverty line may alter the profile of the poor, further work would be required to establish a robust method for determining poverty lines that can evolve with demographic developments and changing consumption patterns.

The survey data available does not allow for individual level analysis of consumption, but the inequality of per capita household consumption is so high that it cannot be ignored by looking at households only. More work would be necessary to refine welfare and poverty concepts to reflect the composition of households (e.g. reviewing the Botswana PDLs and redesigning the survey questionnaire), and the implications for analysing the incidence of fiscal interventions should be kept in mind.

In light of other analysts using an adjusted consumption aggregate (notably the World Bank), I give priority to the alternative aggregate for analysing the BMTHS micro data further in Chapter 5. An alternative welfare aggregate, correcting for measurement and quality bias in the data, is a necessary but not sufficient step to determine poverty. To guide policy makers, there must be consensus on where to draw the line to determine who is poor. Applying the lowest IPL, PPP $1.90, to the wider alternative aggregate leads to a poverty head count below 10%, which provides a benchmark for extreme[43] poverty. Meanwhile. the recalibrated poverty lines, the indicators for self-assessed poverty, and the fact that Botswana is a classified as an upper-middle-income country are arguments in favour of broadening the focus to the higher IPLs (PPP $3.20 and $5.50) in the next chapter. Taking account of housing consumption, the alternative aggregate is more evenly distributed than the official aggregate (by 6 Gini points). As there is no comparable alternative aggregate for previous surveys, no trend can be deduced at this stage. Nevertheless, until an updated, comparable aggregate is available, more in-depth, comparative static analysis of the BMTHS can provide insights as to how policy instruments impact poverty and inequality.

[43] Also referred to as "*abject poverty*" in official publications.

5 The impact of fiscal policy in Botswana

So far, economic academic literature on Botswana's fiscal policies has primarily focused on their macroeconomic implications for growth and fiscal sustainability given the reliance on revenue from mineral extraction (with the risks related to Dutch Disease, see Pegg (2010) and Barczikay et al. (2020)), and from the Southern African Customs Union membership. Timuno and Eita (2020) find evidence of a mismatch between productivity developments and Botswana's fiscal policy model. Adapting the Dynamic Stochastic General Equilibrium model of Basdevant et al. (2011), Timuno and Eita point to labour tax cuts as the most effective fiscal stimulus response in the event of a persistent mining productivity shock.[44] Analysing the weak growth in Botswana's Total Factor Productivity, they further caution that VAT "*seems to have a negative impact on TFP growth across all sectors*" and expenditure on social services "*reduces TFP growth in the secondary and tertiary sectors but improves it in the primary sector*".

The literature on the distributional impact of Botswana's fiscal policies is still limited. In examining determinants of poverty and inequality in Botswana, Okatch (2015) uses a static microsimulation model to estimate the impact of the 2010 VAT increase. The World Bank Poverty Assessment (World Bank, 2015) is underpinned by benefit incidence analysis by (Tesliuc et al., 2013) on 2002/03 data, updated with 2009/10 data. With a benefit incidence analysis using 2015/16 BMTHS survey data, Seleka and Lekobane (2020) examine the targeting and effectiveness of social protection programmes in place. An early application of CEQ methodology using BCWIS 2009/10 survey data was reported by IMF (2018). These studies have relied on the official welfare aggregate, whereas a recent study of inequality in the SACU countries (Sulla et al., 2022) use a different aggregate for Botswana.

Using the most recent BMTHS 2015/16 data, the present analysis is more comprehensive than the incidence studies available, allowing for analysis of the interaction of different fiscal instruments and their sensitivity to underlying assumptions. The analysis builds on the critical review of data and methods in the previous sections, which must be considered when comparing with and interpreting earlier findings.

5.1 CEQ methodology applied to Botswana - data, methods, and specifications

The CEQ methodology (presented in Chapter 2) is here applied using micro data and administrative data for Botswana to account for the impact of government fiscal interventions such as transfers (cash or in-kind), subsidies, direct and indirect taxes, benefits of public health and education services. The aim is to shed light on fiscal policy questions concerning the extent of income redistribution and poverty reduction being accomplished through fiscal policy, the equalizing and pro-poor impact of specific taxes and categories of government spending, and the effectiveness of taxes and government spending in reducing inequality and poverty. The methodology also offers tools to evaluate the impact of fiscal reforms that change the size and/or progressivity of a particular tax or benefit. Depending on

[44] With a medium-term (three-year) multiplier of 0.41, a cut in labour tax is estimated to have the quadruple effect of a cut in consumption taxes, or an increase in government consumption or investment.

the data available, these concepts can be derived using income or consumption as point of departure. As Botswana's official welfare aggregate is consumption, I opt for the consumption-based approach, whereby disposable income is set equal to consumption, disregarding any savings. Consumable income is then derived subtracting indirect taxes, adding indirect subsidies; final income furthermore includes in-kind benefits. Working "backwards" to derive the pre-fiscal income, gross income includes direct taxes (corresponding to market income plus direct transfers) while net market income is consumption minus direct transfers (corresponding to market income minus taxes).

Botswana currently has no contributory social insurance scheme, so there is no distinction to be made in considering such pension benefits as either government transfers (in which case pension contributions are considered along with direct taxes) or as deferred income (in which case the pre-fiscal income includes benefits, part of market income, while pension contributions are deducted). While contributory pensions are now compulsory for public employees, they are not for private sector employees and there is no redistribution element. These public employee pension benefits can thus be analysed as private savings, subsidised by the government as part of the employment contract. The same assumption is applied by Goldman et al. (2020) for South Africa.[45]

In section 3.1, I argued that the wider, adjusted aggregate derived corresponds better to internationally applied poverty measures (including shelter) as well as international standards for national accounts. A wider concept requires, however, careful consideration of the implications for the measurement of the level and distribution of poverty, particularly the specification of the poverty line, as demonstrated in Section 3.2. Having examined the consequences of bottom-coding food consumption and of the omission of paid and imputed rents, I opt for focusing the analysis on the alternative welfare aggregate (which is also more in line with CEQ methodology) rather than the total consumption aggregate from BMTHS. Nevertheless, the analysis has been completed also for the official aggregate, with details included in Annex Table 4and further details available upon request.

Complementary analysis based on the different aggregates can show how sensitive the results are to the quality of the data, the methodology, and underlying assumptions. Analysis based on the official welfare aggregate and national poverty line allows for comparison with the analysis based on 2009/10 BCWIS data (IMF, 2018), albeit with some caveats.

The CEQ methodology recommends that informality, tax evasion and indirect effects of taxes on inputs are considered, ideally by using estimated effective tax rates when allocating taxes. No such estimates are available for Botswana (in the public domain) and the data shared does not allow for identifying whether purchases are from formal or informal sellers. Statistics Botswana recently announced that a Supply and Use Table (SUT) has been developed (Statistics Botswana, 2021) for 2016 in the process of rebasing GDP. Although a 2007 Social Accounting Matrix (SAM) for Botswana is publicly available (van Seventer, 2014), it does not

[45] The source of pensions/annuities cannot be determined from the survey data. Based on the generally low take-up of private pension schemes, the authors of IMF (2018) assume that all contributory pensions are public pensions and consider these as social insurance.

take full account of the structural changes in the economy since the official 1996/97 SAM. [46] Using the 2007 SAM would implicitly assume no structural change in the economy over the two decades since the assembly of the SAM, which would be questionable in view of the expansion of service activities (retail trade, telecommunication, financial services). With the new SUT, it might be worthwhile examining the indirect effects of indirect taxes such as VAT and fuel levies in Botswana. Such analysis would have to take account of the price transmission mechanisms, notably the regulated prices in collective transport and utilities.

5.2 Fiscal interventions in the survey period

For an overview of the fiscal instruments available to the government, Table 11 shows the level and composition of expenditure and revenue in the fiscal year spanning April 2016 - March 2017, which overlaps the most with the BMTHS survey data collection period. With a budget of more than a third of Botswana's GDP, the public sector transforms revenue from minerals, customs duties (via the SACU pool for customs and excise revenue sharing) and domestic taxes into public services.

Around half the expenditure can be characterised as social spending on social assistance, health, and education. At the central level of government, such expenditure mainly involves the Ministry of Local Government and Rural Development (MLGRD) as well as the ministries responsible for education and health (Ministry of Basic Education (MoBE), Ministry of Tertiary Education, Research, Science and Technology, Ministry of Health), but also the Office of the President (tasked with poverty eradication). At the local level, responsibilities are shared among decentralised agencies, Village or Ward Development Committees, social workers, health clinics, and schools. Large revenue grants are transferred from the central level to local governments (2% of GDP), but the functional classification of local spending is not available.

[46] The technological (or "Leontief") coefficients of the 2007 SAM are based on the 1996-7 official SAM, updated with 2007 data for gross output, but the sectoral linkages are unchanged. Similarly, in using the 1996/97 SAM to estimate multiplier effects of exogenous shocks to energy and food prices, Tlhalefang and Galebotswe caution that the outdated base year affects the extent to which the analysis captures the structure of the economy Tlhalefang, J., & Galebotswe, O. (2013). Welfare effects of higher energy and food prices in Botswana: a SAM price multiplier analysis. *Botswana journal of economics*, *11*(15). .

Table 11. Government revenue and expenditure Fiscal Year 2016/17

	BWP million	% of GDP		BWP million	% of GDP
Total Revenue & Grants	**58,478.8**	**35.1**	**Total Expenditure**	**56,274.9**	**33.8**
Revenue	58,322.6	35.0	General Public Services	9,827.4	5.9
Tax Revenue	36,621.1	22.0	Defence Spending	5,972.4	3.6
Direct taxes of which	16,784.7	10.1	Social Spending	25,343.6	15.2
Personal Income Tax	6,626.2	4.0	Social Assistance of which	5,915.8	3.6
Corporate Income Tax	10,151.0	6.1	Conditional Cash Transfers (CCT)	1,586.2	1.0
- of which mineral tax	7,212.5	4.3	Non-Contributory Pensions	452.2	0.3
Taxes on Property	7.5	0.0	Near Cash Transfers (NCT)	3,089.6	1.9
Indirect Tax of which	19,836.3	11.9	Entrepreneurship support	189.4	0.1
VAT	6,535.3	3.9	Other soc admin	598.3	0.4
Excise Taxes and Levies	1,491.9	0.9	Education of which	10,081.8	6.1
- Alcohol	363.8	0.2	Primary (including pre-school)	3,175.5	1.9
- Tobacco	48.7	0.0	Secondary	4,458.4	2.7
- Fuel	1,079.4	0.6	Post-secondary non-tertiary	537.2	0.3
Customs revenue (SACU)	11,773.3	7.1	Tertiary	1,866.4	1.1
Taxes on Exports	3.3	0.0	Health	6,355.1	3.8
Other Indirect Taxes	359.8	0.2	Housing & Urban of which	1,793.0	1.1
Non-tax revenue	21,701.5	13.0	Housing	294.7	0.2
of which			Other social spending	1,747.8	1.1
- Mineral revenue	15,283.4	9.2	Economic services - *of which*	10,819	6.5
- School fees	33.1	0.0	Electricity subsidy	1,667.5	1.0
- Grants	156.2	0.1	Subsidy for agricultural inputs	658.8	0.4
			Urban infrastructure	686.7	0.4
			Roads	1,244.7	0.7
			Public debt interest	877.8	0.5
			Grants to local authorities	3,449.6	2.1

Sources: Author's calculations based on Annual Statement of Accounts (Government of Botswana, 2018), Quarterly GDP statistics (Statistics Botswana, 2021)

Notes: (1) GDP for Fiscal Year 2016/17 (2016Q2-Q4;2017Q1) as rebased in July 2021 (2) Including recurrent and capital spending (on cash basis) and certain special funds which are instrumental for education expenditure and indirect taxation. (3) Bank of Botswana (BoB) and MFED differ on classification of mineral revenue: BoB include Mineral royalties under mineral tax, hence part of Tax Revenue, while MFED, as here, show them separately under Non-Tax Revenue. (4) Excise Taxes and Levies exclude SACU excises, which are included in Customs revenue (SACU). The alcohol, tobacco and fuel levies are thus additional to SACU excises. (5) CCT includes Disability allowance, Ipelegeng (labour intensive public works cash-for-work scheme), Student Allowance, Destitute Allowance (6) Non-Contributory Pensions are Old Age Pension and World War II Veteran pension (7) NCT covers expenditure to Destitute Persons, Needy Students, Community Home Based Care, Orphans and Vulnerable Children, School feeding, and Sponsorships (bursaries/tuition). (8) Entrepreneurship support refers to Poverty Eradication Programme packages (9) Other social administrative spending includes general administration and spending on civil and national registration, immigrants, and refugees. (10) Education spending excludes student allowances and sponsorships/scholarships, included in CCT and NCT above. (11) As the spending funded through revenue support grants to local government is not allocated (the functional classification is not available), the spending in functional categories (including social spending) is effectively higher than indicated here.

To explain the allocation of taxes and transfers, first follows a description of the fiscal interventions focused on the time of the survey period. For each fiscal intervention, the main methodological assumptions for identifying benefitting or paying individuals or households and values are specified. As yardstick, recall that the PPP$1.90 international poverty line (World Bank POVCALNET database) corresponded to BWP 309/month in 2015/16, while the national poverty datum lines applied in the survey reflect a per capita average value of BWP 285/month.

5.2.1 Direct transfers

Botswana citizens receive **cash transfers** from the Government under the *Ipelegeng* cash-for-work scheme and allowances for disabled persons, destitute persons, government-sponsored students as well as through the non-contributory old age pension scheme and the pension for veterans of World War II and their dependents. Cash is also disbursed through the Botswana National Service Programme (BNSP), National Internship Programme, and the Graduate Volunteer scheme (GVS)). While the funds allocated to these schemes may have an important social safety net function to unemployed graduates, the government does not include these schemes in the social protection context but rather as an active labour market policy. Just like social protection beneficiaries, the guidelines do not grant trainees/interns/volunteers explicit rights of obtaining living allowances, but "encourage host institutions to pay them".

Botswana's universal **old age pension** is unique in Africa: All Botswana citizens aged 65 and above are entitled to a monthly non-contributory pension payment. Pensions are also paid to registered **veterans from World War II** and, after they pass on, any surviving unmarried spouses, or – if both parents have passed on - their children aged below 21. During the survey period the old age pension was BWP 330/month, while the WW2 veterans' pension amounted to BWP 450/month. I allocate the value of these universal old age pension benefits to the individual beneficiaries identified in the survey, while the WW2 veterans' pension is allocated to the head of the receiving household.

Ipelegeng is a self-selection, cash-for-work scheme, where able-bodied individuals can apply, monthly, to maintain government facilities (including schools) and public areas. For six hours work daily in a calendar month, beneficiaries receive a monthly cash payment (BWP 420, or BWP 750 for group supervisors at the time of the survey) plus a lunch meal (estimated value BWP 5/meal, BWP 100 per month). The total number of workplaces is decided by the Government (at Cabinet level) monthly, distributed across regions and districts according to population shares. Due to excess demand, local authorities (Village or Ward Development Committees) have had to establish a recruitment process where priority is given to those who did not work the previous month and selection is done by lottery. In the government budget, Ipelegeng expenditure is classified as development expenditure (despite its recurrent nature) rather than a social assistance scheme. Meanwhile, with the National Development Plan 11 it was recognised as part of the social safety net. The value of cash and in-kind payments are allocated to Ipelegeng beneficiaries, identified from their labour market status in the survey.

The **disability allowance**, introduced in 2015, was being rolled out in the survey period. The BWP 300 cash allowance is transferred based on a medical assessment to confirm the severity of the disability and a socio-economic assessment of monthly income below BWP 300. In

addition, beneficiaries are entitled to a food-coupon/food basket through the destitute persons programme. The survey data allows for identifying beneficiaries by inferring from the group of non-working respondents being supported by receiving old age or disability pension recipients aged less than 65.

Following a policy revision in 2002, a cash transfer of BWP 90 per month was introduced for **destitute persons**, categorising the programme as means-tested, mixed assistance, described in detail with other near-cash transfers below.

Student allowances are disbursed to individuals obtaining a government sponsorship for tertiary education in domestic higher education institutions.[47] The sponsorships constitute a grant/loan scheme, where the grant/loan composition depends on the field of study and loans are foreseen to be repaid by a salary deduction of 5% upon employment after graduation. At the time of the survey, however, the students will likely have perceived their allowance of BWP 1,420/month as a grant, given that the recovery rate was very low (Fasih et al., 2014). Some post-secondary students also receive significantly lower allowances (survey data average BWP 172/month). In the absence of a benefit value, survey respondents receiving allowances are assumed to receive the standard allowance or the average for post-secondary, non-tertiary students.

In the CEQ terminology, **near-cash transfers** include programs such as food rations, school uniforms, school feeding programs, and government sponsored tuition. Information about the costs of the various programmes is scarce and difficult to extract, partly due to how management responsibilities are shared. In the few cases where schemes have been evaluated with external assistance, attempts have been made to separate and reconcile spending information from different budget lines, resulting in estimates with explicit caveats and recommendations to improve data availability (BIDPA, 2013; Freeland, 2020; Maundeni & Mupedziswa, 2017).[48] In addition, the benefit rules, and values (or unit costs) are not publicly available and vary considerably across studies. Allocating the value of government funded in-kind transfers is thus a challenging exercise but key to understanding the impact of some fundamental elements of Botswana's social protection system.

Due to recurrent droughts and persistent nutritional challenges, the UN World Food Programme provided food aid from 1 April 1966 until the Botswana government gradually took over the responsibility in the 1990s, fully funding schemes since 1998. Today, public primary, secondary and some post-secondary education institutions provide government funded **school feeding**. Initiated as a nutrition scheme for primary students, the scope has been extended, now potentially reaching ¼ of the total population, implicitly conditional on school attendance during the 185 school days per year. Based on the reported attendance in public schools, benefits are allocated using the monthly value assigned by Statistics Botswana (BWP 115/month).

[47] Living costs are also covered as part of scholarships for studies abroad, not available domestically. These are funded from the same budget as sponsorships, but not likely to be adequately captured in the survey.

[48] Maundeni & Mupedziswa (2017) conclude that *"A close analysis of the rolling out of the social protection system in Botswana seems to suggest that one missing cog is a culture of deliberate efforts aimed at regular monitoring and evaluation of the social protection programmes, with a view to ensuring both efficiency and effectiveness".*

The government (Ministry of Local Government and Rural Development, MLGRD) also procures high-nutrition food rations for the **vulnerable group feeding scheme**, targeting children aged ½-5 years, pregnant and lactating women, TB, and leprosy patients from poor households. Health clinics are expected to screen patients (according to Ministry of Health and Wellness 2011-guidelines) and provide rations only to those that have symptoms of under-nutrition, including all pregnant or nursing teenagers (up to 18 years old). As noted by Seleka and Lekobane (2020), the BMTHS survey data appears not to have captured beneficiary children, the main target population. By simulation, I therefore randomly select beneficiaries amongst eligible individuals from the target populations to match the number of beneficiaries in the UN-sponsored evaluation of the scheme (Turner, 2019) and allocate benefits equal to the unit costs reported in the UN-sponsored study for a National Social Protection Recovery Plan (Freeland, 2020).

