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AN ANALYSIS OF POVERTY IN MYANMAR

PART 01

Trends between 2004/05 and 2015

MOPF
Ministry of Planning and Finance

WORLD BANK GROUP

Foreword

This report is the first of two poverty reports to be released by the Government of Myanmar and the World Bank.

The Myanmar Poverty and Living Conditions Survey (MPLCS) was conducted in early 2015 on a nationally representative sample of households. The survey was undertaken through a close collaboration between the Ministry of Planning and Finance and the World Bank. The principal objective of the survey was to provide updated information on living conditions and socio-economic indicators in the country. The survey used the Population and Housing Census of 2014 to establish its sample, and was designed to be representative at the national, urban/rural and agro-zone levels.

The data from the MPLCS survey was analyzed by a joint technical team from the Government of Myanmar and the World Bank. The reports produced from this analysis reflect the outcomes of this extensive and close technical collaboration. The reports benefitted substantially from the guidance of a Steering Committee and Technical Working Committee, both of which included representatives from Ministries across the Government of Myanmar and from the development partner community.

The first stage of the joint analysis is presented in this report. It documents that Myanmar has made solid progress in poverty reduction over the last decade. Using the poverty measure established by the Government of Myanmar in 2004/05 using the Integrated Household Living Conditions Survey, this report finds that poverty declined from 32.1 percent in 2004/05 to 19.4 percent in 2015. Over the same period, average real expenditure grew, durable goods ownership increased and households saw an expansion of their dietary base.

The report also presents a case for putting forward a revised poverty measure that reflects the needs of Myanmar's population in 2015. This recommendation reflects international best practice for reviewing and updating the basket of goods consumed by the poor; revisions of this kind are typically recommended every ten years. The World Bank and Ministry of Planning and Finance will release their findings on the new poverty measure in a second report that details the profile of poverty in Myanmar.

24/8/2017

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Acknowledgement

The team would like to thank, in particular, the Minister of Planning and Finance for his support to the Myanmar Poverty and Living Conditions Survey (MPLCS) and its analysis. The team warmly thanks the Deputy Minister of Planning and Finance for guidance in the MPLCS Steering Committee.Other special thanks go to members of the MPLCS Steering Committee and the MPLCS Technical Committee for their substantial and substantive guidance and support. The study team would also like to acknowledge the key role played by the Planning Department in supporting survey operations and analysis, and specifically U Maung Maung Tint, Director General, Planning Department, Daw Thway Thway Chit, in her capacity as Deputy Director General, Planning Department, and Dr Wah Wah Maung, Director General, Central Statistics Organization.

Additional contributions were made by the National Nutrition Center, Department of Public Health, Department of Labour, Department of Human Resources and Planning and Training, Department of Myanmar Education Research (Department of Education Research, Planning and Training), Department of Labor, Department of Planning, Department of Agricultural Land Management and Statistics, and Department of Population.

Special thanks also go to the World Bank for their support to the survey and analysis, and more specifically to Ellen Goldstein, World Bank Country Director for Myanmar, Laos and Cambodia; Abdoulaye Seck, in his capacity as Country Manager for Myanmar, and Salman Zaidi, Program Manager of the Poverty and Equity Global Practice in the East Asia and Pacific Region. The task team leader at the World Bank was Dr Reena Badiani-Magnusson, Senior Economist.

Contents

Abbreviations

CBN	Cost of basic needs
GDP	Gross Domestic Product
GOM	Government of Myanmar
HIES	Household Income and Expenditure Survey
IHLCA	Integrated Household Living Conditions Assessment
LFS	Labor Force Survey
LIFT	Livelihoods and Food Security Trust Fund
LSMS	World Bank Living Standards Measurement Studies
MDG	Millennium Development Goals
MICS	Multiple Indicator Cluster Survey
MOPF	Ministry of Planning and Finance
MPLCS	Myanmar Poverty and Living Conditions Survey
NGO	Non-governmental organization
SIDA	Swedish International Development Agency
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNOPS	United Nations Office for Project Services

Tables

Figures

Executive Summary

A joint analysis of poverty and living standards was conducted by a technical team from the Ministry of Planning and Finance, Government of Myanmar, and the Poverty and Equity Global Practice of the World Bank.

The findings of the joint analysis are summarized in a two-part report:

1 **Part One** puts forward trends in poverty over time. Annexes include the technical details of the poverty measurement exercise. This report also makes recommendations on the need to revise the poverty measure used to reflect the needs of the population a decade after poverty was first measured in Myanmar.

2 **Part Two** (forthcoming) presents the poverty profile for 2015 based on the new poverty line.

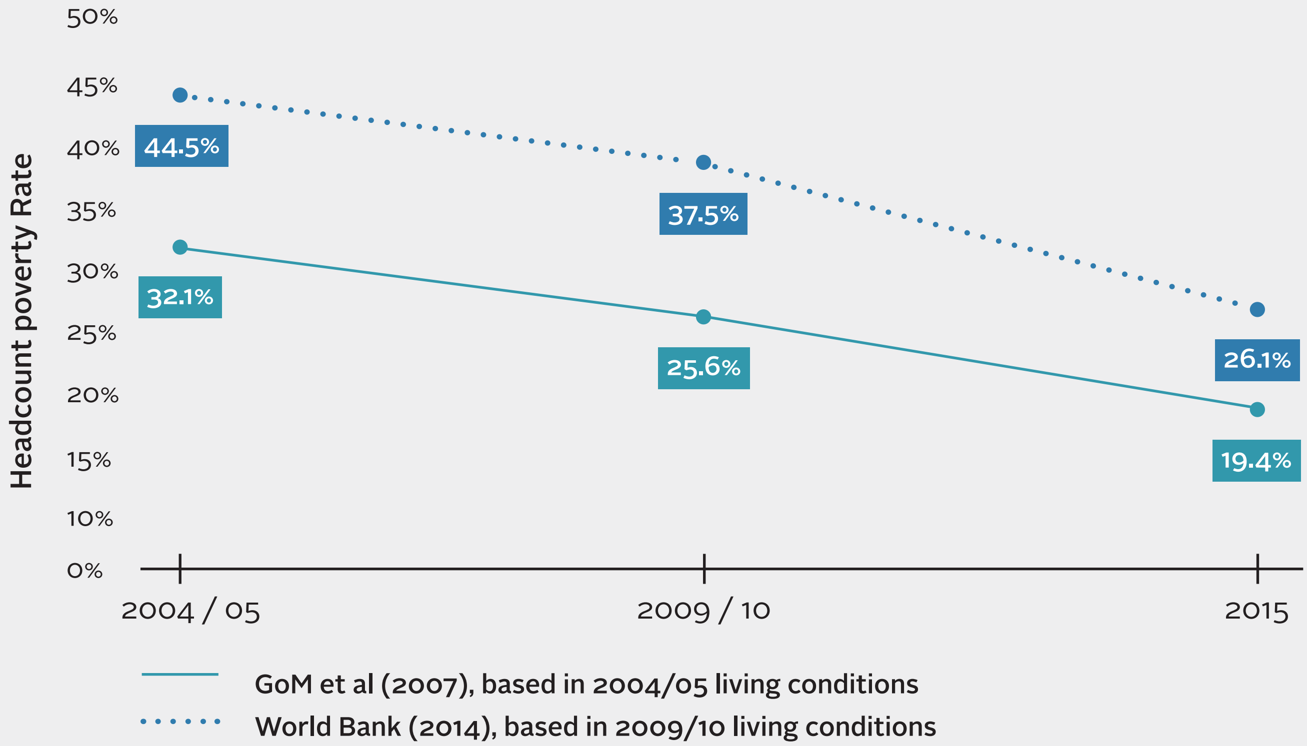
Poverty has previously been estimated using data from the Integrated Household Living Conditions Survey conducted in 2004/05 and 2009/10. A key objective of this part one report was to give an assessment of poverty in 2015 using data from the Myanmar Poverty and Living Conditions Survey.

Poverty in Myanmar has previously been estimated using two different approaches.

Poverty was initially measured by the Government of Myanmar and its development partners using data from IHLCA-I; this first measure of poverty based the poverty line and estimate in the living conditions of 2004/05. Poverty was estimated to be 32.1 percent in 2004/05 and was estimated to have dropped to 25.6 percent in 2009/10 (GOM et al, 2007 and GOM et al, 2011). A poverty estimate based on 2009/10 standards of living was put forward by the World Bank in 2014, using data from the IHLCA-II. The World Bank estimated poverty to be 37.5 percent in 2009/10 (World Bank, 2014).

This report finds that living standards have improved in Myanmar between 2004/05 and 2015, and that poverty has declined.