Based on guidelines (revised in 2002), social workers individually assess nominated candidates for the **destitute persons scheme**, according to their (i) inability to engage in sustainable economic activities, lacking assets and income sources (max 4 livestock units or earning BWP 120/month without dependents, BWP 150/month with dependents), (ii) inability to work and unreliable income due to old age, mental, physical, emotional, psychological disability or terminal illness with no means of support, or (iii) status of minor in need of care but not orphaned, child of terminally ill parent(s). In addition to the cash transfer mentioned above, the scheme covers food coupons (distributed through a smart card) or food baskets in remote areas. Unfortunately, the survey results are incomplete and reported values vary widely, possibly because the value is unknown to respondents. The scheme has not yet been evaluated, but (Chinyoka, 2019) describes its structure and evolution (including the distinction between smaller and larger households). In a reassessment of beneficiaries of the Destitute Persons Program in 2009, 8,765 beneficiaries were considered able to move to the Ipelegeng program; 2/3 had been moved by 2010 (Tesliuc et al., 2013). Based on the costs recorded in administrative accounts and the survey data available, a simplified benefit rule is applied, whereby food support is valued at BWP 450 for households with up to 4 members and BWP 650 for larger households.

While they are in education, children of beneficiaries of the Destitute Persons, Remote Area Development Programs or Community Home Based Care programmes qualify as **needy students** who can receive in-kind support including school uniforms, bedding in the case of boarding, toiletry, transportation accommodation. In addition, they are entitled to special dispensations to access tertiary education and exemption from paying school fees in basic education institutions. Beneficiaries are directly identified in the BMTHS survey data, with reported values ranging from BWP 2 to BWP 7,650, averaging BWP 759.

Since 1999, **orphans and vulnerable children** and their caregivers can apply to receive monthly food coupons (or baskets) and other support (school uniforms, clothing, transportation allowance). The official definition of orphans is narrower than the international one: In Botswana, an orphan has lost either both parents if married or the single parent. A vulnerable child is defined as *"a child under 18 years who lives in an abusive environment, in a poverty-stricken family without access to basic services, in a child-headed household, with sick parents or guardians, or is infected with HIV/AIDS"*. The BMTHS data

available allows for identifying beneficiary households. For most of those households, annual values can be extracted from the reported data; the remaining households are allocated the mean values, distinguishing between households with 4 or less and 5 or more members as for the destitute person scheme guidelines.

In response to the health care needs caused by the HIV epidemic, the Botswana government introduced the **Community Home Based Care** (CHBC) scheme in 1995. Beneficiaries are referred to the programme by the health services and are means-tested using the same criteria as the destitute persons scheme. The target population consists of terminal patients and people with chronic illnesses (including diabetes) with special nutritional needs. The support is mixed: A monthly cash transfer of BWP 202.80 plus food basket/coupon (of BWP 200) or drip feeding if required (estimated value BWP 1,100) (Freeland, 2020). Using the BMTHS data, beneficiary households are identified, and benefits imputed using these estimated values.

Analogously to the student allowances, the tuition fees covered by government **sponsorships** are here considered as grants rather than loans. Sources vary on the range of tuition costs covered. According to Tesliuc et al. (2013), local tuition fees ranged between BWP 36,000 (Arts) and BWP 63,000 (computing) in 2012/13. Based on the BMTHS survey, tertiary students' annual tuition fees range from BWP 4,200 (in a public technical college) to BWP 850,000 (piloting licence from a private institute). Every second student receiving student allowance also report receiving sponsorship. While not all students allowance recipients were entitled to tuition support, respondents frequently report neither tuition fees paid, nor tuition support received. This may be because they are unaware of the value thereof. Consequently, the survey data could falsely give the impression that tertiary education is free. In this analysis, benefitting individuals and values are identified directly from household and individual data, complemented with information from administrative accounts, without seeking to correct such cases of likely underreporting of tuition fees paid and sponsorships received.

Table 12 provides an overview of beneficiaries and benefits of the direct transfer schemes covered by this analysis.

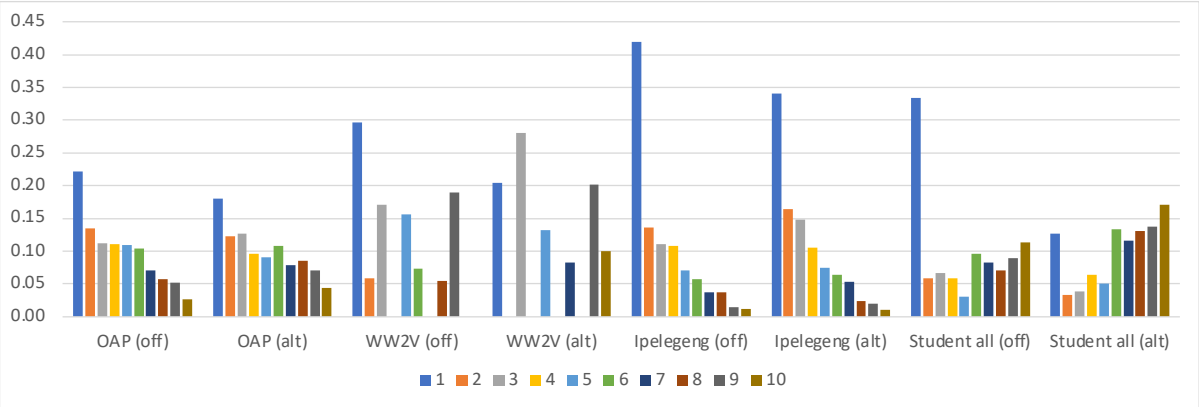
Table 12. Summary table of direct transfers

Scheme	Individual/ household	Benefit value (monthly)	Beneficiaries (survey estimate)		Beneficiaries (admin acc)
CCT					
Disability Allowance	Ind	300	0.2%	3,577	4,709
Ipelegeng	Ind	520-850	2.2%	44,402	64,464
Student Allowance	Ind	up to 1,420	1.4%	29,599	n/a
Destitute Persons	Hh	90	1.0%	19,552	35,366
CHBC	Hh	202.8	0.1%	1,080	1,313
NCP					
OAP	Ind	330	4.8%	98,549	95,649
WW2V	Hh	450	0.1%	1,460	1,569
NCT					
Needy Students	Ind	up to 638	1.3%	27,175	35,550
Destitute Persons	Hh	450-650	1.0%	19,552	35,366
CHBC	Hh	200-1,100	0.1%	1,080	1,313
OVC	Hh	83-2,400	0.7%	14,475	29,375
VGFP	Ind	93-223	11.4%	233,232	233,340
School feeding	Ind	115	23.1%	473,657	502,616
Sponsorship	Ind	up to 70,833 (mean 3,666)	0.9%	18,005	36,806

Notes: CCT - Conditional Cash Transfers; NCP - Non-Contributory Pensions; NCT - Near Cash Transfers. (1) Benefits values in BWP/month applicable during the survey period. Several transfers have subsequently been increased, starting with OAP and WW2V in April 2017. (2) Beneficiaries in % of estimated survey population and compared with administrative data. (3) Student allowances and sponsorships: Survey population includes post-secondary allowances and sponsorships (notably Brigades) reported at varying amounts; actual beneficiaries not available from Administrative Accounts. As potential beneficiaries HRDC (2019) reports the number of tertiary students (which includes some TVET) receiving sponsorships totalling 36,806, while NDP11 reports that 60,583 were enrolled in tertiary education in 2015/16.

The profiles of beneficiaries of the various schemes are sensitive the welfare aggregate in use, see Figure 15 below. Comparing the alternative welfare aggregate to the official aggregate, a greater share of beneficiaries is in the top deciles when looking at the schemes for old age pension, WW2 veteran pension and student allowances (and sponsorships). Some beneficiaries of the *Ipelegeng* scheme are shifted upwards as well, but only to the second and third decile.

Figure 15. Concentration shares across deciles using the official and alternative aggregates



Note: Deciles of the population ranked according to pre-fiscal income per capita

5.2.2 Taxes, levies, and subsidies

Personal income tax is payable on income from employment, profits from farming, investments and other businesses (with specified exemptions, e.g. for employer-funded medical insurance and 1/3 of a severance or retrenchment package). For individuals earning more than the basic allowance of BWP 36,000 annually, a progressive schedule is applied, with increasing rates (5; 12.5; 18.75; 25) for each subsequent bracket of BWP 36,000.[49] I allocate taxable wage income and business profits in line with individually reported shares of Statistics Botswana's aggregate for earned income (cash earned income plus business profits plus wages in kind), deducting employer-funded medical insurance to capture the progressivity of the personal income tax schedule.[50]

In 2015/16, Botswana applied a statutory **value-added tax** (VAT) rate of 12% (increased from 10% in 2010, subsequently further increased to 14% in April 2021, and most recently temporarily reduced, see Section 5.4 below), while zero-rating certain staple goods for poverty alleviating purposes, namely maize meal, samp, sorghum meal, maize cobs, sugar, setswana beans, millet meal, millet grain, bread flour, potatoes, onions, tomatoes, cabbages, carrots, etc. for human consumption and in their natural state, as well as goods subject to fuel levy (leaded petrol, unleaded petrol, diesel oil and illuminating paraffin), tractors and certain inputs for farming. Certain supplies are VAT exempt, notably domestic passenger service, accommodation, educational service, and the first 5 000 litres of water to a dwelling house per month supplied by Botswana's Water Utilities Corporation. Medical services provided by public medical facilities are also exempt; however, as basic health services by public medical facilities are free of charge, I assume household expenditure reported on medical services are at private facilities and hence subject to VAT. In allocating VAT payments, I apply the statutory rate to purchases of goods that are not zero-rated or exempt. Due to a lack of data regarding the place of purchase, I do not correct for informality. For households with incomplete diary data, I apply the average effective VAT rate of households in the same decile (ranked according to disposable income).

[49] As of 1 July 2021, the income tax brackets were increased by BWP 12,000.

[50] Statistics Botswana reports income tax imputed based on cash earnings. On the one hand, this variable does not take account of business profits, hence underestimates income tax due. On the other hand, it applies the individual tax schedule to the household values, hence overestimates the tax paid (by ignoring the basic tax allowance of any other income earners). As it is not clearly defined, cash earnings are presumed to be net of pension contributions.

In the adjusted housing consumption, purchases of building materials are not included, as such purchases are considered investments rather than recurrent consumption spending. VAT on such materials may nevertheless directly and indirectly impact the capacity of the poor in constructing or improving their dwelling.

South Africa adjusts the **SACU alcohol excise duty** rate in a structure that differentiates between wine, clear beer, and spirits, targeting a total consumption tax burden (excise duties plus VAT) as a percentage of the weighted average retail selling price, at the Budget 2012 revised to 23, 35, and 48 percent respectively. In 2008, the Botswana government imposed a 30 percent **alcohol levy** on the price payable for alcohol beverages (in the case of imports, the value for customs duty purposes). The levy was initially proposed at 70 percent but faced strong opposition. Meanwhile, in subsequent years it was increased successively to reach 55 percent in 2015 (applicable during the BMTHS survey period), and eventually reduced to 35 percent in 2019.

Based on data collected December 2017-January 2018, Van der Zee and Walbeek (2019)[51] find average price differences between bordering regions of Botswana and South Africa, which exceed the direct effect of the 30% and 40% Botswana levy on production costs on tobacco and alcohol, respectively. The persistence in price differences on tobacco and alcohol suggests that smuggling is limited, which the authors attribute to effective measures by customs and border control. Limited competition may also play a role, especially in sparsely populated areas.

Concerns about the alcohol consumption data are explained in Section 3.1.5 above. For the present purposes, the levy revenue is allocated based on Statistics Botswana's estimated alcohol expenditure in the household.[52] A better estimation of the effective incidence of the alcohol levy would require review of the underlying methodology and its coherence with reported individual consumption.

Botswana's **tobacco levy** of 30% of unit production cost (cost insurance freight (CIF) price for imported tobacco) was introduced by Presidential directive in February 2014 as an additional instrument to the SACU tobacco excise duty. The BMTHS survey gathered data on tobacco expenditure (in a 7-day recall period as well as in the 14-day diary of non-food purchases) and consumption patterns (frequency of use). As with alcohol expenditure, Statistics Botswana have assumed proportionate underreporting by a factor of 3.23.[53] The data includes

[51] Kirsten van der Zee and Corné van Walbeek (2018) Botswana-Lesotho: An Analysis of Alcohol and Cigarette Prices in Maseru, Gaborone, and Neighboring South African Towns, in Dutta, Sheila ed. (2018) Confronting Illicit Tobacco Trade: A Global Review of Country Experiences (p. 551-583)

[52] Using the estimated levy share based on the price survey of Van der Zee and Van Waalbeek (2018) would result in estimated revenue of 27% of the revenue collected by BURS. This is a lower bound estimate as their analysis did not include wine, due to the significant brand variation among wine products, and because of the low level of consumption of wine relative to the other alcohol types, notably beer. Tourist consumption would have a higher share of wine and generally higher value products, thus likely to drive the levy share up. Meanwhile tourist consumption is not captured in the BMTHS survey.

[53] This factor is deduced from the micro data and assumed to represent the proportionate adjustment using local production and import figures, as referred to when revising its Consumer Price Index in 2018 based on the BMTHS Survey (Statistics Botswana, 2018c, p. 14), see Section 3.1.5.

purchases of cigarettes as well as other types of tobacco, but the reported purchases of informal tobacco and marihuana are not categorised appropriately and totalling negligible amounts. Noting that the South African authorities adjust excises to maintain the tax burden (in line with anticipated inflation), I use the WHO 2018 tax shares for the most sold brand of cigarettes (excise (31.1%) and levy (8%), totalling 39.1% of retail price).[54] The incidence of the excise and levy is calculated by applying the tax share to the tobacco expenditure of the household.

Several instruments are used to tax petroleum products, but an overview thereof is not publicly available. In addition to a regular **fuel levy**, BURS collects the levy for the National Petroleum Fund (NPF, since 1986), used for price stabilisation as well as stocks and insurance of government's strategic oil storage facilities. Specified in thebe (100 thebe = 1 BWP), the NPF levy of 13.5 thebe per litre was set 6 December 2014. BURS reports that fuel levies on petrol and diesel were reduced from 21 and 12 thebe/litre to 12 and 7 thebe/litre respectively affecting the collection in FY2016/17. From 1 February 2016, the Road Fund Levy was increased to 80 thebe/litre. BURS collected BWP 107m in fuel levy in 2016/17. The Auditor General did not receive a submission from the National Petroleum Fund (it subsequently transpired that some funds had been siphoned off), but based on the levy rates, revenue from the NPF levy would be 50% higher than the BURS collected fuel levy. The Road Levy Collection Fund recorded levy income of BWP 932m in 2016/17. The National Road Safety Fund collected BWP 40m in 2016/17. In total, BURS and these off-budget funds collected around BWP 1,255m plus BWP 35m in customs and excise (likely collected in South Africa). Rather than determining the incidence of each levy separately, I rely on the aggregate tax value per litre (BWP 1.105/l for petrol, BWP 1.055/l for diesel) applicable from 1 February 2016, when prices were adjusted downwards (Khoabane, 2017). To estimate the direct effect of the fuel levies, I use 2016 average pump prices (World Development Indicators, sourced from German Agency for International Cooperation (GIZ)) to determine estimated volumes from household expenditure.

The state-owned Botswana Power Corporation (BPC) sells electricity at a two-step block tariff regulated by Government to ensure affordability to customers. In the survey period, the tariff for domestic consumers (inclusive of 12% VAT) was 0.6505 BWP/kWh up to 200 kWh, 0.8828 BWP/kWh for more than 200 kWh (tariffs as communicated via Facebook). In financial year 2015/16 ending 31/03/2016, BPC's average production cost was 1.39 BWP/kWh (production cost from BPC's annual report 2017, (Botswana Power Corporation, 2017)). The difference is allocated as (implicit) subsidy based on household consumption of electricity.[55]

Unfortunately, the survey data obtained excludes the data needed for allocation of subsidies for agricultural inputs. The Integrated Support Programme for Arable Agriculture Development (ISPAAD) provides recurrent support in the form of seeds, fertilizer, herbicides as well as agricultural services. The Livestock Management and Infrastructure Development (LIMID) provides means-tested, once-off, in-kind support in the form of small livestock. The

[54] World Health Organisation. (2021a). *WHO report on the global tobacco epidemic, 2019, Country Profile Botswana*. http://www.who.int/tobacco/surveillance/policy/country_profile/en/

[55] The implicit government subsidy for water is not as substantial, and I have not allocated it to consumers. The Water Utilities Corporation operates with block tariff structures for potable water and wastewater. The first 5 m^3 potable water consumed is VAT exempt with negligible impact (BWP 2.1/ year).

associated expenditure (Table 11) exceeds that of the universal old age pension and is likely to have significant redistributive impact.

Similarly, data is inadequate for allocating support to affordable housing. Such support is provided as loan-based support through the Self Help Housing Agency (since 1973), as well as the Public/Youth/District Housing initiatives, now managed by Botswana Housing Corporation. Given the relatively small scale and restrictive eligibility criteria, these initiatives are not likely to have significant redistributive impact.

Finally, rather than subsidising small businesses, Botswana provides support to stimulate entrepreneurship via Poverty Eradication Packages. In May 2013, the "starter-kits" provided to approved candidates varied in value from P4,357 (for a hair salon) to P34,923 for jam and vegetable pickers. [56] The support is classified as development expenditure rather than current expenditure (see Government of Botswana (2020)). Following the CEQ methodology, the incidence of this type of on-off investment support is not considered.

5.2.3 Public education and health service benefits

In official data, it is particularly difficult to disentangle spending and enrolment figures for TVET, post-secondary, and tertiary education. Based on the findings in the Public Expenditure Review of Basic Education and analysis of fiscal administrative documentation (World Bank et al., 2019), I resort to applying annual mean benefit values to all beneficiaries in public primary (BWP 9,151), secondary schools (BWP 25,508), public-funded post-secondary (BWP 47,094) and tertiary institutions (BWP 51,705). At tertiary level, annual horizontal expenditure is allocated across all students (BWP 3,676), including those in private institutions, who make up a much larger share than at lower levels.

For the health care benefits, I follow IMF (2018) in a use-based approach, applying WHO CHOICE unit in- and out-patient visit costs per day or visit (World Health Organisation, 2021b). I scale up to take account of the increase in the health budget from 2008/9 to 2016/17 (Government of Botswana, 2018) and scale down by the increasing number of patients days/attendances in the same period.[57] The survey data records health service use with a recall period of 4 weeks. While the assumption is less problematic for chronic illnesses, injuries and maternity-related use of the facilities are likely to be more irregular and rather spread on a larger population. The health benefits allocated are thus more unevenly

[56] Gradually increasing take-up of Poverty Eradication Packages resulted in a total of 37,002 projects funded, out of which 29,504 were operational according to the Government's 2020 mid-term evaluation of the National Development Plan 11 (Government of Botswana, 2020). Of the 46 beneficiary households identified in the BMTHS data, only 9 were classified as poor according to the national PDL.

[57] Specifically, the scaling factors and unit costs are:
(in-patient) hlt_scale_inp=6 355.14/3 039.8 (budget development) * 1 089 613/1 379 920 (patient days)
(out-patient) hlt_scale_out=6 355.14/3 039.8 * 3 601 739/4 867 264 (out-patients grand total attendances)
Unit costs for in-patients at primary level hospital hlt_inpc_uc= hlt_scale_inp*502.3, secondary and teaching hospitals (average) hlt_inph_uc= hlt_scale_inp*(524.0+677.6)/2.
Unit costs for out-patients at health centres without beds hlt_outm_uc= hlt_scale_out*63.6, health centres with beds hlt_outc_uc= hlt_scale_out*78.5, at primary or secondary hospitals (average) scalar hlt_outh_uc= hlt_scale_out*(89.4+93.2)/2.

distributed than would be expected with a longer recall period, but likely to even out when analysed across deciles.[58]

In addition, I integrate the value of free treatment for people living with HIV (PLHIV), based on the self-reported status of BMTHS respondents using unit costs estimated by Cogswell et al. (2016). The population share in the age group 15-49 with self-reported PLHIV is estimated at 9%, making up almost half of the official incidence estimates of 21.8% for 2016 according to UNAIDS (the share is higher when including older population groups reflecting successful roll-out of anti-retroviral (ARV) treatment. As the benefit allocated to PLHIV is limited to the cost of the ARV-treatment, I avoid double-counting vis-à-vis other HIV-related health care services rendered, for instance due to opportunistic infections.