Poverty is estimated to have declined from 32.1 percent in 2004/05 to 25.6 percent in 2009/10 and to 19.4 in 2015 using the method first proposed by the Government of Myanmar and its development partners in 2007, based on living standards from 2004/05. Similarly, a decaline was registered using the methodology put forward in World Bank (2014): using this second method, poverty is estimated to have declined from 44.5 percent in 2004/05 to 37.5 percent in 2009/10 and to 26.1 percent in 2015.



Increases in well-being were seen across a number of indicators.

These improvements in well-being are also reflected in multiple measures of welfare, including average consumption expenditures and asset ownership.

Urban areas have seen faster expenditure growth than rural areas.

While living standards in rural areas have seen substantial improvements, the changes have been more limited than those seen in Myanmar's cities and towns. The share of the population working in agriculture has remained broadly constant between 2004/05 and 2015, and growth in agriculture has been more limited than growth in manufacturing and services.

Measures of inequality rose over the last five years, albeit from a low base.

The rise in inequality is noteworthy but unsurprising, as individuals with better education and more capital to invest benefitted more from the early liberalizations and reforms. The rise in inequality replicates the experience of reform periods seen in multiple countries in the region. While the inequality figures in Myanmar are not at levels that stand out from a regional or global perspective, it will be important to monitor reform efforts to ensure that they have the potential to reach the entire population. Supporting stronger growth in Myanmar's farms and villages will be vital, both for reducing poverty and for keeping inequality in check.

The joint assessment recommends that the Government of Myanmar consider revising and rebasing its poverty measure in order to better reflect living standards and the needs of the poor in 2015.

Myanmar's poverty estimates are currently based on living conditions in 2004/05, when poverty was first measured in Myanmar. Since Myanmar and the needs of its poor have changed in multiple ways since 2004/05, this joint technical analysis recommends rebasing and revising Myanmar's consumption aggregate and poverty line. Updates to a country's welfare aggregate and poverty line are recommended approximately every ten years to reflect changes in living conditions, such as an increase in the non-food share, and to reflect changes in survey and poverty estimation methodology. This revision is suggested at the end of the period of reporting for the Millennium Development Goals, and at the beginning of the new period of international monitoring for the Sustainable Development Goals.

Living conditions and the needs of the poor have changed in three ways since poverty was first measured in 2004/05.

First, the share of food in a household's basket has declined while non-food items have become more diverse, raising the need to capture a greater diversity of non-food items. Second, and related, the number and variety of goods has increased, particularly for household assets. Third broad reforms have changed the spending patterns of households, as government resources to key services have increased allowing households to diversify the range of items they spend resources on. This report therefore recommends revising the consumption aggregate and poverty line to reflect the needs of the population in 2015.

Following acceptance of the recommendation to revise and rebase the national poverty measure, Part Two of the poverty assessment (forthcoming) will present a comprehensive poverty profile using a revised and rebased new poverty measure for Myanmar.

01.

Introduction

Overview of Content

This report is the first report in a two-part poverty assessment series. The reports produced describe the estimation of poverty in Myanmar by a joint team from the World Bank's Poverty and Equity Global Practice and Living Standards Measurement Survey Team, and the Government of Myanmar, Ministry of Planning and Finance (MOPF).

The joint analysis had 3 interlinked objectives:

1. To construct comparable poverty estimates over three survey waves;
2. To present a measure of poverty that reflects the situation of poverty in Myanmar in 2015 and;
3. To conduct analysis of the correlates and determinants of poverty, to provide an overview of the critical human and economic development needs in Myanmar.

The technical collaboration between the World Bank and MOPF has led to 3 reports:

1. Survey Conduct and Quality Control Report for the Myanmar Poverty and Living Conditions Survey, (MPLCS), 2015;
2. Analysis of Poverty in Myanmar:

   a) **Part One:** Poverty trends between 2004/05 and 2015, based on previous measurements

   b) **Part Two:** Poverty trends and profile based on the new poverty estimates
3. Technical Poverty Estimation Report, accompanying Part Two of the Poverty Analysis

Institutional Arrangements

A Steering Committee for the Myanmar Poverty and Living Conditions Survey was established in July 2015 by the President's Office. The Ministry of Planning and Finance was represented by the Chair and Secretary, and the Ministries of Health, Education, Agriculture and Rural Development, Livestock and Fisheries were represented by members. Representatives from the development partner community participated as members of the Technical Working Group and Steering Committee. The Technical Working Group included representatives from the United Nations Development Programme (UNDP), Asian Development Bank (ADB), United Nations Children's Fund (UNICEF), World Food Programme (WFP), International Labour Organization (ILO), United Nations Population Fund (UNFPA) and International Growth Centre (IGC). The Steering Committee included representation from the World Bank, UNDP and ADB.

This report proceeds as follows. Chapter 2 puts forward a background on poverty estimation. Chapter 3 focuses on the construction of poverty trends over time, and presents the results as well as robustness checks of this analysis. Detailed annexes explore the construction of poverty trends over time, present the results of the robustness checks of this analysis and present a comparison of the surveys used to conduct this analysis.

02.

An overview of poverty measurement in Myanmar

Overview of Content

Before examining the changes in poverty in Myanmar, we first give an overview of household surveys and poverty measurement, and introduce key references that will be drawn upon in this report.

Background to the measurement of household living standards in Myanmar

Prior to 2015, two nationwide surveys were collected in Myanmar that included comprehensive information on household expenditures.[1] Welfare and poverty were twice measured in Myanmar using the Integrated Household Living Conditions Assessment (IHLCA), conducted in 2004/05 (IHLCA-I) and in 2009/10 (IHLCA-II).[2]

In early 2015, the Myanmar Poverty and Living Conditions Survey (MPLCS) was conducted to capture living conditions in Myanmar. Although the MPLCS is relatively small in scale, with a sample size of 3,648 households, the sample can be used to describe the national, urban/rural and agro-ecological zone level. It cannot be used at the state and region level. The MPLCS used the 2014 Population and Housing Census to draw its sample.[3]

Table 2.1

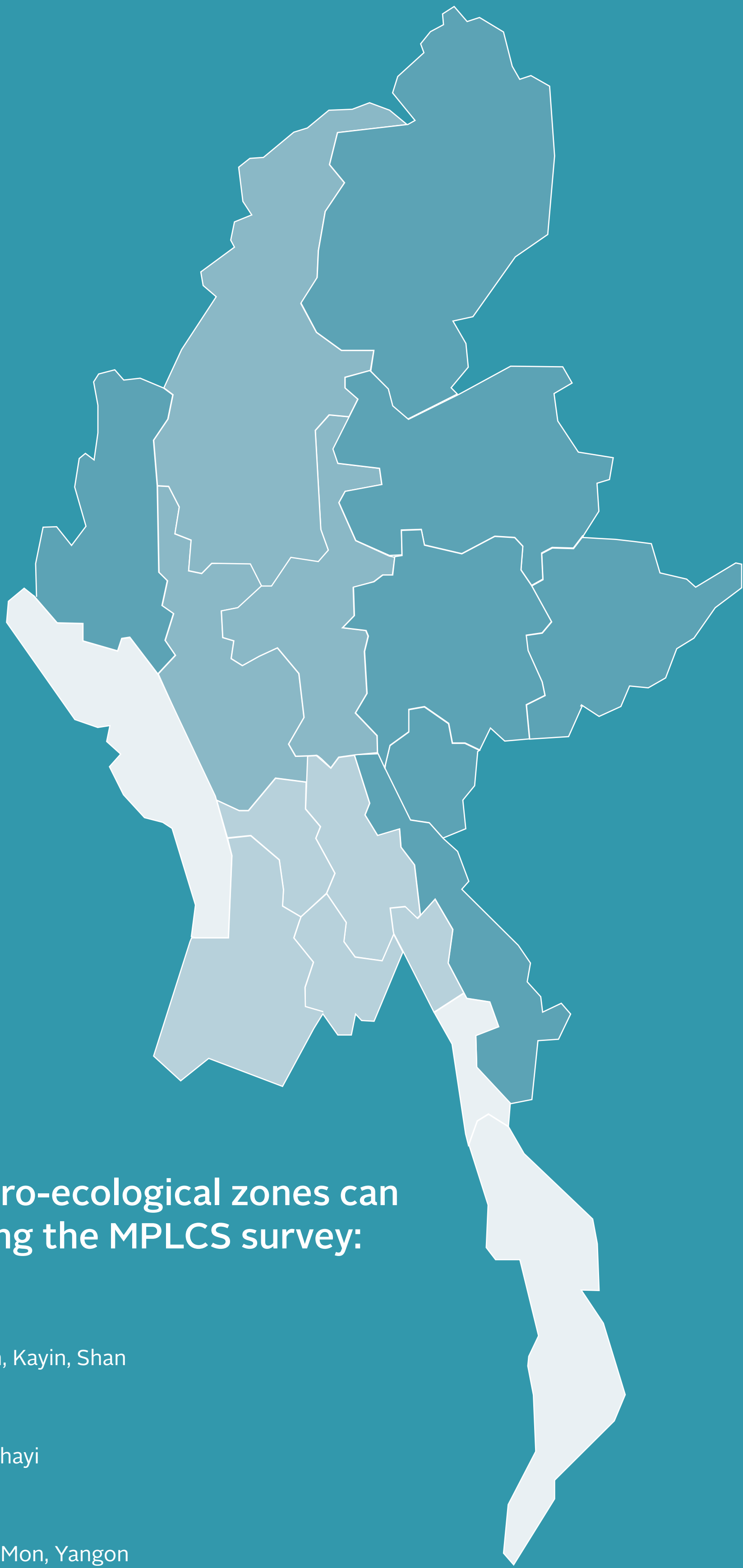
Summary of surveys used to measure national poverty in Myanmar