5.3 CEQ assessment results explained

We can visualise the outcome of allocating taxes, transfers, and benefits across the population through a range of indicators and graphs. The overview in Figure 16 serves to recall the CEQ methodology (see Section 2.4) relating income concepts with fiscal interventions: The market (or pre-fiscal) income net of direct taxes (*dtx*) is the net market income, adding instead the direct transfers (*dtr*) gives the gross income. The disposable income is derived by subtracting taxes and adding transfers. Further subtracting indirect taxes (*itx*) and adding subsidies (*sub*) leads to the consumable income. The "final income" concept further takes account of the value of publicly provided services such as education (*edu*) and health (*hlt*). In the case of Botswana, where the welfare aggregate is consumption, the "income" concepts are derived from disposable income, set equal to the consumption aggregate. The other income concepts are then derived using the same fiscal building blocks (*dtr, dtx, itx, sub, edu, hlt*) as indicated by the arrows.

The shortfall in the consumption aggregate compared with National Accounts (see Section 3.1) affects the coverage of all income and expenditure categories. Meanwhile, the similarity of shares for direct taxes and transfers is retained; the value of direct taxes and transfers allocated to households accounts for 5.5% and 5.6% of private consumption, respectively (in the column on the left), while the personal income tax revenue and the relevant share of social assistance expenditure in the administrative accounts corresponds to 10% and 7.8% of private consumption (4.0% and 3.6% of GDP in Table 11). The VAT share is not as well covered: The allocated tax incidence amounts to 2.9% of private consumption (the main part of the 3.8% in indirect taxes), whereas the VAT revenue in administrative accounts would make up 9.9%. Similarly, only a third of the fuel tax revenue is allocated. This falls in line with the hypothesised underreporting of cash consumption (as described in Chapter 3) as well as the lack of accounting for indirect effects and taxation of foreigners not covered by the survey, counterbalanced by the lack of correction for informal transactions. Moreover, the electricity subsidy allocated accounts for half the value estimated from administrative data sources. The redistributive impact of the subsidy is thus underestimated by not accounting for indirect effects.

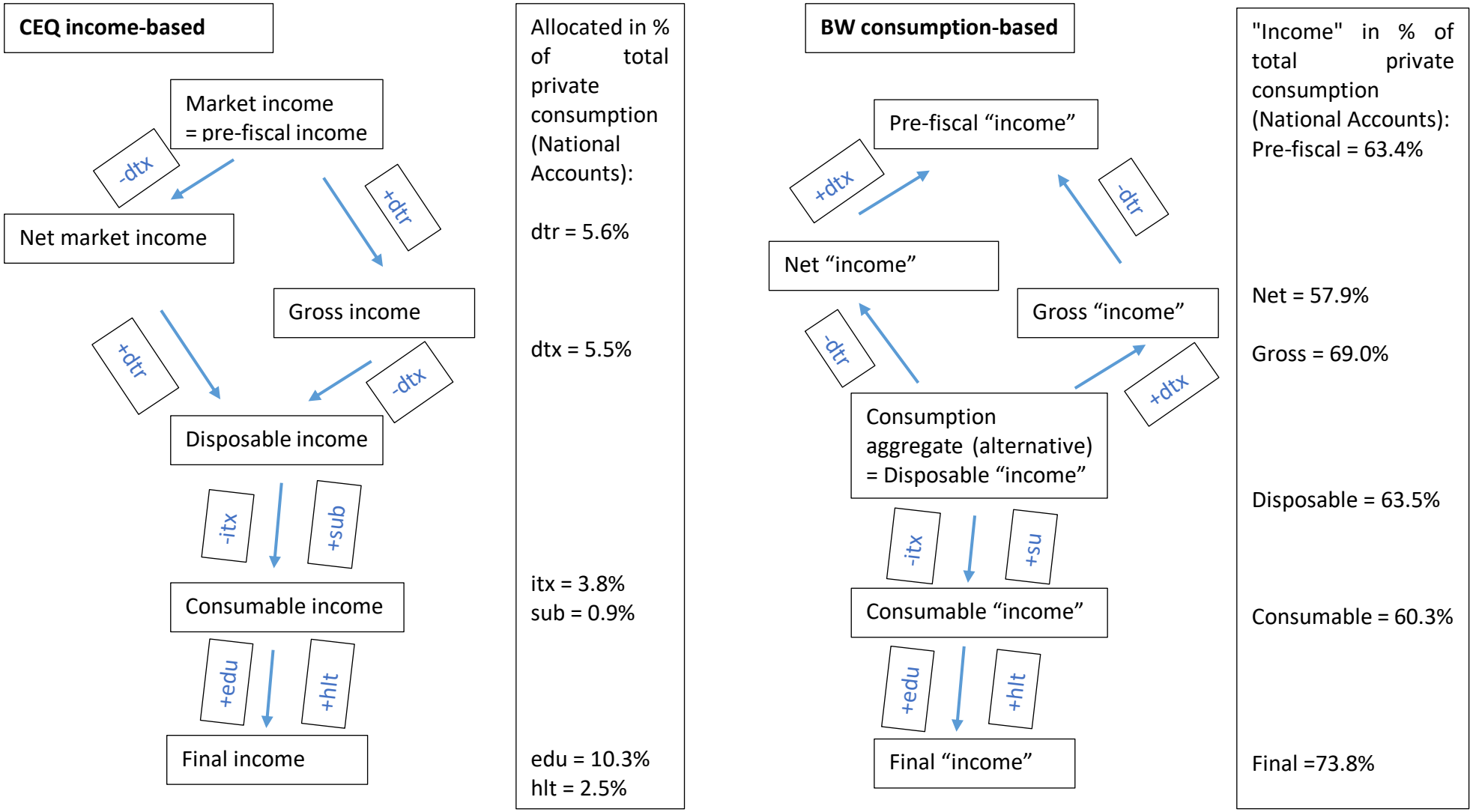
The allocation of social assistance, although challenged by the availability of administrative data, overall corresponds to the coverage (see also Table 12 for beneficiaries), though old age

[58] The approach is guided by the CEQ Handbook (Lustig, 2018), Appendix 6F by Barofsky & Younger (2018).

pensioners appear to be slightly overrepresented in the sampled households. The education related transfers and benefits are particularly difficult to control due to lack of budgetary data and varying classifications. Better data for student allowance and sponsorship beneficiaries would be necessary to control for survey bias.

Annex Table 4 provides a more detailed overview of the definitions and methods used in accounting for the fiscal interventions as well as comparison with administrative accounts. The STATA code for preparing the data in line with the CEQ methodology for the fiscal incidence analysis is available upon request.

Figure 16. Overview of CEQ methodological concepts and relations, and summary indicators for the CEQ analysis of Botswana 2015/16



Answers are sought to the following questions about the distribution of welfare: (i) How does fiscal policy change the distribution when we look at the system as a whole? (ii) To what extent does fiscal policy lift people out of poverty? (iII) To what extent does the fiscal impact on poverty depend on how the poverty line is drawn? (iv) Fiscal policy affects people in positive and negative ways; while some are lifted out of poverty or get closer to it, some poor get poorer. How large are these movements? (v) Analysed separately, which fiscal tools have relatively larger effect on poverty and inequality?

5.3.1 Fiscal impact on inequality

Table 13 summarises the impact of fiscal policy on inequality, having defined disposable income as equivalent to the respective consumption aggregate. Measured in percentage point changes in the Gini coefficient, sequentially from pre-fiscal to post-fiscal income, the total fiscal impact of taxes, transfers and benefits is a reduction in inequality by 14 points using the alternative, fiscally consistent aggregate. More than half the impact reflects the value of education and health services, reflecting high public spending on free education and health care, while government transfers explain a quarter. The redistribution brought about by the direct personal income tax scheme accounts for a sixth of the total impact, whereas the combination of indirect taxes and subsidies have limited, but equalising impact on the distribution of consumable income. The latter can reflect that *Lambert's conundrum* applies (see Section 2.4), which is examined in Section 5.3.4 below.

Table 13. Impact of fiscal policy on inequality

	Alternative		**Adjusted**		**StatsBots**		**BCWIS 2009/10**	
Income	**Gini**	***Change***	**Gini**	***Change***	**Gini**	***Change***	**Gini**	***Change***
Pre-fiscal	0.601		0.606		0.691		0.639	
Net market	*0.578*	*-2.2*	*0.584*	*-2.2*	*0.672*	*-1.9*	*0.628*	*-1.1*
Gross	*0.573*	*-2.8*	*0.566*	*-3.9*	*0.635*	*-5.6*	*0.615*	*-2.4*
Disposable	0.551	*-5.0*	0.543	*-6.3*	0.611	*-8.1*	0.605	*-3.4*
Consumable	0.549	*-0.2*	0.541	*-0.2*	0.609	*-0.2*	0.604	*-0.1*
Final	0.463	*-8.6*	0.453	*-8.7*	0.493	*-11.6*	0.534	*-7.0*
Total reduction		***13.8***		***15.4***		***19.8***		***10.5***

Notes: (1) Disposable income is set equal to consumption; consumable income is derived subtracting indirect taxes, adding indirect subsidies; final income furthermore includes in-kind benefits. Working backwards to derive the pre-fiscal income, gross income includes direct taxes (corresponding to market income plus direct transfers) while net market income is consumption minus direct transfers (corresponding to market income minus direct taxes). (2) BCWIS 2009/10 calculations by Younger (2020) for IMF (2018); not directly comparable due to differences in treatment of public employee pensions, scope of indirect taxes, transfers, and benefits included.

As illustrated with the "adjusted" welfare aggregatre, the adjustment of food and (notably) housing consumption leads to a distribution of disposable income which is more equal than the official aggregate. In the "alternative" aggregate, the further adjustment for fiscal

consistency proves to have minor impact (in Gini terms). The corresponding lower impact of transfers, i.e. the change from pre-fiscal to gross income, thus reflects that more transfers are "correctly" accounted for in the alternative aggregate when ranking households at pre-fiscal level. Comparing across the aggregates, the inequality-reducing impact of direct taxes is largely the same, as is the combined impact of indirect taxes and electricity subsidies.

Caution is needed when comparing with the earlier estimates for Botswana (IMF, 2018) based on 2009/10 BCWIS data. Although both sets are derived using the CEQ methodology, there are some methodological differences, in part due to the data made available. Moreover, as outlined in Section 4.2.2, the changes in the Gini coefficient between the surveys are statistically not different from zero. With these caveats in mind, using the official aggregates, estimated inequality is higher in 2015/16 when measured by pre-fiscal, net market, gross or disposable income, but lower in final income and the same for consumable income. In 2015/16, the in-kind benefits have a larger effect, as I include ARV treatment on top of in- and out-patient health care. Disregarding any survey differences, the larger impact of direct taxation can be explained by fiscal drag as brackets had not increased with income or inflation. The larger impact of direct transfers is mainly due to methodological differences, notably the inclusion of *Ipelegeng* and student sponsorships transfers.

Given that tax and benefit schemes have been largely unchanged in the period between surveys, we can expect that the changes in the distribution derive from evolving consumption possibilities driven by economic development, notably employment, in so far as measurement differences are accounted for. Looking at the difference between consumable, disposable and pre-fiscal income in Table 13, the treatment of transfers matters for how much impact we can assign to government-funded transfers: The multiple schemes in place reduce Gini by 2.8 points, which is half of what the official aggregate would indicate.[59] With direct and indirect taxation and subsidies reducing inequality by a further 2.4 points, these estimates confirm that fiscal policies do have significant redistributive impact, but also that unchanged policies would require major shifts in the pre-fiscal income distribution to reduce the Gini coefficient (in disposable income) from 0.6 to 0.45 as set out in the government's Vision 2036.[60]

Caution is also warranted in comparing distributions – and assessments of fiscal impacts - across countries, given the sources of error and uncertainty afflicting each study. The advantage of applying the CEQ methodology is that many of the associated risks are mitigated through detailed guidelines and common tools. Based on the standard indicators gathered by the CEQ data centre[61], maintaining the fiscally consistent, alternative consumption aggregate

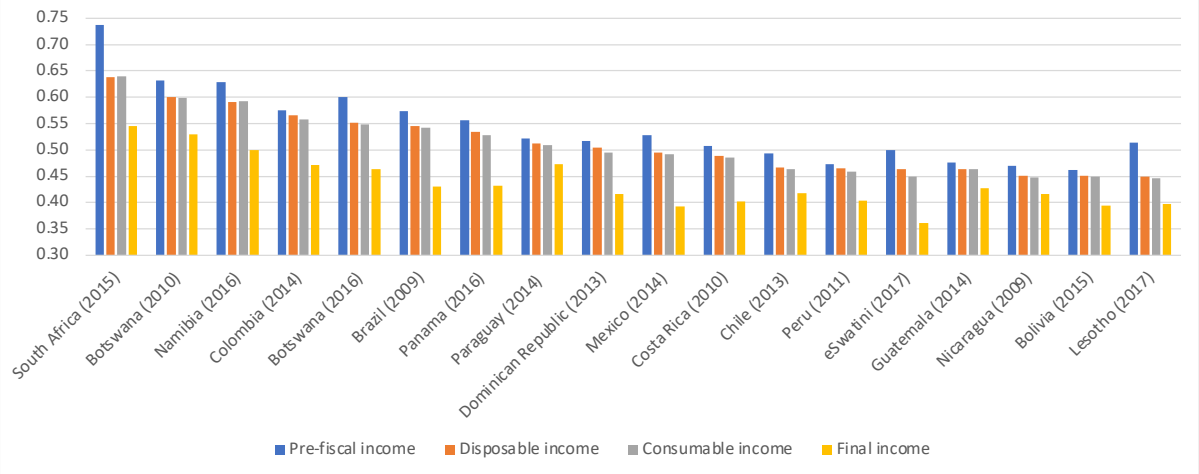
[59] World Bank calculations based on the ASPIRE database arrive at a similar estimate of 3.1 points, see Sulla, V., Zikhali, P., & Cuevas, P. F. (2022). Inequality in Southern Africa: An Assessment of the Southern African Customs Union. .

[60] As this and other studies equate disposable income with consumption, the measurement problems in Chapter 3 should hence not be underestimated.

[61] Commitment to Equity Institute Data Center on Fiscal Redistribution, May 2022. Based on information from: ALBANIA (Davalos et al. 2018); ARGENTINA (Rossignolo, 2020); ARGENTINA (Ladronis et al., 2019); ARMENIA (Younger et al., 2019); BELARUS (Bornukova, Shymanovich, and Chubrik, 2017); BOLIVIA (Paz Arauco et al., 2014); BOLIVIA (Paz Arauco et al., 2020); BOTSWANA (Houts and Younger, 2020); BRAZIL (Higgins, Pereira and Cabrera, 2020); BURKINA FASO (World Bank, 2018); CHILE (Martinez-Aguilar, 2020); CHINA (Yang, 2020); COLOMBIA (Melendez and Martinez, 2019); COLOMBIA (Melendez and Martinez, 2019); COMOROS (Jellema

as benchmark for Botswana (2016), pre-fiscal inequality is higher only in South Africa and Namibia.

Figure 17. Gini coefficients across income concepts in high inequality countries



Notes: The countries selected have disposable income Gini coefficients of 0.45 or higher. At the time of submission, the Botswana (2016) results reported here were being validated by the CEQ institute. The welfare aggregate is different from the Botswana (2010) results. For all others, the most recent study is used. See Annex Table 5 for underlying figures.

The same ranking appears if evaluated at the level of consumable income, but taking account of in-kind benefits, inequality is higher also in Paraguay, Colombia, and Peru (compared with Botswana (2016)). Through direct taxes and transfers, inequality is brought down by 10 percentage points in South Africa, recording twice the fiscal impact but still higher inequality compared to Botswana. In Lesotho, the impact is also larger, even from a lower point of departure. Indirect taxes and subsidies generally reduce inequality (except in South Africa and

2020); COSTA RICA (Sauma and Trejos, 2014); CROATIA (Inchauste and Rubil, 2017); DOMINICAN REPUBLIC (Aristy-Escuder, 2019); ECUADOR (Llerena et al., 2020); EGYPT (Lara Ibarra, et al., 2019); EL SALVADOR (Oliva, 2020); EL SALVADOR (Oliva, 2020); EL SALVADOR (Oliva, 2020); EL SALVADOR (Oliva, 2020); ESWATINI (Habib et al., 2020); ETHIOPIA (Hill et al., 2014); GEORGIA (Cancho and Bondarenko, 2015); GHANA (Younger et al., 2018); GUATEMALA (Cabrera, 2019); GUATEMALA (Cabrera et al., 2020); GUINEA (Batana et al., 2019); HONDURAS (Espino, 2020); INDIA (Khundu and Cabrera, 2020); INDONESIA (Jellema, Wai-Poi, and Afkar, 2015); IRAN (Enami, Lustig, and Taqdiri, 2017); IVORY COAST (Jellema, 2020); JORDAN (Abdel-Halim et al., 2016); KENYA (Kulundu et al., 2019); LESOTHO (Massara and Houts, 2020); MALI (Hounsa, Coulibaly, and Sanoh, 2019); MEXICO (Scott, 2013); MEXICO (Scott et al., 2020); MEXICO (Scott et al., 2020); MONGOLIA (Freije-Rodriguez and Yang, 2018); NAMIBIA (Jellema and Renda, 2020); NAMIBIA (Jellema and Goldman, 2020); NICARAGUA (Cabrera and Moran, 2020); NIGER (Hounsa, Coulibaly, and Sanoh, 2019); PANAMA (Martinez-Aguilar, 2020); PARAGUAY (Gimenez et al., 2017); PERU (Jaramillo, 2015); PERU (Jaramillo, 2020); POLAND (Goraus and Inchauste, 2016); ROMANIA (Inchauste Comboni and Militaru, 2018);; RUSSIA (Popova, 2019); SOUTH AFRICA (Inchauste et al., 2016); SOUTH AFRICA (Goldman and Woolard, 2020); SPAIN (Bengoechea and Quan, 2019) ; SRI LANKA (Arunatilake et al., 2019); TAJIKISTAN (Benicio et al., 2017); TANZANIA (Younger, Myamba, and Mdadila, 2019); TOGO (Jellema and Tassot, 2020); TUNISIA (Jouini, 2020); TURKEY (Caglayan, 2020); UGANDA (Jellema and Renda, 2020); UGANDA (Deisy et al., 2020); UKRAINE (Bornukova, Leshchenko, and Matytsin, 2019); No MWB is available for this project. Data was sourced from the publication derived from this assessment, which is: Higgins, Sean, Nora Lustig, Whitney Ruble and Timothy Smeeding. 2016. Comparing the Incidence of Taxes and Social Spending in Brazil and the United States. Review of Income and Wealth 62, no. 1, pp. 22-46. DOI: 10.1111/roiw.12201.; UNITED STATES (Carrera et al., 2019); URUGUAY (Bucheli, 2019); VENEZUELA (Molina, 2020) and ZAMBIA (Jellema et al., 2020). Full references can be found on www.commitmentoequity.org

Namibia), but the impact is less than one percentage point (except in eSwatini). Taking account of direct benefits, the largest fiscal impact among these high inequality countries is achieved in South Africa, Namibia, and Brazil, followed by Botswana and eSwatini. Among high income countries with lower inequality, CEQ studies for Argentina, Spain, and the USA report larger overall fiscal impact than in Botswana.