Survey	Timing	Level of representation	References drawn upon in this report
Integrated Household Living Conditions Assessment Survey I and II (IHLCA)	**2004/05: Repeat visits in November/ December 2004 and May 2005**	National; Rural/Urban; State/Region	Poverty Profile: GOM et al, 2007. Technical Report: GOM et al, 2010.
	2009/10: Repeat visits in December 2009/ January 2010 and May 2010	National; Rural/Urban; State/Region	Poverty Profile: GOM et al, 2011. Technical Report: GOM et al, 2011.
Myanmar Poverty and Living Conditions Survey (MPLCS)	**2015: Households were enumerated in January through April 2015**	National; Rural/Urban; Agro-Zone	MPLCS Survey Report

1 There have been other surveys used to capture poverty in Myanmar. The Livelihoods and Food Security Trust Fund (LIFT) conducted a household survey in 2011, 2013 and 2015 in order to evaluate progress made in rural areas covered by LIFT programs. The results from these surveys are thus not nationally representative.

2 The survey includes a nationwide representative sample of 18,660 households, based on a sample drawn from administrative population counts. The survey was comprehensive in scope, including modules on basic household characteristics, housing, education, health, consumption expenditures, assets, labor and employment, business, finance and savings. The survey was supported by development partners, and in particular by the UNDP, UNICEF, UNOPS and SIDA.

3 The survey was comprehensive in scope, including modules on basic household characteristics, housing, education, health, consumption expenditures, assets, labor and employment, business, and finance and savings, as the IHLCA did, and additionally including modules on subjective well-being and self-reported incidence of shocks. The survey was supported by the World Bank Living Standards Measurement Studies (LSMS) and Poverty and Equity teams, and was conducted under the oversight of the Planning Department and Central Statistical Organization in the Ministry of Planning and Finance (previously the Ministry of National Planning and Economic Development).



The following agro-ecological zones can be examined using the MPLCS survey:

Hills and Mountainous Zone
covering Chin, Kachin, Kayah, Kayin, Shan

Coastal Zone
covering Rakhine and Taninthayi

Delta Zone
covering Ayeyarwady, Bago, Mon, Yangon

Dry Zone
covering Mandalay, Magwe, Nay Pyi Taw, Sagaing

More details on these surveys can be found in the Annex and in the survey report.

Poverty Measurement using household surveys

This section provides a brief introduction to key concepts that are used throughout the report.

There are two principal steps in poverty measurement: the construction of a welfare aggregate and the construction of a poverty line. The primary elements of poverty analysis are described in Table 2.2 below, which defines terms that are reoccurring through this poverty profile.

Table 2.2

Components of welfare and poverty measurement

Welfare	Welfare refers to an individual's well-being or long-term happiness.
Measure of welfare	Welfare is commonly measured in monetary terms, for example household expenditures or household income. Households with higher monetary welfare measures are considered better off.
Poverty line	The poverty line defines the minimum welfare level needed to not be considered severely deprived. What is implied by a minimum need varies across countries and as a country develops. In countries where people have severe difficulty feeding themselves, this is often benchmarked around meeting calorie needs. In better off countries where food adequacy is no longer an issue but where worse off households may be excluded or deprived in other ways (e.g. inadequate health care, limited education), poverty may be measured relative to the average or median household.
Poor	The poor live in a household in which income or expenditures per person (or adult equivalent) is less than or equal to the total poverty line.

A welfare aggregate captures well-being in monetary terms. It includes four main items. The four principal items included in a welfare aggregate are food; non-food expendables spending which includes: spending on energy, taking buses or buying fuel for motorbikes, education and, sometimes, health; the use value of durables, which captures a value from using the home assets in the household's possession; and finally the imputed value of the household's housing.

A poverty line defines the minimum standard of living that is needed for a household to live a reasonable life, meaning that they are able to feed themselves and to purchase basic non-food items. A household is considered to be poor if their welfare aggregate, effectively the value in kyats that they report consuming, falls below the minimum that is considered needed in Myanmar to support a basic minimum standard of living.

The year that a poverty line is based in matters for the estimate of poverty produced. Even if the methodology to estimate a poverty line is completely unchanged, a poverty line based in two different years will yield two different poverty estimates. A poverty line is a benchmark that reflects standards of living at a given moment in time – it is based in a particular reference year. Poverty lines are typically anchored in food needs and using the food tastes and preferences of the poorest households in a society. Poorer households tend to consume a lower quality diets than richer households, with fewer calories, more basic carbohydrates, and less protein. As households grow richer their diets improve, they consume more non-food items and increase their range of leisure goods. As the diets and consumption patterns of the poorest in society evolves, the line that reflects their basic minimum needs should be revisited.

The headcount rate is the most commonly used measure of poverty. The headcount rate captures the proportion of the population who live in poor households. A household is defined as poor if their per capita (or per adult equivalent) welfare is less than or equal to the poverty line. A household is food poor if their per capita or per adult equivalent consumption expenditures lie below the food poverty line.

The depth and severity of poverty provides a sense of whether the deprivation is relatively shallow—with many people just failing to meet their needs—or deeper and more dispersed. The headcount rate of poverty captures the proportion of the population whose expenditures are lower than what is needed to meet basic societal minimum food and non-food needs. The headcount poverty measure is not sensitive to the depth of poverty among the poor—if the number of people living below the poverty line remains the same but the poor become better off, the headcount measure does not change. The poverty gap and severity measures are sensitive to changes in welfare under the poverty line. The poverty gap captures the depth of poverty using the average shortfall from the poverty line; the poverty severity measure places more weight on people who are further away from the poverty line.

History of poverty measurement in Myanmar

Poverty was previously benchmarked using the consumption patterns of people in Myanmar in 2004/05. Poverty was initially measured in Myanmar using consumption expenditures data collected from IHLCA-I in 2004/05. The Government of Myanmar and its development partners established a consumption aggregate to measure living standards, and subsequently estimated a poverty line based on the minimum needs of the population in 2004/05. Using this benchmark and methodology, poverty was estimated to be 32.1 percent in 2004/05, subsequently dropping to 25.6 percent in 2009/10 (GOM et al, 2007 and GOM et al, 2011). A poverty estimate based on 2009/10 standards of living was put forward by the World Bank in 2014. Using data from the IHLCA-II to construct a consumption basket and define minimum living standards, the World Bank estimated poverty to be 37.5 percent in 2009/10 (World Bank, 2014).

Table 2.3

Poverty estimates from previous poverty estimation

	Estimated Poverty Rate		Poverty Line Base Year
	2004/05	2009/10	
GoM et al (2007) methodology	32.1	25.6	2004/05
World Bank (2014) methodology	-	37.5	2009/10

Although there are a handful of technical choices that differentiate the two poverty estimates, only a few have substantial explanatory power. Due to the number of people in Myanmar living in difficult circumstances, small changes in assumptions can lead to large changes in poverty estimates:

- The first significant difference is the base year used to anchor the standard of living measure and definition of poverty.
- The second factor is the choice of adult equivalence parameters and application of the normalization process. These are used to convert welfare from household to individual.[4]

These differences are explained in greater depth in Annex A1.

4 When expressing consumption in per capita terms, people are treated the same regardless of age—a household with two adults and two young children would have the same number of individuals as a household with four adults. If young children are seen as having different needs than adults—for example, a baby needs fewer calories than an adult male¬—then a household with four adults would have more adult equivalents than a household with two adults and two young children.

03.

Changes in poverty and household consumption over the last decade

Overview of Content

This Part One report uses the two measures of poverty previously measured in Myanmar to estimate changes in poverty between 2004/05, 2009/10 and 2015.

The report finds:

- Poverty declined by 40 percent between 2004/05 and 2015. Both measures find consistent declines of a similar magnitude.
- Standards of living have increased more rapidly in urban areas than in rural.

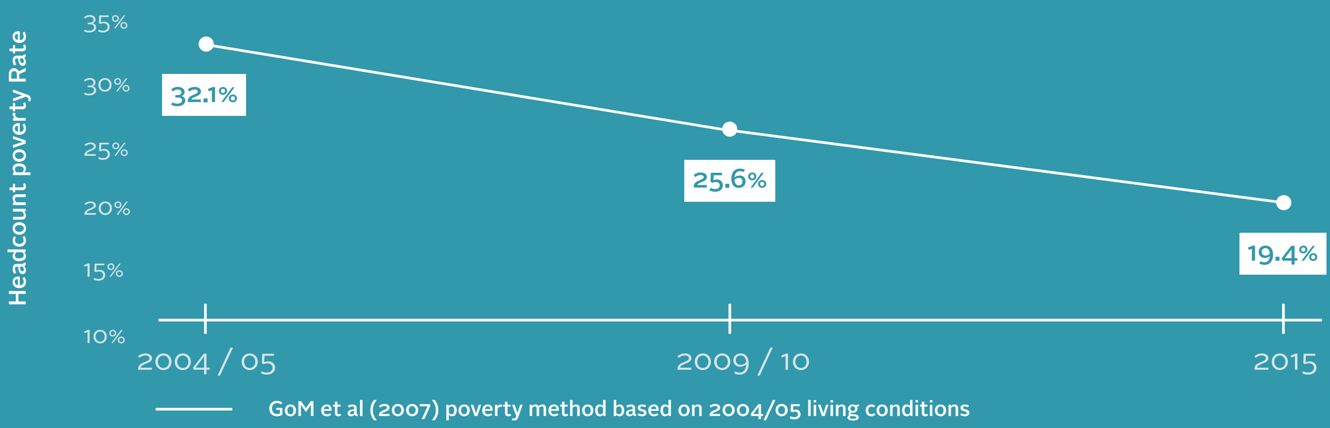
Changes in poverty

Trends in the headcount rate of poverty

The share of the population who are poor in Myanmar declined between 2009/10 and 2015. As presented in Figure 3.1, there has been a decline in poverty over the three successive household surveys used to measure it using the two methodologies that have been previously used to measure poverty.[5] Poverty is estimated to have decreased from 25.6 percent in 2009/10 to 19.4 percent in 2015, measured using the methodology of GOM et al. (2007).

Figure 3.1

Estimated trends in poverty rates, GoM et al (2007) method based on 2004/05 living conditions



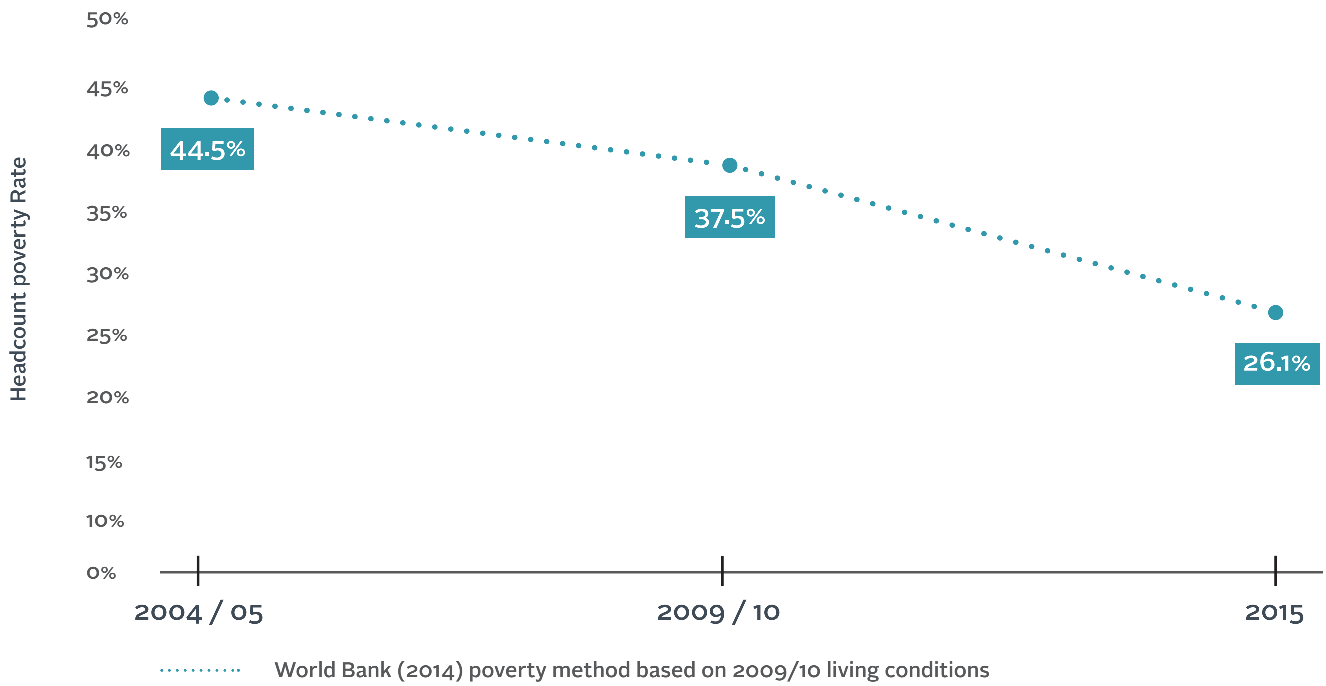
Note: Imputation methods are used to restore comparability as far as possible in poverty estimation for GoM et al (2007) estimates in 2015. See Annex for a detailed discussion of the robustness of these methods.

5 We use imputation techniques to establish comparable consumption aggregates and assess poverty estimates over time. Although point estimates and confidence bands vary by model, our results are robust to model specifications. This is discussed in the Annex of this report.

The decline in poverty is seen regardless of how poverty is defined and the methodology used to estimate poverty. Using the alternative methodology of World Bank (2014), poverty is estimated to have declined from 44.5 percent in 2004/05 to 37.5 percent in 2009/10 and 26.1 percent in 2015.[6]

Figure 3.2

Estimated trends in poverty rates, World Bank (2014) method based on 2009/10 living conditions



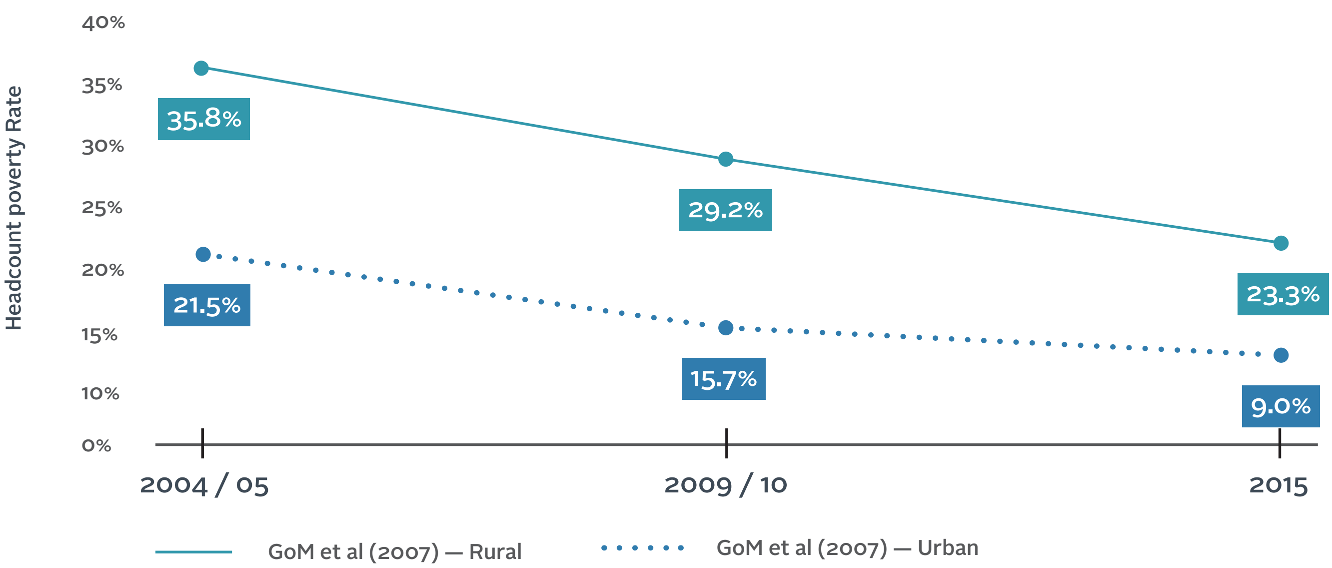
Note: Imputation methods are used to restore comparability in poverty estimation for World Bank (2014) estimates in 2004/05 and 2015. See Annex for a detailed discussion of the robustness of these methods.