Table 14. Fiscal impact on inequality across strata

	Cities/Towns		Urban villages		Rural	
Income	**Gini**	***Change***	**Gini**	***Change***	**Gini**	***Change***
Pre-fiscal	0.519		0.560		0.629	
Net market	*0.492*	*-2.7*	*0.542*	*-1.8*	*0.613*	*-1.6*
Gross	*0.510*	*-0.9*	*0.525*	*-3.5*	*0.559*	*-7.0*
Disposable	0.485	*-3.4*	0.507	*-5.3*	0.541	*-8.8*
Consumable	0.486	*0.1*	0.504	*-0.3*	0.537	*-0.4*
Final	0.434	*-5.2*	0.409	*-9.4*	0.440	*-9.7*
Total		***8.5***		***15.1***		***18.9***

In the urban/rural perspective, inequality is higher in rural areas than in urban areas across all income concepts, see Table 14. This contrasts with the finding of (Martorano et al., 2021), underscoring the importance of determining whether welfare is measured per capita or per household (regardless of its composition) and a welfare aggregate that is comparable across surveys. Though based on a different aggregate, World Bank calculations show lower inequality in urban than in rural areas (Sulla et al., 2022) as above. They report a large reduction in urban inequality compared with the 2009/10 survey (from 0.61 to 0.54), with the explanation that "*growth was robust for the middle part of the distribution and much lower for those in the bottom and top 10 percent of the distribution*". The data obtained does not allow for such comparison (see Chapter 3). A geographical decomposition of the sources of inequality lies beyond the scope of this study, but the analysis of the welfare aggregate provides some explanations. The distribution of population shares (Figure 7) confirms that more than 5% of the population, in the top three deciles, reside in rural areas, where commercial agriculture and tourism generates income. The population residing in urban villages is more evenly distributed across deciles, which includes commuters to the high- and low-paying service sector jobs in the cities and towns. Household heads reporting to be currently out of employment make up 19% in cities and towns, 34% in urban villages and 37% in rural areas. Private sector employment is dominant in urban areas, but central and local governments are prominent employers across all three strata. Among household heads, the share of respondents with (current) central government employment is 13% in cities and towns, 12% in urban villages, and 8% in rural areas. Local government employment is reported by 5%, 7% and 6% of the household head respondents respectively in cities and towns, urban villages and rural areas. As employers of household heads, parastatals account for a further 9% in cities and towns, and only few in the other strata (1-2%). The organisation of government, with decentralised administration of publicly funded services thus has a

spatial redistributive impact via employment, which contributes to inequality within each strata.[62]

Fiscal policy interventions reduce inequality markedly more in rural areas than in urban areas, reflecting a larger impact of direct transfers and in-kind benefits. The provision of public health and education services and implementation of universal schemes, such as school feeding and old age pension, enable the government services to reach widely, also to remote rural areas. Due to lack of data, I refrain from conjecturing about the possible impact of the government funded support to agricultural inputs.

In cities and towns, direct taxation reduces inequality more than elsewhere, whereas the unequalising impact of indirect taxes outweighs the impact of subsidies and therefore increase inequality slightly (which is not the case in other strata).

5.3.2 Fiscal impact on poverty

Botswana is an upper-middle-income country, so poverty is here evaluated using the three international poverty lines (PPP$1.90, 3.20, and 5.50) usually applied to lower-, lower-middle- and upper-middle-income countries.

As argued in Section 3.2.1, the set of national poverty lines (PDLs) is not compatible with the fiscally consistent, alternative consumption aggregate, but - for completeness – results using the official aggregate and various poverty lines are included in Annex Table 2. The re-calibrated poverty line developed in Section 4.3 corresponds most closely to the PPP$3.20 international poverty line.

The poverty impact of the various types of fiscal interventions (Table 15) is evaluated by comparison to pre-fiscal incomes, but not at the level of final incomes for methodological reasons. Recalling that Botswana spends around 10% of GDP on education and health care, these benefits accrue to the wider population over a lifetime. However, public health and education services, especially when provided free of charge, are not marketable, and thus cannot be "traded in", e.g. to lift other household members above the poverty line. As ARV treatment is available for free, the "market value" is zero for HIV positive individuals, but the fiscal impact is significant and, if valued at cost (similar to a direct transfer), it would lift 1.6% of the population above the extreme poverty line. Services are valued based on average cost, which ignores differences in quality, as health and education benefits are identical across urban and rural areas by assumption.

[62] While recalling the caveats concerning the data and use of households as unit of analysis (see section 4.2.2), Martorano et al. (2021) find that "*in 2015/16, the household characteristics that contributed the most to consumption expenditure inequality were working in the public sector (as in the past), living in urban areas, and whether the household head has tertiary education.*"

Table 15. Impact of fiscal policy on poverty

	PPP$1.90		PPP$3.20		PPP$5.5	
Income concept	Headcount	Change	Headcount	Change	Headcount	Change
Pre-fiscal	19.2		34.7		52.4	
Net market	19.2	0.1	35.0	0.3	53.0	0.7
Gross	9.6	-9.6	26.6	-8.0	48.7	-3.7
Disposable	9.6	-9.6	26.8	-7.9	49.1	-3.3
Consumable	10.7	1.1	28.6	1.8	50.8	1.7
Total fiscal impact	8.5		6.0		1.6	

Notes: Change and total fiscal impact in poverty headcount percentage points.

More than half of government revenue stems from mineral extraction and redistribution of SACU customs revenue (Table 11), implying that the government is less reliant on taxing citizens and businesses to fund fiscal interventions for reducing poverty. While direct and indirect taxes inevitably increase the poverty headcounts, their impact is far outweighed by the fiscal impact of direct transfers. At the lowest poverty line, transfers lift half of the pre-fiscal poor (nearly a tenth of the population) out of poverty.

When applying the higher international poverty lines, corresponding to higher poverty headcounts, fiscal policy has less power to lift people out of poverty, and the counter-acting effect of taxes increases. While the highest international poverty line expands the poverty classification to around half the population, transfers nevertheless outweigh the combined effect of direct and indirect taxes.

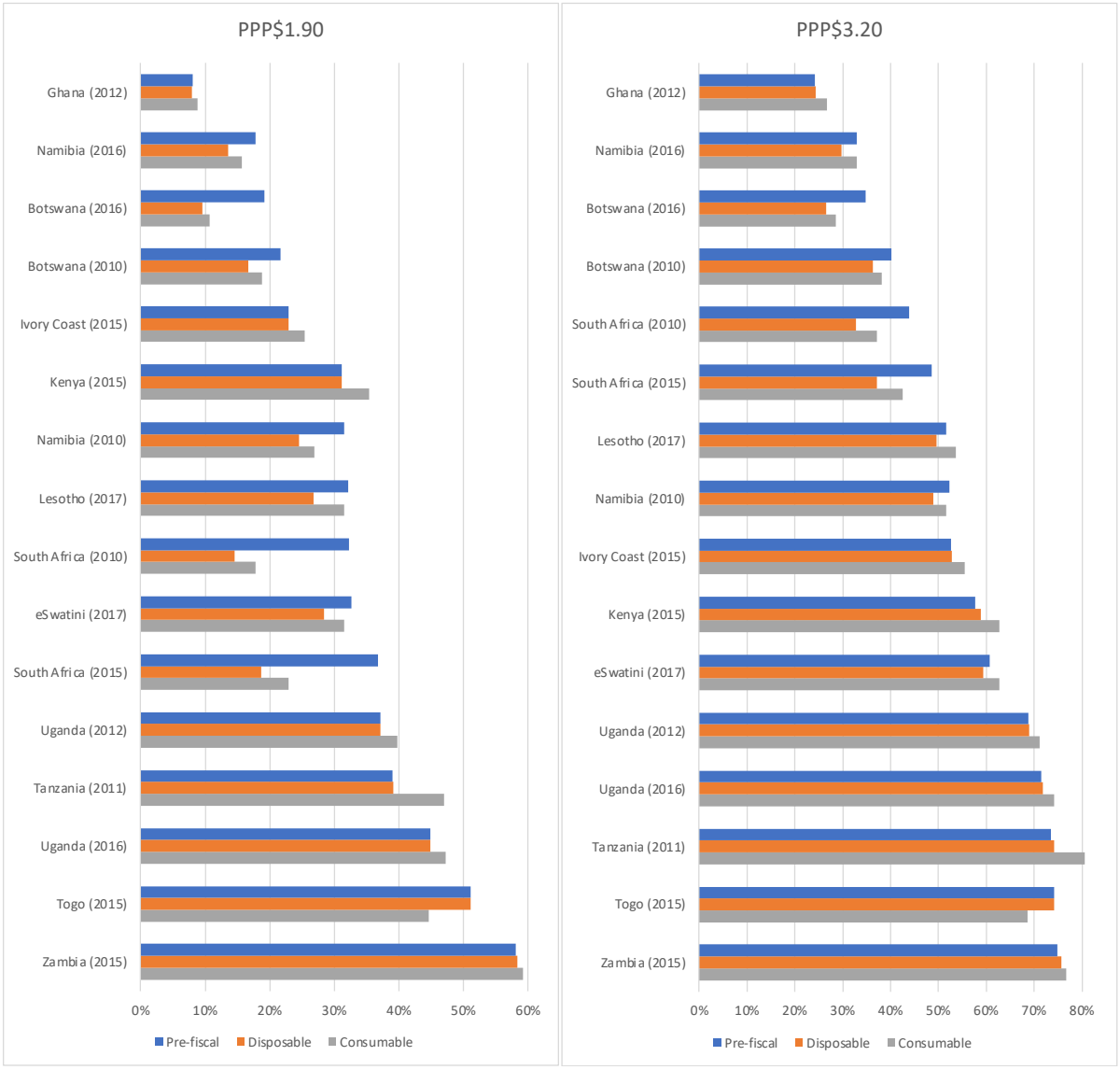
Focusing on eradicating extreme poverty, the government would be most concerned with reducing the PPP $1.90 head count. Meanwhile, given the wider, alternative aggregate developed here, taking account of housing consumption, and the increase in self-evaluated poverty, I consider the PPP $3.20 line preferable for evaluating fiscal policy impact. Measured at disposable income (i.e. consumption), it classifies a quarter of the population as poor, after direct transfers have lifted 8% of the population above the line (a quarter of the pre-fiscal poor).

CEQ analyses allow for identifying similarities and differences across countries, while acknowledging the caveats relating to international comparability of poverty headcounts and underlying welfare aggregates (e.g. due to divergent treatment of housing consumption).[63] Compared with other countries in Sub-Saharan Africa (Figure 18), Botswana records one of the lowest headcounts along with Ghana. Botswana's fiscal system records the second largest impact on poverty after South Africa. Although to a lesser extent, Namibia and eSwatini also succeed in reducing poverty through transfers, of which the effect outweighs poverty-increasing indirect taxes at the lowest international poverty line. Poverty reduction in Togo is achieved purely through subsidies.

[63] At the time of submission, the Botswana (2016) results reported here were being validated by the CEQ institute. The welfare aggregate is different from the Botswana (2010) results.

In stark contrast, fiscal policies lead to higher poverty, particularly in Tanzania, Kenya, Uganda, and Ghana, driven by both direct and indirect taxes. In Ivory Coast, the impact is purely due to indirect taxes. At the PPP3.20 poverty line, both Lesotho and eSwatini see the fiscal impact of direct transfers on disposable incomes outweighed by poverty-increasing indirect taxes reducing consumable income.

Figure 18. Poverty headcounts in SSA CEQs across pre-fiscal, disposable, and consumable incomes for the lower international poverty lines



Notes: Retrieved from CEQ Data Centre Standard Indicators, dated May 2022. Countries in SSA for which CEQ analysis is available, sorted by pre-fiscal poverty headcount at PPP$1.90 and PPP$3.20, respectively. For references, see footnote 61.

5.3.3 Who wins, who loses?

The assessment of fiscal impact on poverty and inequality above is sequential, starting from pre-fiscal income, taking account of aggregates of fiscal interventions. In this way, the population is first ranked and then re-ranked successively, resulting in several distributions of the same population. Official poverty and inequality measures are derived at the level of disposable income. Meanwhile, to a fiscal policymaker the relevant overall comparison is

likely at the level of consumable income, taking account of indirect taxes and subsidies as well, as this reveals the *ex-post* allocation of consumption given the existing structure of interventions. For comparison of individual interventions, however, the policymaker would be interested in the impact relative to pre-fiscal income to gain an *ex-ante* perspective.

The choice of concept for ranking individuals or households matters not only for how many are considered poor, but also who the poor are. With a change of concept, in the implicit reranking of individuals, some will fall below the poverty line according to one concept and not another. An anonymous measure of poverty will ignore such movements, which can be detrimental to assessing popular support to fiscal redistribution.

From the description of fiscal interventions, it can be expected that households benefitting from government transfers, including school feeding are likely find these outweigh the taxes and levied paid on cash consumption and income. Meanwhile, a household with limited or no access to transfers and a large share of consumption of highly taxed products such as alcohol, tobacco, and fuel, is likely to experience an overall reduction when comparing post-fiscal, consumable income with pre-fiscal income. Table 16 sets out the indicators for Fiscal Impoverishment (FI) and Fiscal Gains to the Poor (FGP) (Higgins & Lustig, 2016) as presented in Chapter 2, which confirm that Botswana's fiscal system benefits the poorest. At the lowest international poverty line, only 0.5% of the population are fiscally impoverished when comparing post-fiscal (consumable income) to pre-fiscal income, owing to the combined effect of direct and indirect taxes. While this corresponds to one in twenty amongst the poor, the magnitude of the average loss is minuscule (one thebe per year per poor individual). Even at higher poverty lines, where one in ten or one in six amongst the (pre-fiscal) poor is impoverished by the fiscal system, the magnitude of losses is negligible.

Nearly all (pre-fiscal) poor experience fiscal gains. Meanwhile, the gains are also of limited magnitude, below one PPP$ annually, which is similar to South Africa (estimated at ZAR5.1 per person annually, by Goldman et al. (2020)).

Table 16. Estimated Fiscal Impoverishment and Fiscal Gains to the Poor

	Poverty Line in PPP$		
	1.90	3.20	5.50
Pre-fiscal poverty headcount	19.2	34.7	52.4
Change to post-fiscal	-8.5	-6.1	-1.6
FI % of population	0.5	2.8	8.2
FI % of post-fisc poor	5.0	9.6	16.1
FGP % of pre-fisc poor	97.9	93.3	86.9
Total FI (PPP$ annually)	793	8,093	45,072
Total FGP (PPP$ annually)	211,063	407,634	593,328
FI/FGP (%)	0.4	2.0	7.6
FGP per capita (PPP$ annually)	0.1	0.2	0.3

Notes: Poverty headcounts at pre-fiscal (=market) and post-fiscal (=consumable) income. For FI, the headcounts are post-fiscal poor, who are poorer than when assessed at pre-fiscal income, taking

account of direct taxes, transfers, and indirect taxes and subsidies (for consumable income). For FGP, the headcounts are pre-fiscal poor that become less poor due to the fiscal system (transfers as well as indirect taxes for consumable income).

Compared with the findings of Higgins and Lustig (2016), when assessed at the lowest international poverty line, Botswana should hence not be added to the group of ten countries where it has been estimated that more than one-quarter of the poor pay more in taxes than they receive in transfers and subsidies.[64] The widespread but modest fiscal gains are consistent with the finding that Botswana operates many small schemes and some universal schemes (i.e. the old age pension, school feeding) which provide wide overall coverage but leaves a large share of the population still poor. While direct and indirect taxes do impoverish a share of the poor, their effect is minimal on average.

Focusing on the middle poverty line (PPP $3.20), as justified by the wider welfare concept, one-tenth of the post-fiscal poor are fiscally impoverished. In this context, it should be recalled that the government relies more on revenue from mineral extraction and favourable redistribution within SACU of its customs revenue than on direct and indirect taxation of its citizens (Table 11). Replacing such revenue sources by domestic taxation (such as higher VAT) would aggravate the extent of fiscal impoverishment.

5.3.4 Which fiscal tools do what?

Estimating the marginal redistributive and poverty reducing contributions for each scheme is a useful approach for evaluating fiscal redistribution instruments. These are derived by comparing the distributions with and without a specific intervention or groups thereof. In line with the CEQ methodology, I use the following terminology for characterising the fiscal interventions:

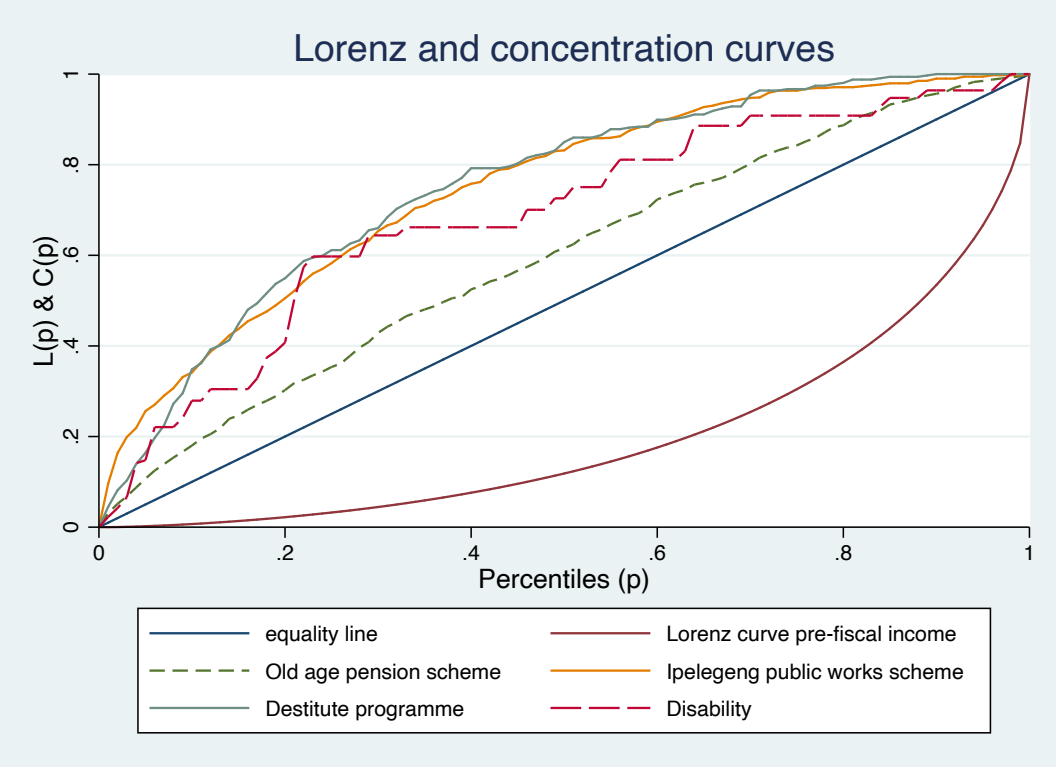
Term	Criterion	Necessary but not sufficient condition
Pro-poor, globally progressive transfer (absolute)	C-curve everywhere above equality line	CC<0, Kakwani>0
Globally progressive transfer	C-curve everywhere above the Lorenz curve	CC<Gini, Kakwani>0
Globally progressive tax	C-curve everywhere below Lorenz curve	CC>Gini, Kakwani>0
Globally regressive tax	C-curve everywhere above Lorenz curve	CC<Gini, Kakwani<0
Equalising/unequalising	Reducing/Increasing Gini, measured in Gini points (+/-)	
Poverty reducing/increasing	Reducing/increasing poverty headcount, measured in percentage points (+/-)	

Source: Lustig (2018). Chapter 8 by Sean Higgins provides a succinct overview of the definitions used and their sources, including the adaptation of the index defined by Kakwani (1977) for taxes to be applied to transfers.

[64] Among the countries analysed at the lower IPL, Higgins and Lustig (2016), finds that FI/FGP ranges from 4.2% in the Dominican Republic (in 2007), to 262.1% in Ghana (in 2013). By comparison, the effects are minimal in Botswana.

Before evaluating each intervention separately, these criteria are applied to the concentration and Lorenz curves in Figures 19-22 below. The main direct transfer schemes are pro-poor, globally progressive in absolute terms (see Figure 19; for the remaining direct transfer schemes see Annex Figure 1[65]).

Figure 19. Main direct transfer schemes

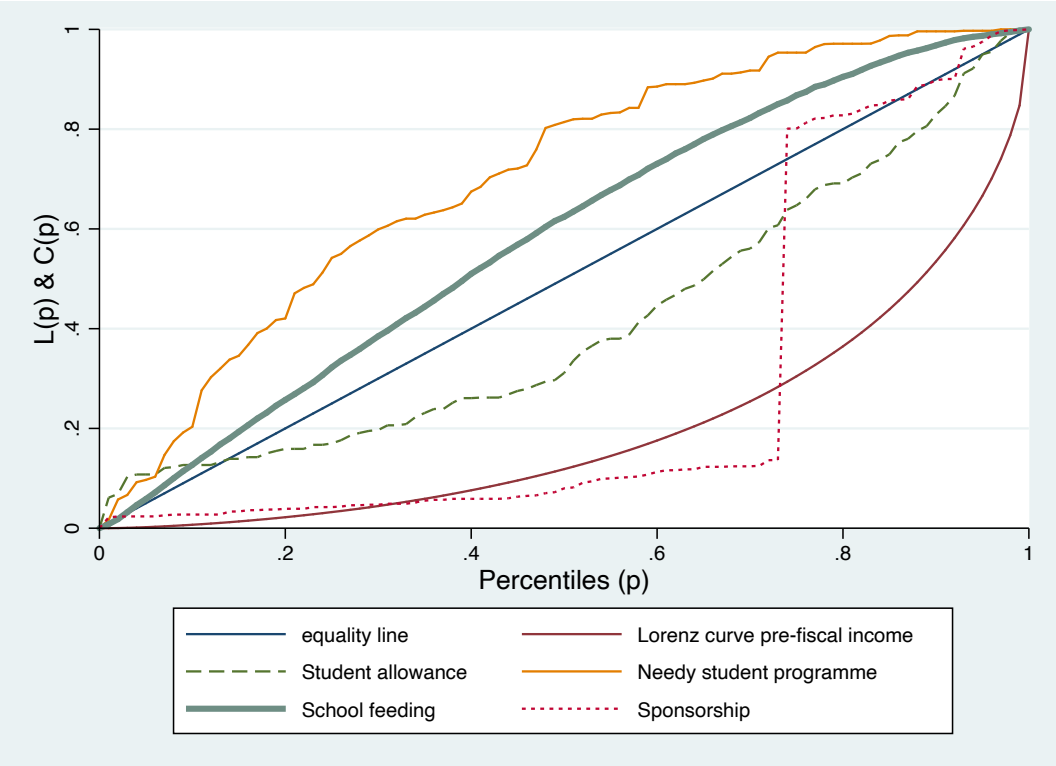


For education-related support, in Figure 20, the curves show a mixed result and the underlying assumptions should be recalled in their interpretation. School feeding and support to needy students is pro-poor. Whereas student allowances are globally progressive[66], this is not the case for sponsorships: Tuition support (to post-secondary, non-tertiary students) shows signs of progressivity for the lower third of the distribution, but the vast majority of funds targeting tertiary education benefits the top quartile.

[65] Due to a small number of observations in the sample, some concentration curves have sharp kinks, notably for the World War II veterans' pension and the community home based care scheme.

[66] As shown in Figure 15, student allowances beneficiaries are well represented in the higher deciles. Nevertheless, it is possible that some students have underreported consumption in the form of in-kind support from relatives, and - based on anecdotal evidence - that some students in the lower deciles share the relatively generous allowances with relatives in other households.

Figure 20. Education-related transfer schemes



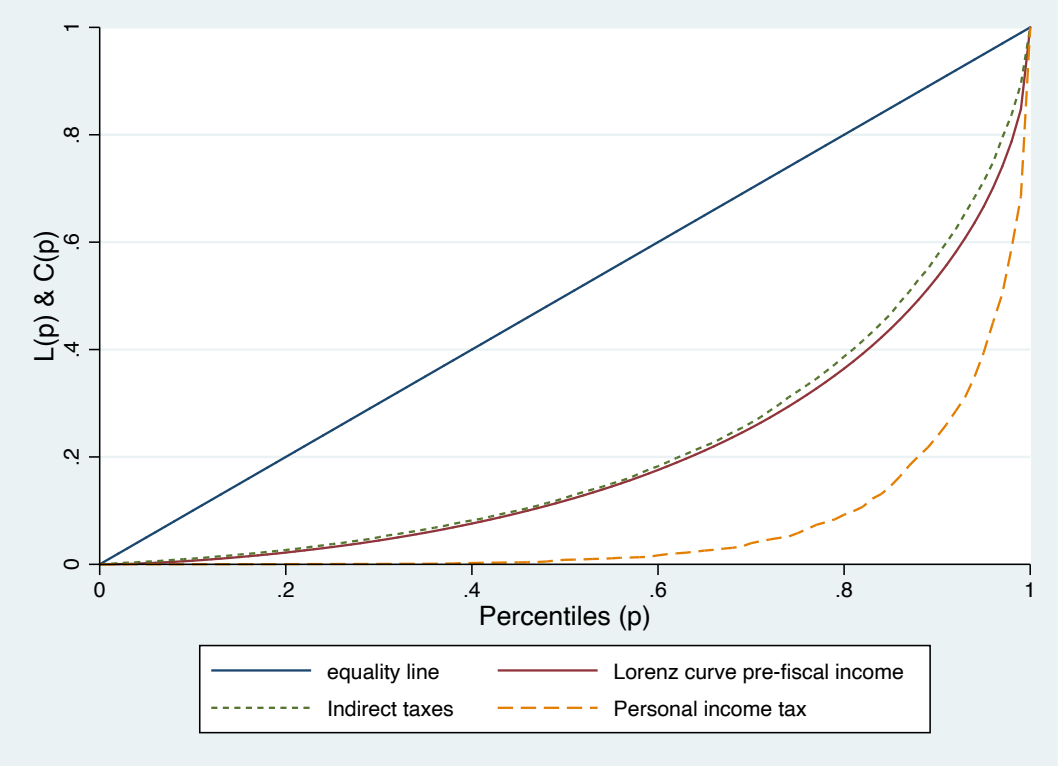
From an efficiency perspective, public funding for tertiary education can be justified theoretically if correcting market failures, e.g. when capital markets do not accept human capital as collateral or do not take account of potential positive externalities of a better educated workforce. As pointed out by Barr (1987), efficiency arguments for public education spending may be reinforced by vertical equity motives, supporting transfers for education of the poor, but leaves it open what the optimal extent of support may be. On paper, Botswana's grant/loan scheme reflects the consensus which Barr saw emerge in the 1990s, with a public subsidy element, a targeting mechanism, diversified fee structures, and income-contingent repayments.

As described in Section 5.2.1, tuition covered by sponsorships is here treated as a grant and considered a near-cash transfer, forming part of private consumption equated with the disposable income. Supposing the income-contingent repayments are effectively implemented going forward, the benefit value (i.e. grant-element) of the sponsorships would be significantly lower. Meanwhile, given the comprehensive consumption-based welfare aggregate, the tuition expenditure (covered by the sponsorship funds) would remain part of current consumption (reflecting education services consumed), placing recipients in the top deciles. Reclassifying sponsorships as loans would remove the instrument from the group of direct transfers, which ought to be mirrored in a reorganisation of the government account to reflect that such spending would mostly be repaid.

Focusing next on taxes and subsidies, Figure 21 shows that personal income tax is globally progressive, paid only by the top half of the population. The top decile pays 76% the total revenue; the top ventile accounts for more than 90%. Jointly, indirect taxes (VAT, fuel,

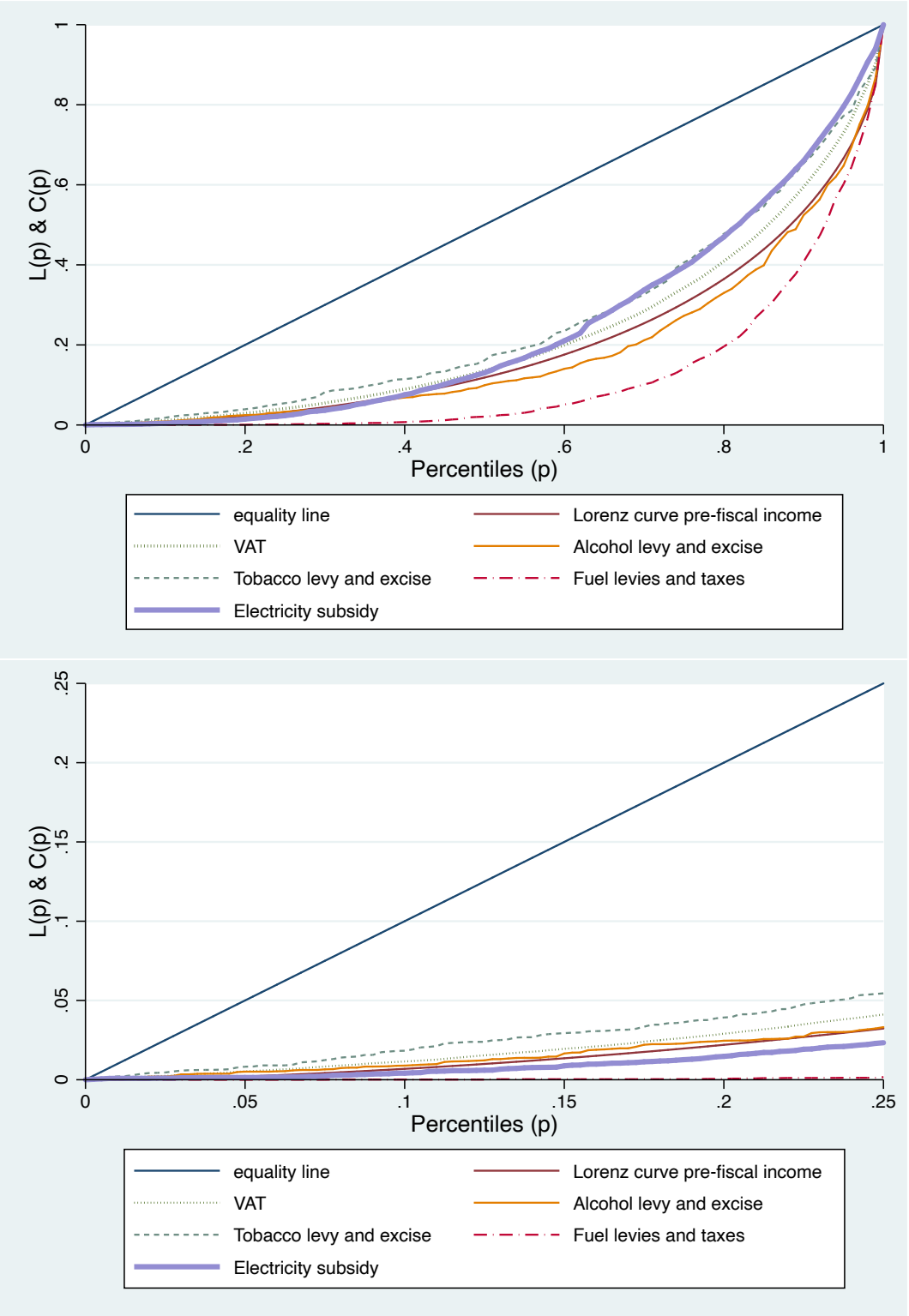
alcohol, and tobacco) are globally regressive when evaluated against pre-fiscal income. The top ventile accounts for 62% of all indirect taxes, while the lowest half record 12%.

Figure 21. Direct and indirect taxes (aggregated)



Evaluating each instrument separately in Figure 22, the conclusions are not as clear: VAT and tobacco excises are globally regressive, fuel taxes are globally progressive, while alcohol taxes weigh more heavily on the poorest quarter at which point the concentration curve crosses the Lorenz curve (and hence cannot be characterised as globally regressive or progressive). Given that the concentration curve of the electricity subsidy also crosses the Lorenz curve around the third decile, it cannot be characterised as globally progressive.

Figure 22. Indirect taxes and electricity subsidy, total distribution and lowest quartile



In line with the CEQ methodology, each fiscal intervention can be evaluated based on its marginal contribution to redistribution and poverty reduction. Table 17 sets out the estimated impact of each of the direct transfers and indirect taxes along with their aggregate effects, as well as the impact of the personal income tax, the electricity subsidy, and benefits from free health and education services.

Table 17. Marginal contribution to redistribution and poverty reduction by fiscal intervention

	% of Pre-fiscal Income	Conc Coeff	Kakwani	Marginal Contributions to Redist	Pov Red (Nat PDL)	Pov Red (PPP$1.90)	Pov Red (PPP$3.20)	Pov Red (PPP$5.50)
NCP World War II Veterans' Scheme	0.0	-0.09	0.69	0.01	0.17	0.00	0.08	0.01
NCT Community Home Based Care, mixed transfer	0.0	-0.21	0.82	0.01	0.06	0.00	0.03	0.03
NCT Orphans Vulnerable Children scheme	0.3	-0.19	0.79	0.19	0.17	0.34	0.42	0.26
CCT+NCT Destitute Persons, mixed transfer	0.3	-0.50	1.10	0.33	0.69	1.29	0.77	0.19
CCT Ipelegeng Public Works	0.8	-0.49	1.10	0.83	2.13	2.09	1.64	0.47
CCT Student allowance	1.0	0.17	0.43	0.08	0.23	0.17	0.29	0.55
CCT disability allowance	0.0	-0.37	0.97	0.03	0.09	0.13	0.11	0.02
NCP Old Age Pension scheme	0.9	-0.19	0.79	0.66	1.22	1.84	1.54	0.61
NCT Needy Student Package	0.0	-0.40	1.00	0.05	0.03	0.13	0.20	0.05
NCT Vulnerable Group Feeding Programme	0.5	-0.25	0.85	0.41	1.09	1.37	0.70	0.33
NCT School Feeding Programme	1.6	-0.17	0.77	1.19	2.43	3.09	2.69	1.48
NCT Sponsorship of student	3.4	0.43	0.17	-1.24	0.03	0.13	0.14	0.29
All Direct Transfers	***8.9***	***0.05***	***0.56***	***2.97***	***9.56***	***10.00***	***7.46***	***3.97***
Direct Taxes (Personal Income Tax)	**-8.7**	**0.86**	**0.26**	**2.36**	**-0.02**	**0.00**	**-0.15**	**-0.53**
Subsidy (implicit) for electricity	**1.3**	**0.52**	**0.08**	**0.04**	**0.08**	**0.15**	**0.49**	**0.64**
VAT applying statutory/zero rates and exemptions	-4.6	0.55	-0.05	0.00	-0.49	-1.06	-1.77	-1.85
Tobacco excise and levy	-0.5	0.49	-0.11	-0.04	-0.06	-0.23	-0.26	-0.29
Alcohol levy scaled down	-0.6	0.63	0.03	0.03	-0.03	-0.16	-0.19	-0.18
Fuel taxes	-0.6	0.76	0.16	0.12	0.00	-0.03	0.00	-0.10
Indirect Taxes	**-6.3**	**0.57**	**-0.03**	**0.12**	**-0.61**	**-1.21**	**-2.18**	**-2.17**
All Taxes	***-15.0***	***0.74***	***0.14***	***2.33***	***-0.62***	***-1.21***	***-2.27***	***-2.52***
Health in-kind benefit: outpatient care	1.9	0.01	0.59	0.95				
Health in-kind benefit: inpatient care	1.3	-0.13	0.73	0.37				
Health in-kind benefit: ARV treatment	0.8	-0.13	0.73	0.54				
Net health transfers	4.0	-0.06	0.66	1.80				
In-kind transfer primary education	7.4	-0.22	0.82	5.05				
In-kind transfer secondary education	8.3	-0.02	0.62	3.26				
In-kind transfer post-sec (TVET) education	0.6	0.15	0.45	0.01				
In-kind transfer tertiary education	2.2	0.44	0.16	-0.31				
Net education transfers	18.4	-0.04	0.64	7.34				
All net in-kind transfers	***22.5***	***-0.04***	***0.64***	***8.71***				
Education user fees	*-0.6*	*0.19*	*-0.41*	*-0.24*	*-0.24*	*-0.44*	*-0.79*	*-0.64*

Notes: Using the alternative aggregate, Gini for pre-fiscal (market) income is 0.604, Concentration coefficients and Kakwani index at pre-fiscal income. Marginal contributions to redistributive effect in Gini points, to poverty reduction in poverty headcount percentage points, measured at postfiscal (consumable) income. Education user fees cover all levels of education, not comparable with in-kind transfers.

CC negative, Kakwani positive	Equalising/poverty reducing
CC<Gini pre-transfer, Kakwani positive	Unequalising/poverty increasing
CC>Gini, Kakwani positive	
CC<Gini, Kakwani negative	

Even with the substantial adjustments to the welfare aggregate, several results are in line with previous benefit incidence findings (Tesliuc et al., 2013). Multiple small schemes making modest contributions to reductions in poverty viewed separately, e.g. the support for community home based care and needy students packages. In the case of disability allowance, the result may reflect its initial phase of roll-out while the WW2 veterans' scheme would be phased out following demographic developments. The school feeding programme stands out as the direct transfer scheme with most equalising impact while lifting 3% of the population out of extreme poverty. The support given through sponsorships is unequalising, while student allowances have a near neutral impact on inequality, and neither scheme leaves a noticeable impact on poverty.[67]

[67] As illustrated in Figure 15, many of the student allowance beneficiaries are in the higher pre-fiscal deciles, both when using the official and the alternative welfare aggregate. Similarly, the unequalising impact of sponsorships is reflected in the concentration curve for sponsorships in Figure 20.

Due to the wider scope of fiscal instruments, evaluated across several poverty lines, the results add important findings. Small schemes make the results sensitive to where the poverty lines are drawn. The Destitute persons scheme thus has twice as large an impact on poverty when applying the PPP$1.90-line than the national poverty datum lines. Meanwhile, at these same poverty lines, the poverty reducing impact of Ipelegeng is of the same magnitude.

Compared with OAP, making up a similar share of pre-fiscal income, the *Ipelegeng* scheme is both more equalising and poverty reducing, reflecting the merit of the more targeted, self-selection scheme over a universal scheme. Student allowance and OAP also make up about same share of pre-fiscal income, but OAP has ten-fold the poverty-reducing impact (at the international extreme poverty line; five-fold at the national poverty line). The value of the implicit energy subsidy allocated here approaches the value of the school feeding scheme, while its poverty reducing impact is minimal.