6 The finding of a decline in poverty is robust to the method used to estimate poverty. As a robustness check, we construct poverty estimates directly using the World Bank (2014) methodology and the expenditures questions asked in the MPLCS. Using as comparable a consumption aggregate as possible, we find a similar decline in poverty, adding further confidence in the results. We are unfortunately unable to do the same using the GOM et al. (2007) methodology due to the omission of a main variable used for estimating food consumption.

Poverty has declined in both rural and urban areas. Both rural and urban poverty continued to decline rapidly from 2009/10 until 2015, with urban poverty falling from 15.7 percent to 9 percent and rural poverty falling from 29.2 percent to 23.3 percent using the methodology of GOM et al. (2007).[7] Similar patterns are found in the application of the World Bank (2014) methodology, which estimates that urban poverty declined from 34.6 percent in 2009/10 to 19.2 percent in 2015 while rural poverty declined from 38.5 percent in 2009/10 to 28.8 percent in 2015. The more rapid decline in urban poverty relative to rural poverty is mirrored in sectoral growth figures, which show a more rapid rate of growth in manufacturing and services than in the agricultural sector over the same period (World Bank, 2016).

Figure 3.3

Urban and rural poverty, changes over time



Note: Imputation methods are used to restore comparability as far as possible in poverty estimation for GOM et al. (2007) in 2015. See Annex for a detailed discussion of the robustness of these methods.

Trends in the severity and depth of poverty

Welfare among the poor was higher in 2015 than in 2009/10. The increase in welfare among the poor can be seen in the decline in both the depth and severity of poverty between 2004/05, 2009/10 and 2015. Panel (a) of Figure 3.4 shows trends in the poverty gap, while panel (b) shows trends in the squared poverty gap index. These measures are important complements of the headcount poverty rate, allowing for a more robust depiction of the nature of poverty in Myanmar. The GOM et al. (2007) poverty measure, with a lower poverty threshold set in 2004/05, shows a more moderate decline in the poverty gap and poverty gap squared, relative to that seen using the World Bank (2014) methodology.

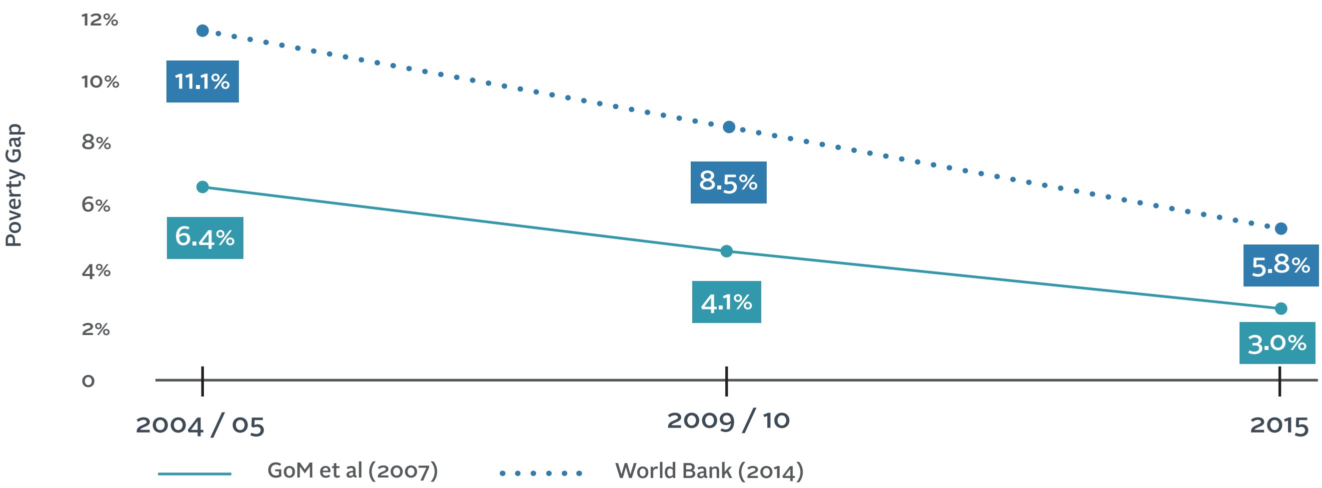
7 The closely aligned imputed and observed estimates for 2004/05 and 2009/2010 suggest the model performs well both within and out of sample both for rural and urban areas.

Despite improvements in living conditions, there are many individuals whose consumption patterns place them just above the poverty line. Individuals are considered to be near-poor or vulnerable to poverty if there is a non-negligible chance that they could fall into poverty. We capture this by looking at the population that lies within 20 percent of the poverty line. Panel (c) of Figure 3.4 shows the changes in those who are poor or near poor over time. Although the fraction of poor and near-poor has declined over time, from 52 percent in 2004/05 to 37 percent in 2015, using the definition of the GOM et al. (2007), the high shares of the population living under the near-poor line signals continued substantial vulnerability to poverty.