By reducing the income of the top half of the population, the personal income tax contributes nearly as much in terms of redistribution as all direct transfers. Its impact on poverty is negligible, even at the highest international poverty line (PPP$5.50).

Even with zero-rates for staple goods, Botswana's VAT is regressive when evaluated at pre-fiscal income, as indicated by the negative Kakwani index. Meanwhile, assessing its marginal redistributive contribution (at post-fiscal income) indicates that it is broadly neutral or slightly equalising.[68] Fuel taxes and alcohol levies are progressive and equalising, while tobacco taxes are regressive and unequalising.[69] Assessed by their joint marginal contribution to redistribution, Botswana's indirect taxes are equalising, illustrating *Lambert's conundrum* (Lambert, 2001): Measured based on pre-fiscal income, the net fiscal system with regressive indirect taxes is more equalising than without them.

5.3.5 Comparative perspectives

Beyond the regular limitations of the CEQ methodology (see Section 2.4), this study has been limited by the design and availability of BMTHS data. On the expenditure side, a more complete picture would require identifying and allocating benefits from agricultural support schemes (notably near-cash transfers of seeds and fertilisers) and taking a more granular approach to the value of education benefits (accounting for quality differences), health services, and identifying sponsorship grant elements. Public employees enjoy sizeable benefits (through pension, accommodation, and access to credit). Pension costs incur to the government as an employer, here treated as part of the remuneration, and not explicitly captured in this analysis. Given the prominence of the state as employer, public pensions have significant redistributive effect in terms of life-time income, but the treatment of pensions is inhibited by the lack of information on the source of pension/annuities.

On the revenue side, the availability of personal income tax data would allow for reconciling the survey data with the distribution of income taxpayers for further analysis of effective

[68] It should be recalled, however, that the VAT allocated in this study falls well short of the VAT collected, which supports Statistics Botswana's suspicion of underreporting, but also reflects that tourist consumption expenditure and investment goods are omitted.

[69] The incidence of fuel taxes does not take account of indirect effects e.g. via public transport. Such effects would be expected to make the tax less progressive.

marginal tax rates. Statistics Botswana's recently completed Supply-Use Table will hopefully allow for closer scrutiny of indirect effects of *inter alia* fuel taxes and VAT on exempt sectors. Supported by access to administrative revenue data, estimates of alcohol and tobacco consumption could be improved to better specify the incidence of the levies thereon.

Other studies have been subject to the same or similar constraints. In the context of the regular IMF Article IV surveillance, the CEQ methodology was applied using BCWIS 2009/10 survey data (IMF, 2018). These studies, which have relied on the official welfare aggregate, indicate larger marginal contributions of transfers to both poverty and inequality. The impact of indirect taxes is also estimated to be higher, while impact of direct taxes is the same. As the transfers are not well allocated in the aggregate, using the official aggregate distorts the results and tends to overestimate the redistributive power of fiscal instruments. In a recent study of the SACU countries, Sulla et al. (2022) review Botswana's inequality estimates based on an amended aggregate for 2015/16 BMTHS, while the fiscal incidence estimates for the largest tax and transfer schemes are based on the BCWIS 2009/10 data (Younger, 2020).

The World Bank Poverty Assessment (World Bank, 2015) is underpinned by benefit incidence analysis by Tesliuc et al (2013) on 2002/03 data, updated with 2009/10 data. With a benefit incidence analysis using 2015/16 BMTHS survey data, Seleka and Lekobane (2020) examined the targeting and effectiveness of social protection programmes in place. Apart from the school feeding program, they point to low coverage of social transfer programs coupled with inadequate targeting effectiveness (due to high leakage rates) limiting the effectiveness in reducing poverty. Again, their analysis suffers from the shortcomings of the official consumption welfare aggregate, which distorts the identification of the poor.[70] Moreover, the coverage rates depend critically on the assumption that missing transfer values (in the survey response) classifies households as non-recipients.

Using a static microsimulation model, Okatch (2015) finds that the estimated impact of the 2010 VAT increase in Botswana on poverty is negligible while the impact on inequality is slightly stronger. Meanwhile, due to data limitations, these results are derived from reweighted 2002/03 HIES micro data, thus not capturing changing consumption patterns. Moreover, relying on household consumption, the analysis ignores the size of households and thus does not capture the per capita impact.

The key contributions of this fiscal incidence study stem from it being (i) internally consistent, (ii) more comprehensive, and (iii) from providing international comparability. Internal consistency is ensured by accounting correctly for near-cash, in-kind fiscal transfers within a more complete welfare aggregate, with adjusted food and housing consumption, better aligned with national accounts. The comprehensive approach allows for assessing the combined impact of many small schemes, including the poverty and inequality reducing impact of *Ipelegeng*. Through international comparison, it is clear that Botswana achieves considerable fiscal impact through taxes, transfers and public spending on free health and education. While poverty and inequality challenges may be less severe than in South Africa,

[70] This household-based analysis relies on Statistics Botswana's total consumption as welfare aggregate, adjusted to reflect equivalized per capita consumption, see Section 4.1, and a relative poverty concept of the lowest quintile.

the impact is also more modest, and inequality remains amongst the highest in the world, while poverty is stubbornly high, especially for an Upper-Middle Income Country.

5.4 Evaluating recent fiscal policy interventions

With the prospect of a declining trend in revenue from mineral extraction (Jefferis, 2015) and the SACU revenue pool, policy makers consider alternatives in the context of annual budgets, reviews of the NDP, the national transformation strategy and other delivery mechanisms for the Vision 2036. In response to the impact of the global pandemic on its public finances, the Government of Botswana included an increase of the statutory VAT rate from 12 to14% in its 2021 Budget proposal. Other taxes or levies proposed (or increases therein) concerned the fuel levy, withholding tax on dividends, sugar-content of sweetened beverages, plastic bags and second-hand vehicles. On the other hand, the government took initiative to alleviate the income tax burden by increasing thresholds and introducing a tax amnesty. In response to rapidly rising costs of living, the finance minister announced in July that VAT would be reduced to 12% temporarily, for six months (Government of Botswana, 2022). With the explicit objective of fostering resilience through time-limited interventions with limited fiscal impact, the government also injected capital in the Botswana Meat Commission for catching up with delayed payments for cattle and increased student allowances by 18.5% to compensate for inflation. These incremental adjustments in taxes and transfers carry significant potential redistributive effects. CEQ results are useful inputs for designing or evaluating such packages of interventions, duly noting the caveats pursuant to data and underlying assumptions and, if necessary, complemented by other studies.

5.4.1 Adjustments to personal income tax (July 2021)

With effect from the 2021 tax year, the Government decided to increase each of the tax brackets by BWP 12,000 "to reduce the tax obligations for taxpayers". This was estimated to reduce the number of taxpayers in the lowest bracket by 26,975 (BWgovernment, 2022). For a top bracket taxpayer, the annual value of the adjustment is BWP 3,000 which would have corresponded to 80% of the PPP$1.90 international poverty line in 2015/16.

Based on the calculations above, assuming that all tax savings are used for increasing consumption expenditure, a simple simulation on the BMTHS survey data indicate that the tax bracket adjustment would lead to a marginal reduction in pre-fiscal inequality (reducing Gini from 0.604 to 0.601) while inequality measured by consumption (considered disposable income) would increase (from 0.544 to 0.552). As expected, given the level of the basic threshold, the adjustment has negligible impact on poverty, detected only at the highest international poverty rate (PPP$5.50, decreasing from 49.1 to 48.9%). The adjustments make the personal income tax more progressive (increasing the concentration coefficient from 0.86 to 0.88, Kakwani index from 0.26 to 0.28, when ranked at pre-fiscal income), while its marginal redistributive effect is reduced from 2.36 to 2.23. To limit the fiscal impact and preserve the redistributive effect, the adjustment could have been limited to the lowest brackets or accompanied by increasing the tax rates in the higher brackets. However, the simulated direct effect of even sizeable rate increases (5 percentage points in the middle and top rates) will not reduce inequality noticeably (0.549).

5.4.2 Fiscal measures to increase revenue (April 2021) and to cushion inflation (July 2022)

The government raised the statutory VAT rate from 12 to 14% with effect from April 2021 to strengthen the domestic revenue base. Meanwhile, in July 2022, concerns of rapidly increasing living costs prompted the government to temporarily reduce the VAT rate to 12% for six months from August 2022. In the same period, cooking oil and liquid petroleum gas will be zero rated for VAT purposes.

The CEQ results in Table 17 indicate that the marginal impact of the 12% VAT rate is neutral in terms of inequality and shows limited poverty-increasing effect. On this basis it could be expected that increasing VAT incrementally by 2 points would not increase inequality or poverty substantially. A simple simulation, keeping the alternative consumption aggregate unchanged, confirms that the immediate effect of increasing VAT to 14% leaves inequality of consumable income unchanged, and poverty only marginally affected (by 0.1 pp at the PPP$3.20 line). When evaluated along with other indirect taxes and levies, Lambert's conundrum still applies, due to the equalising effect of fuel taxes.

As many other countries, the Government of Botswana decided to use VAT as a policy instrument for cushioning the impact of rising inflation on households and the economy. While acknowledging questions of fiscal incidence[71], the government opted for a measure that is *targeted* to specific commodities but *general* in terms of beneficiaries (benefiting all consumers rather than the poorer segments only). The data made available does not allow for evaluating the effectiveness of Botswana's zero-rates and exemptions. In general, however, operating a VAT system with zero-rates and frequent adjustments incurs administrative costs for authorities and taxpaying businesses. Replacing the zero-rates with a targeted transfer instrument, facilitated by the on-going efforts to enhanced targeting capacity, would reduce the distortive effect of the VAT.

Energy inflation raises tax revenue via both fuel taxes and VAT, which are shown to be jointly equalising. However, with persistent inflation, static analysis would need to be extended to take account of indirect effects (including on collective transport) and behavioural response. For such analysis to be anchored actual consumption, it should rely on the detailed BMTHS survey data (or any follow-up consumption data gathered as part of the quarterly multi-topic household surveys, QMTHS). Bottom-coding consumption expenditure (as Statistics Botswana, 2019) or relying on a heavily truncated data set (as Mookodi (2021)) will not support evidence-based policymaking. Further analysis of new or amended levies and their incidence would add perspectives justifying the use of indirect taxation for domestic resource mobilisation.

The July 2022 announcement of increasing student allowances followed on from an announcement in February 2022 that old age and WWII veterans' pensions as well as destitute and disability allowances would be increased with effect from April 2022. Meanwhile *Ipelegeng* would undergo restructuring. As reflected in the CEQ results in Table 17, the student allowance lifts very few out of poverty, explained by the relatively generous

[71] In her July 2022 statement, finance minister Peggy Serame stated: "Needless to say, I expect retailers and other traders to reduce their prices accordingly and ensure that the benefits of these measures are passed on to the intended beneficiaries, that is, households."

transfer: Tertiary education students received BWP 1,420 per month, exceeding the highest international poverty line PPP$5.50 corresponding to BWP 894 per month. Anecdotally, student allowances may serve to support poorer relatives of the student, but the survey data only captures intra-household transfers as the source of remittances are not specified. The CEQ results would point to alternative transfer schemes such as *Ipelegeng* which is more equalising and poverty-reducing.

6 Tying it together

The research for this thesis was carried out with the aim to provide a clearer picture of the distribution and redistribution of welfare in Botswana and the impact of fiscal interventions on poverty and inequality. The key findings of Chapters 3, 4, and 5 serve to draw a range of policy conclusions and recommendations for better measuring welfare, poverty and inequality and for evaluating policy options with a view to effectively reducing poverty and inequality. To assess whether the policy environment is conducive for such policy recommendations, it is useful to consider some further elements of context.

Hailing Botswana as "*An African Success Story*", Acemoglu et al. (2002) praise the strong institutions, underpinning its prudent monetary and fiscal policies, but also caution that "*it remains to be seen whether these will continue to be effective in fostering future economic growth, as well as deal with the unemployment and persistent inequality problems, and most importantly, with the demographic crisis created by the AIDS epidemic*". The reliance on mineral revenues and a favourable allocation of SACU revenues has allowed Botswana's government to grant its citizens a lighter domestic tax burden when providing public goods and services in pursuit of shared prosperity and poverty eradication.

Botswana has a rich tradition for inclusive, participatory debate whereby traditional leaders, *dikgosi*, moderate public debate and seek conflict resolution amongst citizens at local *kgotla* meetings. In present day Botswana, the central government organises *pitso* meetings for a public exchange of views with stakeholders. The *Budget Pitso* is now an annual event[72]. Parliamentary debate allows Members of Parliament to pose questions to the government, but despite the long-held tradition for *therisanyo* (consultation), parliamentary or public scrutiny and debate of expert-assessed impact of fiscal interventions is still lacking. Botswana is committed to evidence-based policy as reflected in successive National Development Plans, in its Vision 2036 and accompanying national transformation strategy, and in its poverty eradication efforts anchored within the Office of the President. Institutions are thus in place to support Scandinavian-style consensus in line with *Wicksellian* decision-making, evaluating alternative tax and spending plans based on assessed impact, including on poverty and inequality.

This study demonstrates that the computing power is readily available, but data quality is found wanting - in terms of survey responses as well as data processing - and some methodological clarifications are required. As this study shows, a more robust methodology must be developed for identifying the population living in poverty, which is essential for designing effective policies and tracking progress towards Botswana's national targets in pursuit of the Sustainable Development Goals (SDGs).

Botswana's vision of reducing the Gini index from 0.60 to 0.45 by 2036 suggests a strong determination to curb inequality, but very different distributions could deliver this result.[73]

[72] Budget pitso material available on https://www.finance.gov.bw/index.php?option=com_content&view=category&id=24&Itemid=110

[73] *Ceteris paribus*, closing the official BMTHS poverty gap by ensuring that everyone reaches at least $1.90 PPP2011 per day would reduce the Gini index only from 0.611 to 0.58. This presupposes perfect targeting ability while ignoring any behavioural effects.

Vision 2036 also stresses self-reliance, *ipelegeng (*or *boipelego* in its noun form*)*, which could indicate an upper limit to the weight given to individuals with low welfare when aggregating social welfare. Botswana is not among the 96 countries studied by Lambert et al. (2003) to analyse observed differences in inequality aversion, but their findings concerning a hypothesized 'natural rate' of subjective inequality are nevertheless relevant: Botswana would fall in line with societies with high objective inequality (as measured by the Gini coefficient) being less averse to inequality. Similarly, Botswana belongs to the countries which provide a more level playing field for their populations (i.e. allocate more resources to public education and have higher adult literacy rates) and which may therefore be more tolerant of resulting inequality. Further research would be needed to estimate inequality aversion in Botswana and to what extent the SDG target of reducing the Gini coefficient to 0.45 represents a political and socio-economic moment calling for redistributive measures, as Lambert et al. (2003) hypothesise would aim to bring subjective inequality in line with an equilibrium natural rate.

Over the 2009-2016 period of the two household surveys, there were no major policy changes to the tax or social systems to reduce poverty or change the income distribution. Moreover, macroeconomic and labour market conditions were broadly similar when surveys were conducted. Policymaking is not helped by studies sponsored by the main international organisations pointing in opposite directions based on the same surveys: A rapid decline in inequality (according to the World Bank) or a steep increase (according to the UNDP).

In examining the data from the two recent surveys (Chapter 3), Botswana's welfare measure - approximated by a total consumption aggregate - is found to be flawed: The survey-based estimate appears to be shrinking in real terms, and leaves a major discrepancy unexplained vis-a-vis total household consumption (as recorded in national accounts), in part due to the most recent food sub-aggregate being underestimated. Proposed corrections to the food sub-aggregate, lin line with survey responses, help to explain a larger share of consumption, and results in a more unequal distribution. Meanwhile, other elements of the welfare aggregate are inadequately covered, in particular housing, durable goods, alcohol and tobacco consumption. The recent survey data allows for estimating housing consumption including imputed rents, a wider welfare aggregate is constructed to take account of the contribution to well-being of accommodation, whether owned, rented or provided for free, e.g. by an employer or relatives. With adjusted food and housing consumption, the welfare aggregate is larger and more equally distributed than the official aggregate. By furthermore accounting for the consumption of government-funded, near-cash transfers, an alternative aggregate is derived, as a better proxy for welfare, suited for analysing fiscal redistribution. Data from the previous survey does not allow for constructing a comparable aggregate (in particular for imputed rents), but establishing a benchmark for future surveys could enable authorities to track the evolution going forward.

Poverty estimates should be interpreted with caution, both due to methodological variations in poverty concepts and empirical challenges in ensuring spatial, inter-personal, and inter-temporal comparability. Botswana's method of poverty datum lines appears to have fallen behind economic developments, in effect narrowing the poverty concept. Moreover, a misinterpretation of the international "dollar-a-day" poverty line is behind the publicly quoted figure of less than 6% of the population living in poverty. Noting also that the

perceived poverty concept of survey respondents, as reflected in the self-evaluated threshold of what is needed "to make ends meet", is much higher than the national poverty line, indicating that a review of the national poverty concept is overdue. A broader consideration of poverty using all three international poverty lines is justified for Botswana as an upper-middle income country, especially when relying on a wider welfare concept, including housing, as the alternative proposed here.

Several clarifications and insights are gained by tracing the developments in welfare, inequality, and poverty using the official and corrected data (Chapter 4). Based on the official aggregates for per capita consumption, inequality is largely unchanged (though results differ when using households as the unit of analysis). The claim that poverty is decreasing hinges on disparate definitions of poverty rather than real welfare improvements, which leaves poverty trends and profiles unclear and uncertain. Using the international poverty lines and the official welfare aggregates, estimated poverty has rather increased. Disregarding the adjustment of housing consumption, the data corrections proposed point to higher estimated extreme poverty in 2009/10 (26% at the PPP $1.90 international poverty line) and lower poverty in 2015/16 (18.5%), though not as low as estimated by the World Bank (14.5%) based on another consumption aggregate. Opting for the alternative aggregate, with adjusted housing consumption, justifies a review of the poverty concept. Recalibrated poverty lines, based on the poorest 20% according to the official aggregate, translate into a poverty head count of 27.7% using the alternative aggregate. A similar head count (26.8%) is estimated using the PPP $3.20 international poverty line for lower-middle-income countries.

In sum, based on the findings in Chapters 3 and 4, Botswana could pursue more effective policies by reviewing and refining the methods for measuring welfare, poverty and inequality. Firstly, the standard, official welfare concept should take account of housing and consumption of other durable goods. A more comprehensive consumption aggregate with explicit spatial price deflators (rather than implicit in the poverty datum lines) would allow for a better evaluation of the distribution of welfare (beyond the poor) throughout the country. Secondly, the relevant unit or units of analysis should be defined. The Sustainable Development Goals are guided by the principle of "Leaving no one behind", justifying a focus on the individual or per capita welfare. Retaining the household as complementary unit of analysis would be useful for examining the sensitivity to sampling and structural changes in household composition, e.g. with urbanisation. Botswana implicitly applies equivalence scales via the poverty datum lines; applying them to the welfare aggregate instead would allow for a broader view of the distribution of welfare, and assessing the sensitivity of welfare and poverty concepts to such specification. Thirdly, the national poverty datum lines merit an update to reflect economic developments and consumption patterns (e.g. shelter, transport, communication). Fourthly, the misinterpretation of the international poverty line should be corrected (implying an update of the SDG indicator) and poverty should be evaluated also at the higher poverty lines for lower- and upper-middle-income countries.

Finally, methodological stability will be key for reaching a more robust assessment of the development in poverty, inequality and shared prosperity in the future. To this end, the authorities could benefit from reviewing the survey design, sampling, and data processing to ensure adequate checks at macro level (against national accounts and administrative data) and at the level of the survey respondent. The challenges of tackling underreporting,

estimating housing consumption and addressing sources of measurement bias are shared by authorities in other countries, so international collaboration and peer reviews can help develop and propagate best practices. Risks of underreporting may be mitigated by clarifying the nature and purpose of the survey (as Statistics Botswana sought to do during the BMTHS survey period). A check could be done with some basic introductory remarks about the relation between income, expenditure and savings to assist the respondent.[74] "*You will be asked about your expenditure and your sources of income. When income not spent, it is likely to have been saved. In other words, if you report lower expenditure than what you have actually spent, it will appear as if you are saving. Over the past month/year, do you consider that your savings are going up, down or staying unchanged?*". Similarly, the purpose of estimating fiscal incidence can be recalled to encourage correct reporting, for example: "*How much you spend also informs us of how much taxes and levies you pay in the form of VAT as well as excises and levies on fuel, tobacco, and alcohol. To understand who bears the burden of these taxes, the rich or the poor, it is important to be as exact as possible in reporting how much you spend.*" For a robust estimate of housing consumption, to address bias in self-assessed value of imputed rent, the respondents could be presented with reference values i.e. estimated market rates for standardised dwellings (with and without water, electricity, flush toilet). Slight adjustments to the modules on sources of income would be required to distinguish between public and private pension contributions and benefits, which are growing in importance. Improving survey respondents' understanding and ease of reporting would likely improve data quality and thus reduce the needs for data corrections (as some of those proposed above) to be addressed in the data processing phase. Transparent, critical, and inclusive review would help in defining and establishing consensus on inherently consistent statistical methods as well as in reaching a shared understanding of policy objectives and how survey results can support evidence-based policymaking.

Compared with other Sub-Saharan African countries, Botswana's fiscal system is important for alleviating extreme poverty and, though to a lesser extent, for reducing inequality. As the CEQ analysis of the alternative welfare aggregate shows (Chapter 5), Botswana's fiscal instruments jointly reduce inequality from 0.60 in pre-fiscal incomes to 0.54 in consumable incomes. Policy recommendations depend on which income concept is selected as target for equalising measures. In Botswana, many efforts have focused on tackling market income inequality through job creation, entrepreneurship support and access to land, yet challenges remain given persisently high youth unemployment. In addition to the immediate poverty- and inequality-reducing impact, the longer-term impact of the *Ipelegeng* public work scheme ought to be evaluated through regular and rigorous household surveys examining graduation to formal employment. Similarly, survey data of present and past beneficiaries would allow for assessing the impact of poverty eradication packages, which cannot explicitly be evaluated in a CEQ analysis.

With unit-cost-based values for education and health benefits, inequality in "final" incomes comes down to 0.46. This result should be interpreted with caution: Unit-costs are a weak

[74] The BMTHS survey questionnaire is quite detailed on loans and personal lending activity (modules 13). Similarly, the sections on credit cards and bank accounts (module 14) solicit specific information, and the data indicates that 83% of households in cities and towns hold a bank account, 67% in rural villages and 35% in rural areas. These modules are not used in the present study but suggest that financial literacy is assumed to be quite high.

proxy for the value of public health and education services, for which the returns materialise only over a longer period in terms of employability and life expectancy of the population. Whether the contribution to welfare exceeds or falls short of the unit value depends on the quality of the service as well as many beneficiary characteristics, for example the exam performance of students receiving instruction performing with implication for their job opportunities, or the outcomes of patients receiving a diagnosis and being prescribed a treatment. It is thus not clear whether the unit value under- or overestimates the reduction of inequality, but a stronger proxy could take account of indicators of the quality of these public services.

The alternative welfare aggregate developed here along with the detailed incidence analysis can support efforts to enhance the effectiveness of the fiscal system in general and to evaluate the appropriate fiscal response to specific challenges. The strength of the approach lies in evaluating each of the tools separately and together, while its weaknesses - notably concerning behavioural response - can be mitigated through targeted, complementary analysis. The estimated marginal contribution to redistribution and poverty reduction of each of the 20 fiscal interventions (Table 17) provide a useful starting point for data-driven policies, whether for *ex ante* or *ex post* evaluation of alternatives. At the international extreme poverty line, fiscal redistribution via direct transfers reduces poverty by half (from 19.2% to 9.6%), only marginally counter-balanced by the poverty-increasing combined impact of indirect taxes and subsidies (increasing the headcount to 10.7%). The many small schemes and some universal schemes provide wide overall coverage with free school meals, the *Ipelegeng* public works scheme, and the universal old age pension having the largest marginal contributions to reducing extreme poverty. Parsimonious benefits leave a large share of the population still poor considering Botswana's status as upper-middle income country. Making up a similar share of total pre-fiscal income, the direct transfers have a larger redistributive effect than personal income tax, reducing inequality by 3.0 and 2.4 Gini points, respectively.

At macrolevel, Botswana appears on track for post-pandemic recovery. At microlevel, international organisations predict that the pandemic temporarily increased poverty, but that the impact is redressed by 2022 or 2023 (IMF, 2022; World Bank, 2022). This prediction will have to be checked in new surveys against pre-pandemic estimates. Recent tax and social security initiatives will have ambiguous immediate effects on inequality in disposable and consumable income (see simulations reported in section 5.4). The upward adjustments in tax brackets and social transfers are interventions with considerable budgetary impact. However, as the largest gains accrue to the upper half of the distribution, the policy measures are providing limited or no contribution to reaching the targets for achieving prosperity for all.

Increased reliance on VAT and levies for raising domestic revenue appears to enhance allocative efficiency without major impact on inequality, but further analysis is required to take account of indirect effects (notably of the fuel levy). Moreover, the sensitivity of the redistributive impact of indirect taxes could be tested with more accurate estimates of the consumption of alcohol and tobacco, supported by administrative data on revenue collection. Poverty effects of higher indirect taxation would be better addressed through transfers targeting the poor than reliance on zero-rates for VAT.

Ongoing efforts to streamline the social security system through administrative means (establishing a single registry, enhanced means-testing, effective recovery of scholarships) are set to deliver efficiency gains, but the impact on poverty will depend on the combined impact of reduced coverage, higher benefit levels, and behavioural effects. This study adds to those who call for evidence that the priority given to funding of tertiary over primary and secondary education is justified, given its immediate inequality-increasing effect.

The availability of resource revenues as funding may reduce the pressure for holding policymakers accountable compared to when spending is financed by taxation, which prompted Devarajan et al. (2011) to examine potential efficiency enhancing effects of transferring resource revenue to citizens and taxing them back. Exploring such more radical options, including a direct distribution mechanism of mineral revenue, could bring fresh perspectives on incentive effects and stimulate the debate on how to best tackle poverty and inequality challenges, but such a study would depend on more robust data being available.

7 Annex tables and figures

Table 1. Reranking of households following adjustment of per capita consumption

		Households ranked by adjusted disposable income										
Households ranked by original disposable income		1	2	3	4	5	6	7	8	9	10	Total
	1	14,936	5,268	3,017	1,402	1,054	595	377	81	59	184	26,974
	2	9,043	9,656	5,423	4,247	1,680	1,546	974	186	-	-	32,753
	3	2,788	9,758	9,304	7,686	2,985	1,904	1,296	378	162	-	36,261
	4	831	5,874	10,894	8,366	8,507	3,472	1,976	1,128	277	47	41,373
	5	261	2,025	6,834	12,048	12,172	8,447	5,182	2,415	910	511	50,805
	6	173	517	2,303	7,970	15,513	16,344	8,264	6,028	2,747	699	60,557
	7	-	492	665	1,880	6,504	19,774	22,347	10,710	3,716	1,779	67,867
	8	-	-	-	265	1,228	6,583	22,804	31,438	13,254	3,215	78,787
	9	-	-	-	-	88	456	3,050	22,044	47,874	13,906	87,418
	10	-	-	-	-	112	238	70	923	15,394	82,511	99,249
	Total	28,032	33,591	38,439	43,864	49,842	59,358	66,340	75,332	84,394	102,851	582,044

Table 2. Inequality measures across surveys and strata

Gini	**National**	**Cities & town**	**Urban villages**	**Rural areas**
BCWIS	0.608	0.608	0.584	0.568
BMTHS	0.611	0.570	0.591	0.587
diff.	0.003	-0.038	0.007	0.019
P>|t|	0.866	0.655	0.877	0.482
Atkinson 0.1	**National**	**Cities & town**	**Urban villages**	**Rural areas**
BCWIS	0.077	0.077	0.068	0.067
BMTHS	0.074	0.062	0.065	0.064
diff.	-0.003	-0.015	-0.003	-0.003
P>|t|	0.629	0.229	0.749	0.803
Atkinson 0.5	**National**	**Cities & town**	**Urban villages**	**Rural areas**
BCWIS	0.308	0.305	0.282	0.272
BMTHS	0.287	0.260	0.250	0.241
diff.	-0.021	-0.045	-0.032	-0.031
P>|t|	0.248	0.197	0.147	0.332
Atkinson 1.0	**National**	**Cities & town**	**Urban villages**	**Rural areas**
BCWIS	0.487	0.481	0.458	0.438
BMTHS	0.447	0.438	0.393	0.369
diff.	-0.041	-0.043	-0.065	-0.068
P>|t|	0.043	0.268	0.011	0.054
Atkinson 1.5	**National**	**Cities & town**	**Urban villages**	**Rural areas**
BCWIS	0.604	0.596	0.574	0.552
BMTHS	0.547	0.568	0.486	0.454
diff.	-0.057	-0.028	-0.088	-0.098
P>|t|	0.004	0.463	0.001	0.006
Theil	**National**	**Cities & town**	**Urban villages**	**Rural areas**
BCWIS	0.822	0.825	0.713	0.715
BMTHS	0.795	0.655	0.709	0.702
diff.	-0.027	-0.170	-0.004	-0.013
P>|t|	0.749	0.251	0.967	0.926
Mean Log Deviation	**National**	**Cities & town**	**Urban villages**	**Rural areas**
BCWIS	0.668	0.656	0.612	0.576
BMTHS	0.592	0.577	0.498	0.461
diff.	-0.076	-0.079	-0.114	-0.115
P>|t|	0.043	0.271	0.010	0.045

Table 3. International poverty line poverty estimates

Differences between three consumption aggregates from 2009/10 (BCWIS/BCWIS_A/BCWIScorr) and BMTHS 2015/16

IPL PPP$1.90

	BCWIS	BMTHS	Diff	P>|t|	BCWIS_A	Diff	P>|t|	BCWIScorr	Diff	P>|t|
P0	0.197	0.244	0.047	0.019	0.264	-0.020	0.333	0.189	0.055	0.006
P1	0.066	0.073	0.007	0.419	0.102	-0.028	0.005	0.055	0.018	0.038
P2	0.031	0.031	0.000	0.956	0.158	-0.127	0.032	0.023	0.008	0.136
Watts	0.090	0.095	0.005	0.56	0.130	-0.036	0.001	0.070	0.025	0.003
SST	0.118	0.131	0.013	0.208	0.184	-0.053	0.000	0.099	0.032	0.001

IPL Statistics Botswana (under revision)

	BCWIS	BMTHS	Diff	P>|t|
P0	0.066	0.059	-0.007	0.622
P1	0.019	0.013	-0.006	0.137
P2	0.009	0.004	-0.004	0.058
Watts	0.0247	0.0147	-0.01	0.009
SST	0.0345	0.0231	-0.011	0.021

National PDL Statistics Botswana

	BCWIS	BMTHS	Diff	P>|t|
P0	0.194	0.163	-0.031	0.028
P1	0.062	0.043	-0.019	0.004
P2	0.029	0.017	-0.012	0.000

Table 4. CEQ income concepts and fiscal interventions in Botswana: Definitions, methods and comparisons with administrative accounts

Concept/Category	Included: Yes/No	Description of Method	Indicator level household (hh) or individual (in)	Totals in BWP million from Survey	Share as a % of Disposable Income or Private Consumption from Survey (BWP 42,002.5 million)	Totals in BWP million from Administrative Accounts	Share as a % of Disposable Income or Private Consumption from Administrative Accounts (BWP 66,150.3 million)	Total Population (e.g., tax payers, beneficiaries, enrolled in school) from Survey (Weighted)	Total Population (e.g., tax payers, beneficiaries, enrolled in school) from Administrative Accounts	Total Population (e.g., tax payers, beneficiaries, enrolled in school) from Survey (Unweighted)	Notes
MARKET "INCOME" = NET MARKET "INCOME" + DIRECT TAXES (no social contributions in BW)				41,933.5	99.8%	67,648.2	102.3%				
NET MARKET INCOME= MARKET INCOME - DIRECT TAXES (BW: DISPOSABLE "INCOME" - DIRECT TRANSFERS)				38,298.9	91.2%	61,022.2	92.2%				
Direct Taxes				3,634.6	8.7%	6,626.0	10.0%				
- Personal Income Tax	Yes	Direct identification from household data, imputed based on StatsBots aggregates including business profits	in	3,634.6	8.7%	6,626.0	10.0%	194571	n/a	2224	
- Corporate Income Tax	No										
- Payroll Tax	No										
- Taxes on Property	No										
GROSS INCOME=MARKET INCOME PLUS PENSIONS + DIRECT TRANSFERS				45,637.1	108.7%	72,776.3	110.0%				
Social Protection (in BW == Social Assistance)				3,716.5	8.8%	5,128.1	7.8%				
Conditional and Unconditional Cash Transfers				774.9	1.8%	1,586.3	2.4%				
- Disability allowance	Yes	Inference, where individuals aged<65 indicate being supported by "old-age or disability pension" based on variable q04_26_5, imputed value based on benefit rule	in	12.3	0.0%	23.4	0.0%	3577	4709	46	1
- Ipelegeng, labour intensive public	Yes	Direct identification from labour module of survey	in	339.8	0.8%	611.1	0.9%	44402	64464	552	
- Student allowance	Yes	Direct identification from household and individual data	in	402.8	1.0%	910.9	1.4%	29599			2
- Destitute allowance	Yes	Direct identification from household and individual data, imputed benefit value	hh	20.1	0.0%	65.7	0.1%	19552	35366	249	3
- Community Home Based Care, cas	Yes	Direct identification from household and individual data, imputed benefit value	hh	2.6	0.0%	3.2	0.0%	1080	1313	13	4
Noncontributory Pensions				395.0	0.9%	452.2	0.7%				
- Old Age Pension scheme	Yes	Direct identification from household and individual data, imputed benefit value	in	387.1	0.9%	442.6	0.7%	98549	95649	1247	5
- World War 2 Veterans scheme	Yes	Direct identification from household data, imputed benefit value	hh	7.9	0.0%	9.6	0.0%	1460	1569	15	
Near Cash Transfers (Food, School Uniforms, etc.)				2,546.7	6.1%	3,089.6	4.7%				
- Needy Student Package	Yes	Direct identification from individual data set, q02_37	in	21.0	0.0%	n/a	n/a	27175	35550	345	6
- Destitute persons, inkind	Yes	Direct identification of beneficiary households, imputed values based on WB/BIDPA SP Assessment (2013)	hh	124.2	0.3%	n/a	n/a	19552	35366	249	6
- Community Home Based Care	Yes	Direct identification from household data, imputed benefit value	hh	4.1	0.0%	11.8	0.0%	1080	1313	13	7
- Orphans Vulnerable Children Sche	Yes	Direct identification of beneficiaries in household data (q08_28), deducing values from aggregates where possible and imputing for the remaining households	hh	118.3	0.3%	258.6	0.4%	14475	29375	170	
- Vulnerable Groups Feeding Progra	Yes	Simulation based on individual data (age, health status, recent health consultation, food insecurity) to match population, allocating unit costs reported in NSPRP (2020)	in	201.1	0.5%	255.0	0.4%	233232	233340	2792	8
- Schoolfeeding	Yes	Direct identification from household data, allocated to individuals, using StatsBots benefit value	in	654.9	1.6%	599.0	0.9%	473657	502616	5644	9, 10
- Sponsorship (tuition)	Yes	Direct identification from household and individual data	in	1,423.2	3.4%	2,042.0	3.1%	18005	36806	192	11
DISPOSABLE INCOME == PRIVATE CONSUMPTION (= NET MARKET INCOME + DIRECT GOVERNMENT TRANSFERS)				42,002.5	100.0%	66,150.3	100.0%				

Concept/Category	Included: Yes/No	Description of Method		Totals in BWP million from Survey	Share as a % of Disposable Income or Private Consumption from Survey (BWP 42,002.5 million)	Totals in BWP million from Administrative Accounts	Share as a % of Disposable Income or Private Consumption from Administrative Accounts (BWP 66,150.3 million)	Total Population (e.g., tax payers, beneficiaries, enrolled in school) from Survey (Weighted)	Total Population (e.g., tax payers, beneficiaries, enrolled in school) from Administrative Accounts	Total Population (e.g., tax payers, beneficiaries, enrolled in school) from Survey (Unweighted)	
CONSUMABLE INCOME = DISPOSABLE INCOME + INDIRECT SUBSIDIES - INDIRECT TAXES				39,909.1	95.0%	59,790.6	90.4%				
Indirect taxes				2,483.1	5.9%	8,027.2	12.1%				
VAT	Yes	Imputation, applying statutory rates (standard and zero) to estimated cash consumption without correction for informality (so far).		1,937.7	4.6%	6,535.3	9.9%	2071150	n/a	7049	
Excise Taxes				545.4	1.3%	1,491.9	2.3%				
- Alcohol Levy	Yes	Imputation, allocating the revenue (scaled down in line with total consumption) based on StatsBots consumption expenditure	hh	271.3	0.6%	363.8	0.6%	103055	n/a	1261	
- Tobacco Levy	Yes	Imputation, based on WHO estimated levy share of retail price	hh	39.9	0.1%	48.7	0.1%	108941	n/a	1353	
- Tobacco excises, to SACU, not in BW budget				152.6							
- Fuel taxes	Yes	Imputation, applying an aggregate of fuel levy, road fund levy, excise, petroleum fund levy (applicable December 2016) per litre estimated at average fuel prices for 2016, not (yet) accounting for indirect effects.	hh	234.3	0.6%	1,079.4	1.6%	144039	n/a	1643	
Customs Duties	No										
Indirect subsidies				542.2	1.3%	1,667.5	2.5%				
- Electricity	Yes	Imputation, beneficiary households identified in the survey, subsidy being difference between cost of production and consumption expenditure, using the official two-step tariff applicable at the time		542.2	1.3%	1,667.5	2.5%				
- Fuel	No										
- Agricultural Inputs	No										
FINAL INCOME = CONSUMABLE INCOME + GOVERNMENT IN-KIND TRANSFERS				48,799.4	116.2%	76,183.1	115.2%				
Education				6,834.1	16.3%	10,037.5	15.2%				
- Pre-school	No					n/a					
- Primary	Yes	Direct identification from individual data, allocating budget per pupil		3,093.5	7.4%	3,175.5	4.8%	339261	347022	4070	10, 12
- Secondary	Yes	Direct identification from individual data, allocating budget per student		3,468.8	8.3%	4,458.4	6.7%	136395	174787	1601	10, 13
- Post-secondary (TVET)	Yes	Direct identification from individual data, allocating budget per student		271.8	0.6%	537.2	0.8%	5772	11406	67	10, 14
- Tertiary	Yes	Direct identification from individual data, allocating budget per student		902.5	2.1%	1,866.4	2.8%	38092	51573	436	10, 15
Health	Yes			1,686.6	4.0%	6,355.0	9.6%				
Contributory	No					n/a					
Noncontributory	Yes			1,686.6	4.0%	6,355.0	9.6%				
- In-patient	Yes	Direct identification of use, recall period 4 weeks, up to two facilities, with repeat visits. Allocating WHO CHOICE 2008 unit costs for BW per patient day in clinics and hospitals, scaled up with expenditure per patient. Unit costs exclude drugs and diagnostics.	in	535.1	1.3%	n/a		13014	n/a	148	16
- Out-patient	Yes	Direct identification of use, recall period 4 weeks, up to two facilities, with repeat visits. Allocating WHO CHOICE 2008 unit costs for BW per visit in clinics and hospitals, scaled up with expenditure per patient. Unit costs exclude drugs and diagnostics.	in	807.8	1.9%	n/a		230310	n/a	2771	16
- ARV treatment, lower bound	Yes	Direct identification of beneficiary reporting HIV as chronic illness or reason for consultation, allocating estimated average unit cost (Cogwell et al 2016)	in	343.7	0.8%	n/a		135277	273054	1678	17