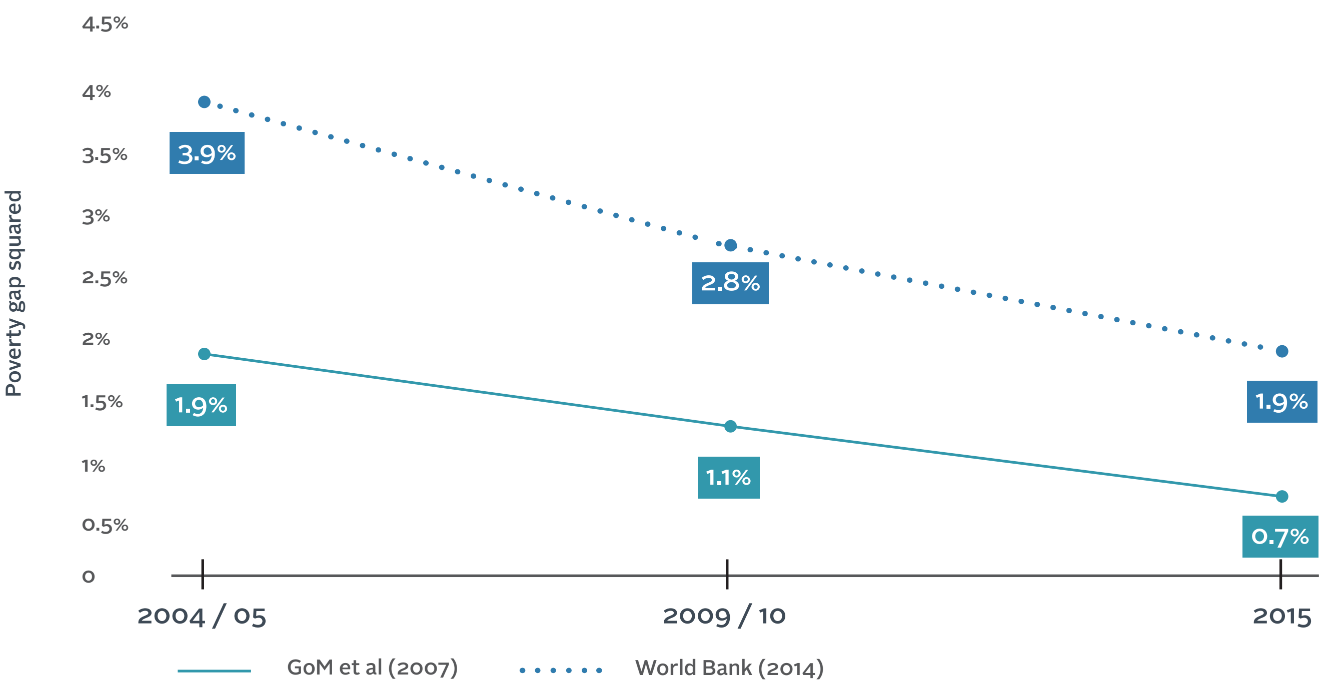
Figure 3.4

Trends in other welfare measures 2004/05-2015

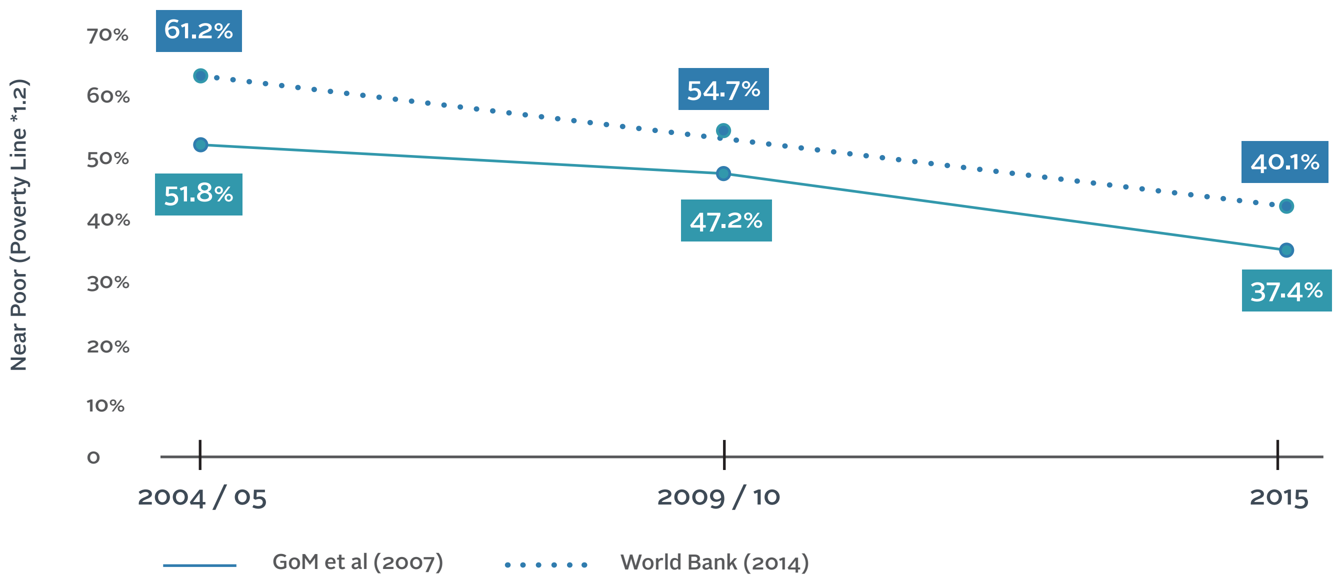
(a) Poverty gap



(b) Poverty gap squared index



(c) Poor and Near-poor



Note: All three panels use imputation methods to restore comparability as far as possible in poverty estimation for the following data points: GOM et al. (2007) in 2015; World Bank (2014) in 2004/05 and 2015. See Annex on Poverty Measurement for a detailed discussion of the robustness of these methods.

The finding of a reduction in poverty is mirrored in other non-monetary indicators of well-being. The share of expenditures devoted to food has declined over time, as typically expected to accompany an increase in welfare. Net total enrollment in primary school increased from 88 percent in 2009/10 to 93 percent in 2015, while net total enrollment in secondary school increased from 53 percent to 55 percent.[8] Ownership of assets such as televisions and motorcycles have also displayed a sustained increase over time. Asset ownership is strongly associated with well-being in Myanmar, with valuable assets mostly concentrated among richer households in urban areas or in the top expenditure quintile. An increase in asset ownership over time is likely a reflection of both a deepening of markets as well as of rising consumer purchasing power.

Real expenditure per adult equivalent has grown between 2004/05, 2009/10 and 2015. Real per adult consumption using the dentition of the GOM et al. (2007) is estimated to increase by approximately 15 percent over a 10-year period, corresponding to an annualized growth of 1.4 percent. Using the methodology of World Bank (2014), real per adult consumption growth is estimated to have risen by 31 percent between 2004/05 and 2015, which is equivalent to an annual average growth of 2.7 percent. Per adult equivalent growth of expenditures was faster in the last half of the decade for both methodologies. The annual average growth rates based on GOM et al. (2007) and World Bank (2014) methodologies between 2004/05 and 2009/10 are 1.2 and 2.5 percent, while those between 2009/10 and 2015 are 1.7 and 3.0 percent, respectively. The lower growth rate in per adult equivalent expenditure using the GOM et al. (2007) aggregate may be a reflection of the omission of durable use values: the proportion of households owning durables such as phones,

8 Further discussion on the construction of these enrollment trends, including comparability issues, is found in Part-II of the poverty analysis (forthcoming).

bicycles, fans and televisions has increased over time. Motor-cycle ownership increased from just under 10 percent of households to a quarter of households in 2009/10, 39% in 2014 and just over 42 percent of households in 2015 (GoM et al 2011; GoM 2015; MPLCS survey data).[9]

Growth has been faster in urban areas over the decade. An acceleration of growth in real expenditure per adult equivalent in the 2009/10 to 2015 period was clearly seen in rural areas. Growth in the last decade was lower in rural areas than in urban: 1.1 percent per annum in rural areas compared to 1.9 percent in urban areas using the GoM et al. (2007) method. Growth in average real expenditure was faster in the second half of the last decade in rural areas, where annualized growth increased from 0.8 percent between 2004/05 and 2009/10 to 1.4 percent between 2009/10 and 2015 using the GoM et al (2007) aggregate.[10] [11] By contrast to the growth seen on average in the population, in rural areas there is no demonstrable change in welfare among the bottom 10 percent. In rural areas a similar increase in well-being can be seen for those above the 10th percentile.

A study of livelihoods in rural Myanmar upholds the finding of improvements in living standards. The Livelihoods and Food Security Trust Fund (LIFT) conducted an analysis of changes in multiple indicators of living standards between 2011 and 2013 (LIFT, 2015). Although the analysis was designed as an evaluation of their programming, an assessment of control areas can provide a sense of the change in living conditions in these areas not targeted by the organization's poverty alleviation programs. In the two years between the surveys, there was a substantial increase in household dietary diversity in the control communities and an increase in the number of households reporting eating eggs, meat, and dairy. There was also a notable decline in the reported incidence of households not having sufficient food to meet their needs.

Changes in Inequality in Myanmar

Inequality refers to disparities between individuals or households. There are many types of inequality in society. Inequality in outcomes refers to differences in well-being, or in measured income and consumption, which are closely linked to individual and household welfare and living standards. Inequality in outcomes is the result of inequality of opportunities, societal institutions, effort, and luck. In this analysis, we focus on inequality in measured consumption.

We use a number of alternative measures to describe the distribution of incomes in Myanmar. Measures include the Gini, the Theil-L, the Theil-T, and the ratio of incomes between households in the 10th, 50th and 90th percentiles.

9 Our estimates of consumption growth per adult equivalent between 2004/05 and 2009/10 are slightly higher than those reported in GoM et al (2011) since we report estimates of per adult equivalent growth while GoM et al (2011) reports household growth.

10 In urban areas, mean expenditure per adult equivalent grew by 2.0 percent between 2004/5 and 2009/10 and 1.9 percent between 2009/10 and 2015.

11 Using the World Bank (2014) method, growth over the decade was 2.3 percent in rural areas compared to 3.5 percent in urban areas. Growth accelerated in both rural and urban areas. In rural areas, mean expenditure per adult equivalent grew by 2.9 percent between 2009/10 and 2015, up from annualized growth of 1.8 percent between 2004/05 and 2009/10.

The analysis presented in the discussion on trends in this section is subject to the caveat that it uses the most comparable constructed consumption aggregates directly from the household survey using the new aggregate. We do not report inequality numbers for the GoM et al (2007) methodology since we are unable to construct comparable estimates from the household survey.

Inequality in Myanmar remains at levels comparable to or below those of other neighboring countries. Inequality is lower in countries where individuals are similar to one another, where there are few disparities to mark them apart. The relatively low levels of inequality still seen in Myanmar are a reflection of the compactness of the expenditure distribution – there are many individuals who live in poverty or near the poverty line. There are some households at the top of end of the distribution who show markedly different consumption patterns, in particular in their ownership of higher value durables. These households act to push up the Gini coefficient and others measures of inequality. Many of the countries in South East or East Asia with similar inequality figures have lower poverty rates, larger non-farm sectors and greater variation in the sectoral composition of their labor markets and real sectors. At similar stages of development, Gini coefficients in Vietnam and Thailand were in the low 30s (Government of Thailand, 2012; World Bank, 2012). The relatively moderate inequality figures for Myanmar therefore need to be considered in the broader context of the level of economic development and economic structure.

Table 3.1

Measures of inequality, 2015

	National	Urban	Rural
Gini	31.7	36.6	28.0
Theil-0	17.1	22.5	13.1
Theil-1	20.6	29.1	13.7
Share bottom 20%	8.4	7.6	9.1
90/10	3.7	4.2	3.4
90/50	2.0	2.1	1.9
50/10	1.9	2.0	1.9

Note: Inequality estimates are based on comparable consumption values for 2015 using the World Bank (2014) methodology

Inequality within urban areas is substantially higher than inequality within rural areas. This is consistent with typical findings in other South East and East Asian countries when they were at similar levels to development to Myanmar. The Theil index of inequality can be decomposed to signal the contribution of inequality within urban and rural areas relative to differences in average standards of living between these areas (within versus between inequality). The majority of inequality in Myanmar is attributable to inequality within urban and within rural areas. Although only 30 percent of the population live in urban areas, because inequality levels in urban areas are substantially higher, inequality within these areas accounts for almost as much of total inequality as inequality within rural areas.

Table 3.2

International comparisons of inequality

	Income/Expenditure share of...				
	Gini	Top 10%	Top 20%	Bottom 10%	Bottom 20%
Thailand, 2012	39.3	30.4	46.3	2.8	6.7
Vietnam, 2012	38.7	30.1	45.7	2.6	6.5
Indonesia, 2009	35.6	28.2	43.7	3.4	7.6
China, 2010 (Income)	42.1	30.0	47.1	1.7	4.7
Myanmar, 2015	31.7	25.9	40.2	3.5	8.4

Sources: World Development Indicators (2016)

All measures point to a rise in disparities, with a notable increase occurring at the bottom end of the expenditure distribution. Households at the top 90th percentile have seen faster consumption growth than those at both the bottom 10th and the median household. As seen in Figure 3.5 below, the ratio of the expenditures of the 90th percentile relative to those at the 10th percentile rises sharply from 3.1 in 2009/10 to 3.7 in 2015, and similar, albeit smaller, increases are seen relative to households at the median of the distribution. The share of expenditures going to the bottom 20 percent and to the bottom 40 percent has declined since 2009/10.

Figure 3.5

Indicators of rising inequality between 2009/10 and 2015 – share of expenditures

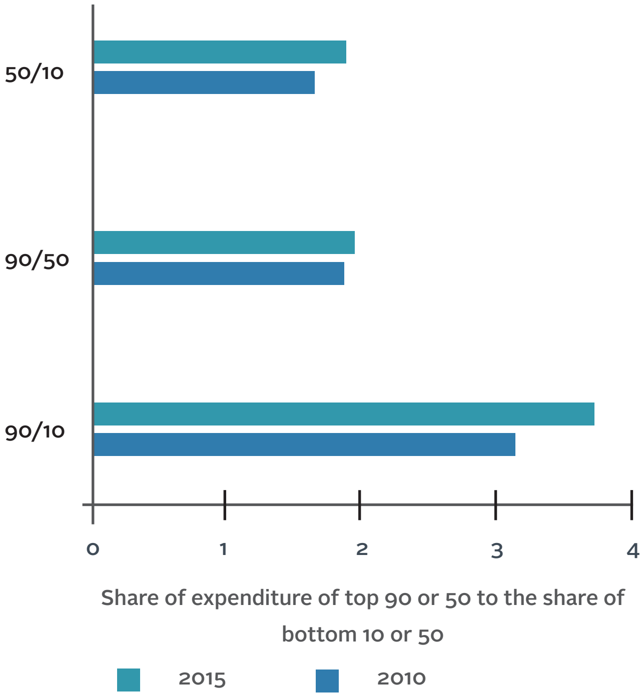
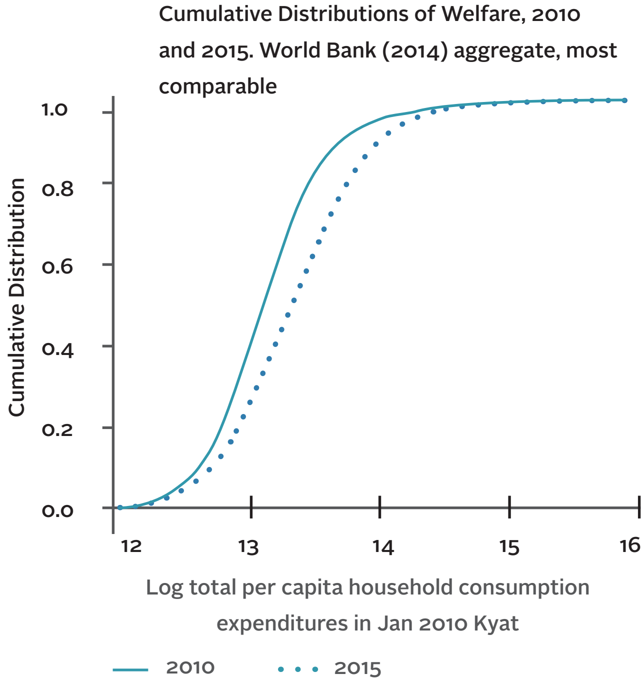


Figure 3.6

Indicators of rising inequality between 2009/10 and 2015 – distribution of expenditures

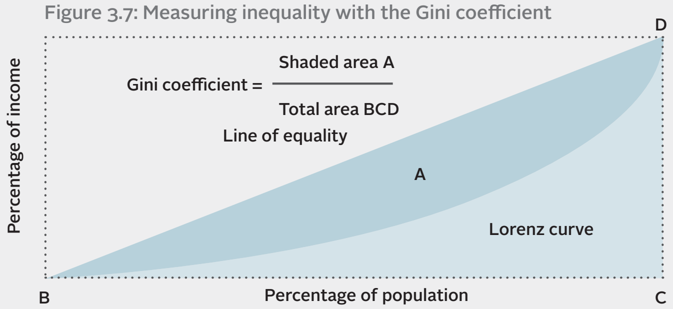


Box 1: How do we measure inequality?

How is inequality measured?

The most commonly used measures of inequality—the Gini, the class of generalized entropy measures including the Theil, and ratios of outcomes of people at different percentiles of the outcome distribution—capture inequality in relative terms. The most widely used measure of inequality is the Gini coefficient. It is based on the Lorenz Curve, which compares the distribution of welfare that exists in a society with the distribution under complete equality. The Gini index measures the extent to which the distribution of welfare of individuals or households deviates from the perfectly equal distribution. A Gini index of zero represents perfect equality, while an index of 1 implies perfect inequality. The Gini coefficient takes on values between 0 and 1 with zero interpreted as no inequality.

Figure 3.7: Measuring inequality with the Gini coefficient



Inequality measures differ in terms of their sensitivity to different segments of the income distribution, and thus collectively provide a good picture of distributional changes. For example, the Gini is most sensitive to changes in the middle of the distribution, while the Theil-L is more affected by changes in the lower tail of the distribution and the Theil-T is more affected by changes at the upper tail of the distribution.

Economic growth and poverty

The growth elasticity of poverty reduction

The growth elasticity of poverty captures how effectively growth has translated into poverty reduction. The total growth elasticity of poverty reduction is the percent change in poverty with respect to a one percent change in per capita GDP (or mean expenditure per capita).

Table 3.3

Growth elasticity of poverty reduction

(a) GoM et al (2007) method

	National			Urban			Rural		
	Mean	Poverty	Elasticity	Mean	Poverty	Elasticity	Mean	Poverty	Elasticity
2004/05	1289	32.1		1471	21.5		1224	35.8	
2009/10	1365	25.6	-3.4	1622	15.7	-2.6	1275	29.2	-4.5
2015	1484	19.4	-2.8	1783	9.0	-4.3	1369	23.3	-2.7
2005 - 2015			-2.6			-2.7			-2.9

(b) World Bank (2014) method

	National			Urban			Rural		
	Mean	Poverty	Elasticity	Mean	Poverty	Elasticity	Mean	Poverty	Elasticity
2004/05	1450	44.5		1622	42.2		1389	45.4	
2009/10	1638	37.5	-1.2	1885	34.6	-1.1	1518	38.5	-1.6
2015	1898	26.1	-1.9	2289	19.2	-2.1	1748	28.8	-1.7
2005-2015			-1.3			-1.3			-1.4

Source: World Bank staff estimates using IHLCA-I, IHLCA-II and MPLCS data. The mean per adult equivalent expenditures and poverty estimates derived using the GOM et al (2007) and World Bank (2014) methodologies.

The growth elasticity of poverty reduction was estimated to be lower than the average found in other countries. The GoM et al (2007) method estimates the average growth elasticity over the entire decade of -2.6 while the World Bank (2014) method estimates -1.3. This implies that for a 1 percent increase in mean expenditures, poverty declined by 2.6 and 1.3 percent based on the GoM et al (2007) and the World Bank (2014) methods, respectively. Myanmar's growth elasticity over the entire period lies just below the average elasticity found in other countries with a substantial fraction of the population living in absolute poverty. Across these countries, a one percent increase in mean per capita expenditures or GDP has been found to contribute an average of three percent to poverty reduction (Ravallion and Chen, 1997) although the median elasticity is closer to 2 (Bourguignon 2002).