Notes to Annex Table 4: *In addition to the survey data, the main sources are the Annual Statements of Accounts (ASA) for 2015/16 and 2016/17, complemented by other government publications, and international organisations (UNESCO, UNAIDS). The numbered notes refer to specific caveats and assumptions related to the amounts or populations compared. (1) Population of receiving beneficiaries, whereas there are 5,528 registered beneficiaries (NDP11 MTR). (2) Estimated as 30% of total amount from the budget line in Administrative Accounts. Survey population includes post-secondary allowances (notably Brigades), Administrative Accounts is only tertiary (which includes some TVET). (3) Administrative accounts budget line for Destitute Allowance (ASA 2016/17 0814 00128) likely also covering administrative costs and possibly also near-cash transfers under the scheme. No response received from MLGRD concerning the allowance rate for 2016. (4) Cash element total in administrative accounts estimated based on benefit value and administrative number of beneficiaries. (5) It is not clear whether administrative accounts refer to individuals or households; in the survey, 1,047 households receive, corresponding to 83,193 households (weighted). (6) There is no separate budget line in ASA, but part of Destitute Programme, ie. under ASA 2016/17 0814 00128 but with costs covered by other budget lines as well. (7) Derived residually, subtracting cash element above, see note (4). (8) Administrative accounts do not specify the costs, so using estimated costs from UNICEF evaluation (UNICEF (2019)): MLGRD estimated recurrent expenditure (including only some MLGRD overheads) of P255m.*	*(9) Administrative accounts do not specify the transfer to local communities to cover the costs of preparing school meals, likely to be part of the grant. Estimated 62% share of MLGRD budget line for Food (shared across VGFP, Primary School feeding and Destitute Persons). Total population based on enrolment data for 2016 (primary/secondary) and 2015 (public TVET), and most recent percentage of private institutions (7.4% in primary (2015), 2.8% in lower secondary (2013), assumed equal for upper secondary share). (10) More detailed documentation of the assumed allocation of ASA education expenditure is available from the author upon request. (11) Expenditure: Estimated 70% of total from Administrative Accounts, see note (2). Population: Government sponsorships reported in HRDC/Statistics Botswana Tertiary Education Statistics 2019. Survey population includes post-secondary allowances (notably Brigades), Administrative Accounts is only tertiary (which includes some TVET), see note (2). (12) Administrative population is total enrolment. If assuming 2015 percentage of enrolment in private education, public enrolment is 321,376. (13) Administrative population is total enrolment. If assuming 2013 percentage of enrolment in private education, public enrolment is 169,833. (14) Enrolment from NDP11, p. 103, in public institutions. The categorisation of post-secondary/TVET vs tertiary education is not consistent throughout the survey data. (15) Enrolment from UNESCO SE.TER.ENRL. (16) See footnote 57 for unit cost, scaling factors and references. (17) 2016 data for population in Admin Accounts sourced from https://aidsinfo.unaids.org.*

Table 5. CEQ Gini coefficients across income concepts in high inequality countries (from Figure 17)

	Pre-fiscal income	Disposable income	Consumable income	Final income
South Africa (2015)	0.737	0.638	0.640	0.546
Botswana (2010)	0.632	0.601	0.599	0.530
Namibia (2016)	0.629	0.591	0.592	0.500
Colombia (2014)	0.575	0.566	0.559	0.471
Botswana (2016)	0.601	0.551	0.549	0.463
Brazil (2009)	0.573	0.545	0.542	0.430
Panama (2016)	0.557	0.534	0.529	0.432
Paraguay (2014)	0.522	0.513	0.510	0.473
Dominican Republic (2013)	0.517	0.505	0.496	0.417
Mexico (2014)	0.528	0.494	0.492	0.393
Costa Rica (2010)	0.508	0.489	0.486	0.402
Chile (2013)	0.494	0.467	0.464	0.419
Peru (2011)	0.473	0.465	0.459	0.404
eSwatini (2017)	0.499	0.464	0.449	0.362
Guatemala (2014)	0.476	0.463	0.463	0.427
Nicaragua (2009)	0.470	0.451	0.447	0.416
Bolivia (2015)	0.462	0.451	0.450	0.394
Lesotho (2017)	0.514	0.449	0.446	0.398

Figure 1. Lorenz and concentration curves for other direct transfer schemes

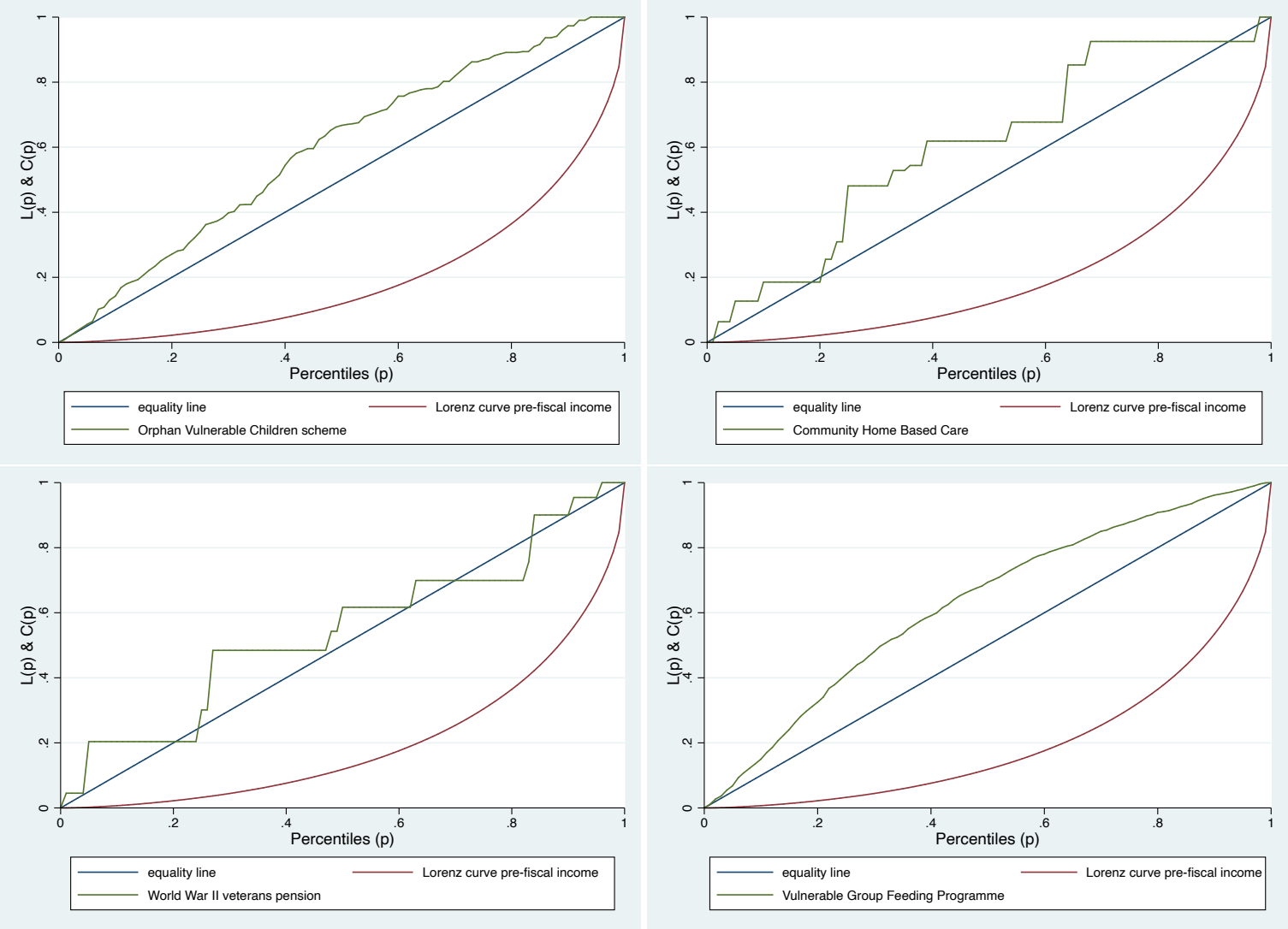


Table 6. Marginal contribution to redistribution and poverty reduction by fiscal intervention across original, adjusted, and alternative welfare aggregates

	Original						Adjusted								Alternative					
				Marginal Contributions to						Marginal Contributions to								Marginal Contributions to				
	% of Pre-fiscal Income	Conc Coeff	Kakwani	Redist	Pov Red (PPP$1.90)	Pov Red (Nat PDL)	% of Pre-fiscal Income	Conc Coeff	Kakwani	Redist	Pov Red (Nat PDL)	Pov Red (PPP$1.90)	Pov Red (PPP$3.20)	Pov Red (PPP$5.50)	% of Pre-fiscal Income	Conc Coeff	Kakwani	Redist	Pov Red (Nat PDL)	Pov Red (PPP$1.90)	Pov Red (PPP$3.20)	Pov Red (PPP$5.50)
NCP World War II Veterans' Scheme	0.0	-0.22	0.91	0.02	0.02	0.06	0.0	-0.08	0.69	0.01	0.01	0.00	0.01	0.02	0.0	-0.09	0.69	0.01	0.17	0.00	0.08	0.01
NCT Community Home Based Care, mixed transfer	0.0	-0.25	0.94	0.02	0.03	0.01	0.0	-0.20	0.80	0.01	0.01	0.01	0.01	0.01	0.0	-0.21	0.82	0.01	0.06	0.00	0.03	0.03
NCT Orphans Vulnerable Children scheme	0.4	-0.15	0.84	0.27	0.85	0.83	0.3	-0.16	0.76	0.20	0.46	0.52	0.36	0.14	0.3	-0.19	0.79	0.19	0.17	0.34	0.42	0.26
CCT+NCT Destitute Persons, mixed transfer	0.5	-0.45	1.14	0.46	0.86	1.35	0.3	-0.47	1.07	0.35	1.28	0.87	0.61	0.21	0.3	-0.50	1.10	0.33	0.69	1.29	0.77	0.19
CCT Ipelegeng Public Works	1.1	-0.52	1.22	1.11	1.81	2.35	0.8	-0.48	1.09	0.81	2.13	1.74	1.14	0.43	0.8	-0.49	1.10	0.83	2.13	2.09	1.64	0.47
CCT Student allowance	1.3	-0.17	0.87	0.64	1.21	1.42	1.0	-0.01	0.61	0.37	0.60	0.57	0.55	0.65	1.0	0.17	0.43	0.08	0.23	0.17	0.29	0.55
CCT disability allowance	0.0	-0.46	1.15	0.04	0.04	0.10	0.0	-0.36	0.96	0.03	0.03	0.21	0.01	0.01	0.0	-0.37	0.97	0.03	0.09	0.13	0.11	0.02
NCP Old Age Pension scheme	1.2	-0.28	0.97	1.08	1.70	2.42	0.9	-0.17	0.78	0.68	1.58	1.42	1.30	0.65	0.9	-0.19	0.79	0.66	1.22	1.84	1.54	0.61
NCT Needy Student Package	0.1	-0.27	0.96	0.06	0.17	0.15	0.1	-0.36	0.97	0.05	0.08	0.12	0.06	0.03	0.0	-0.40	1.00	0.05	0.03	0.13	0.20	0.05
NCT Vulnerable Group Feeding Programme	0.6	-0.23	0.93	0.58	0.69	1.38	0.5	-0.27	0.87	0.42	1.18	1.20	0.53	0.35	0.5	-0.25	0.85	0.41	1.09	1.37	0.70	0.33
NCT School Feeding Programme	2.1	-0.15	0.84	1.70	2.93	4.20	1.6	-0.16	0.77	1.18	2.46	2.59	2.53	1.01	1.6	-0.17	0.77	1.19	2.43	3.09	2.69	1.48
NCT Sponsorship of student	4.6	-0.71	1.40	-0.40	0.98	0.96	3.5	-0.73	1.34	-0.50	0.60	0.62	0.54	0.67	3.4	0.43	0.17	-1.24	0.03	0.13	0.14	0.29
All Direct Transfers	***11.9***	***-0.43***	***1.13***	***4.84***	***12.56***	***16.02***	***9.0***	***-0.41***	***1.02***	***3.16***	***9.55***	***9.88***	***7.92***	***4.17***	***8.9***	***0.05***	***0.56***	***2.97***	***9.56***	***10.00***	***7.46***	***3.97***
Direct Taxes (Personal Income Tax)	**-11.6**	**0.87**	**0.18**	**1.94**	**-0.47**	**-0.57**	**-8.0**	**0.87**	**0.26**	**2.07**	**-0.07**	**-0.09**	**-0.34**	**-0.44**	**-8.7**	**0.86**	**0.26**	**2.36**	**-0.02**	**0.00**	**-0.15**	**-0.53**
Subsidy (implicit) for electricity	**1.7**	**0.46**	**0.23**	**0.37**	**0.99**	**0.89**	**1.3**	**0.51**	**0.09**	**0.11**	**0.19**	**0.38**	**0.70**	**0.56**	**1.3**	**0.52**	**0.08**	**0.04**	**0.08**	**0.15**	**0.49**	**0.64**
VAT applying statutory/zero rates and exemptions	-5.7	0.57	-0.12	-0.76	-2.75	-2.34	-4.8	0.55	-0.05	-0.27	-1.29	-1.62	-1.21	-1.80	-4.6	0.55	-0.05	0.00	-0.49	-1.06	-1.77	-1.85
Tobacco excise and levy	-0.6	0.53	-0.16	-0.11	-0.11	-0.23	-0.5	0.49	-0.11	-0.06	-0.18	-0.15	-0.14	-0.16	-0.5	0.49	-0.11	-0.04	-0.06	-0.23	-0.26	-0.29
Alcohol levy scaled down	-0.6	0.65	-0.04	-0.03	-0.11	-0.23	-0.6	0.63	0.02	0.01	-0.06	-0.01	-0.12	-0.17	-0.6	0.63	0.03	0.03	-0.03	-0.16	-0.19	-0.18
Fuel taxes	-0.8	0.77	0.08	0.06	-0.05	-0.02	-0.6	0.75	0.15	0.08	0.00	-0.03	-0.01	-0.01	-0.6	0.76	0.16	0.12	0.00	-0.03	0.00	-0.10
Indirect Taxes	**-7.7**	**0.59**	**-0.10**	**-0.89**	**-3.27**	**-3.04**	**-6.5**	**0.57**	**-0.03**	**-0.26**	**-1.44**	**-1.98**	**-1.60**	**-2.18**	**-6.3**	**0.57**	**-0.03**	**0.12**	**-0.61**	**-1.21**	**-2.18**	**-2.17**
All Taxes	***-19.3***	***0.76***	***0.07***	***1.14***	***-3.86***	***-3.51***	***-14.5***	***0.74***	***0.13***	***1.95***	***-1.52***	***-2.03***	***-1.95***	***-2.77***	***-15.0***	***0.74***	***0.14***	***2.33***	***-0.62***	***-1.21***	***-2.27***	***-2.52***
Health in-kind benefit: outpatient care	2.6	0.00	0.69	1.56	3.70	4.71	2.0	0.01	0.60	1.07	2.38	2.14	2.25	1.46	1.9	0.01	0.59	0.95	0.82	1.83	2.14	1.87
Health in-kind benefit: inpatient care	1.7	-0.11	0.80	0.58	1.58	1.49	1.3	-0.13	0.73	0.46	0.60	0.86	0.96	0.96	1.3	-0.13	0.73	0.37	0.14	0.54	0.98	1.07
Health in-kind benefit: ARV treatment	1.1	-0.09	0.78	0.80	1.51	2.23	0.8	-0.12	0.73	0.58	1.33	1.32	0.95	0.55	0.8	-0.13	0.73	0.54	0.63	1.56	0.95	0.66
Net health transfers	5.4	-0.05	0.74	2.82	6.83	7.39	4.1	-0.06	0.67	2.03	3.74	4.31	4.10	2.97	4.0	-0.06	0.66	1.80	1.35	3.53	4.20	3.50
In-kind transfer primary education	9.9	-0.20	0.89	7.20	18.89	18.96	7.5	-0.22	0.82	5.35	9.11	11.56	12.60	5.84	7.4	-0.22	0.82	5.05	2.98	7.97	13.73	7.24
In-kind transfer secondary education	11.1	-0.02	0.71	5.12	12.17	9.80	8.4	-0.01	0.61	3.71	3.42	5.30	8.55	7.74	8.3	-0.02	0.62	3.26	0.86	2.54	7.67	8.96
In-kind transfer post-sec (TVET) education	0.9	0.08	0.62	0.18	0.41	0.42	0.7	0.12	0.49	0.10	0.16	0.16	0.40	0.33	0.6	0.15	0.45	0.01	0.00	0.08	0.35	0.29
In-kind transfer tertiary education	2.9	0.27	0.42	0.37	0.80	0.84	2.2	0.36	0.24	0.10	0.35	0.31	0.42	0.73	2.2	0.44	0.16	-0.31	0.00	0.11	0.25	0.40
Net education transfers	24.7	-0.05	0.74	11.61	25.98	22.27	18.8	-0.04	0.65	8.50	10.11	13.83	18.89	15.96	18.4	-0.04	0.64	7.34	3.17	8.40	17.72	18.19
All net in-kind transfers	***30.1***	***-0.05***	***0.74***	***13.60***	***28.98***	***24.89***	***22.9***	***-0.05***	***0.65***	***10.03***	***11.27***	***15.79***	***21.84***	***19.37***	***22.5***	***-0.04***	***0.64***	***8.71***	***3.50***	***9.19***	***20.32***	***21.70***
Education user fees	*-0.8*	*0.19*	*-0.50*	*-0.42*	*-1.17*	*-1.02*	*-0.6*	*0.20*	*-0.41*	*-0.26*	*-0.63*	*-0.43*	*-0.39*	*-0.48*	*-0.6*	*0.19*	*-0.41*	*-0.24*	*-0.24*	*-0.44*	*-0.79*	*-0.64*

Notes: Gini for pre-fiscal (market) income is 0.691 using the baseline aggregate, 0.609 for the adjusted aggregate and 0.604 for the alternative aggregate , Concentration coefficients and Kakwani index at pre-fiscal income. Marginal contributions to redistributive effect in Gini points, to poverty reduction in poverty headcount percentage points, measured at postfiscal (consumable) income. Education user fees cover all levels of education, not comparable with in-kind transfers.

CC negative, Kakwani positive	Equalising/poverty reducing
CC<Gini pre-transfer, Kakwani positive	Unequalising/poverty increasing
CC>Gini, Kakwani positive	
CC<Gini, Kakwani negative	

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