It is common to find different estimates of the growth elasticity of poverty when using alternative measures of economic growth, though the discrepancy appears larger in Myanmar. Measures of poverty reduction appear much more responsive to survey-based household consumption growth than to growth measured using national accounts. When growth is measured by changes in real GDP the growth elasticity of poverty is around -0.3 for both the GoM et al (2007) and the World Bank (2014) methodologies, indicating that a 1 percent increase in economic growth will reduce the headcount rate of poverty by only 0.3 percent.[12] A large literature discusses the inconsistencies between national accounts and household survey data (Ravallion 2001, Adams 2004), and the strengths and weaknesses of both. The discrepancies between the two include the definition of consumption in national accounts, inflation adjustment, omission, and measurement error. Although there is no clear consensus on which of these measures of economic growth is more accurate, growth measured from survey data is more closely related with changes in households' consumption and income and better reflects the spending behavior of the poor.

Living standards and the macro-fiscal economic context

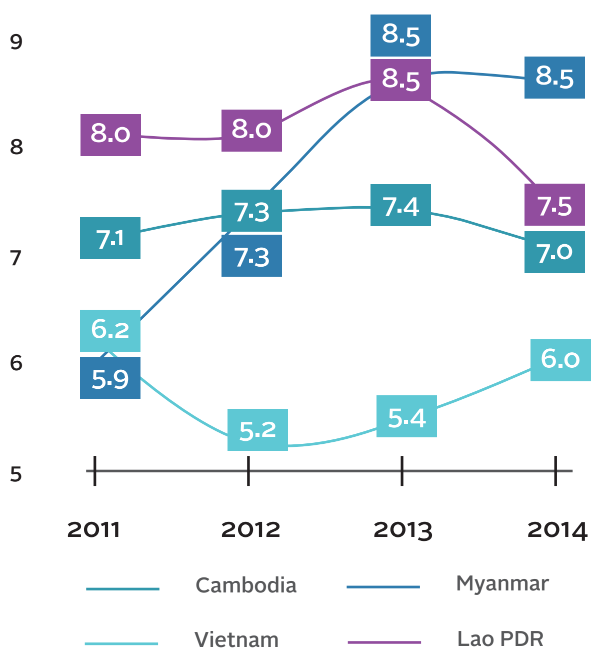
In the period between 2009/10 and 2015 when marked poverty reduction occurred, Myanmar undertook substantial economic reforms. The reforms underway since 2010/11 have touched upon multiple sectors, from reducing red tape and bureaucracy (albeit from high levels) that stymies private sector development (World Bank, 2014b), to filling key infrastructure gaps. Foreign exchange, trade and investment liberalization have opened up economic opportunities and the space for investment beyond a small group of highly protected sectors. Increased public sector transparency and decentralization have started to gradually bring the state closer to the people.

12 We use per capita GDP at constant Kyat from World Development Indicators between 2005 and 2015. Using this series, GDP per capita grew 80.1 percent over this ten year period while poverty declined by 39.7 or 41.3 percent over the same period (GoM et al (2007) and World Bank (2014)). Growth is estimated using linear growth ratios.

Growth during this period has been comparable to other countries in the region and also to high performing countries following the start of economic liberalization. Myanmar's economy has grown at an average of 7 percent a year between 2010/11 and 2014/15 (World Bank, 2015a). Growth in the last five years compares favorably to other countries in the region (Figure 3.8), reflecting pent up demand and a rebound in economic activity supported by economic reforms. GDP in countries such as Korea, Vietnam, China and others grew between 6 and 10 percent when the process of opening up their economies first began (Figure 3.9).

Figure 3.8

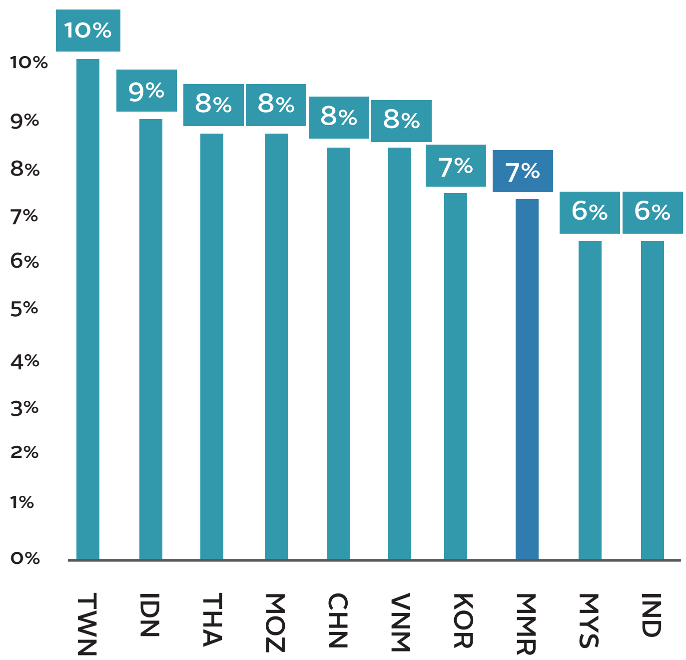
Real GDP growth 2011-2014 (%)



Source: World Bank (2015a). The growth estimates shown in this figure are slightly different from those of the Government of Myanmar, which use the government's fiscal year rather than calendar years. The government's fiscal year runs from April through March. The growth estimates from the Government of Myanmar are: 2011/12 5.6 percent; 2012/13 7.3 percent; 2013/14 8.4 percent; and 2014/15 8.0 percent for the provisional actual data.

Figure 3.9

Real GDP growth (average for 5 years after liberalization)



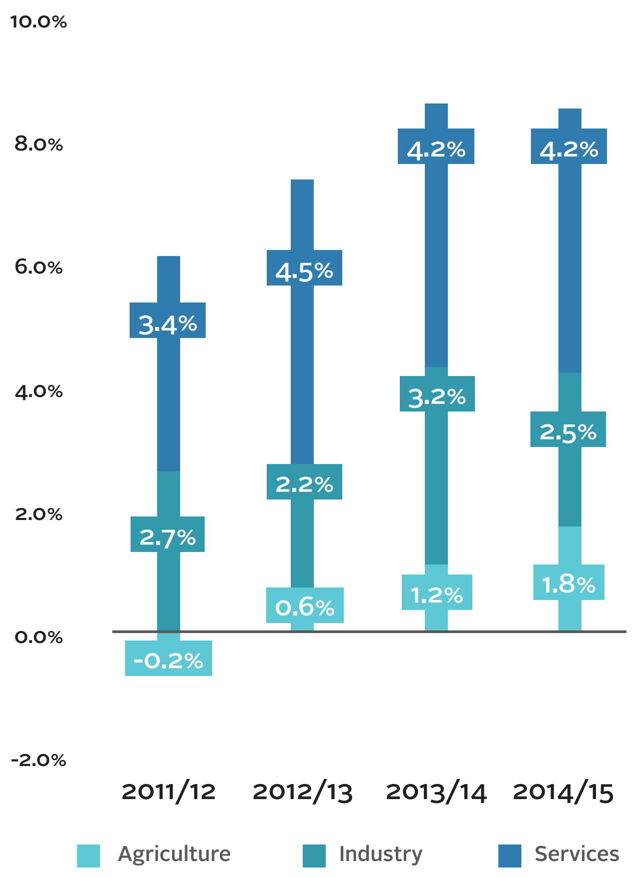
Source: World Bank (2015a).

The positive impact of ongoing reforms is reflected in the robust growth of the services sector but has yet to be fully felt in the agricultural sector, where the majority of the poor work. Services were the biggest contributor to annual growth between 2011/12 and 2014/15, contributing 3 percentage points in 2011/12 and over 4 percentage points in 2014/15 (Figure 3.10). An important driver of this contribution was telecommunications, which has expanded rapidly due to new investments and fast-growing consumption as a result of market liberalization (World Bank 2015a). The transportation sector further contributed a third of service sector growth over the same time horizon, a reflection of expanding internal and external trade. Manufacturing and construction sectors have also provided important contributions to growth. As a consequence of higher-than-average sector growth the share of GDP attributable to services increased between 2009/10 and 2014 from 37 percent to 41 percent while the share contributed by the manufacturing increased from 26 percent to 29 percent.

Growth in services—and to some extent manufacturing—is likely to have impacted the income-generating opportunities of the urban poor more than the rural poor. Growth in the construction sector and in manufacturing has been predominantly focused in urban and peri-urban areas that have better access to reliable electricity and transportation infrastructure. The strong growth seen in telecommunications is likely to have wide-ranging impacts on businesses and consumers through falling costs of telecommunications services, and due to increasing their accessibility and quality through investment in network infrastructure.

Figure 3.10

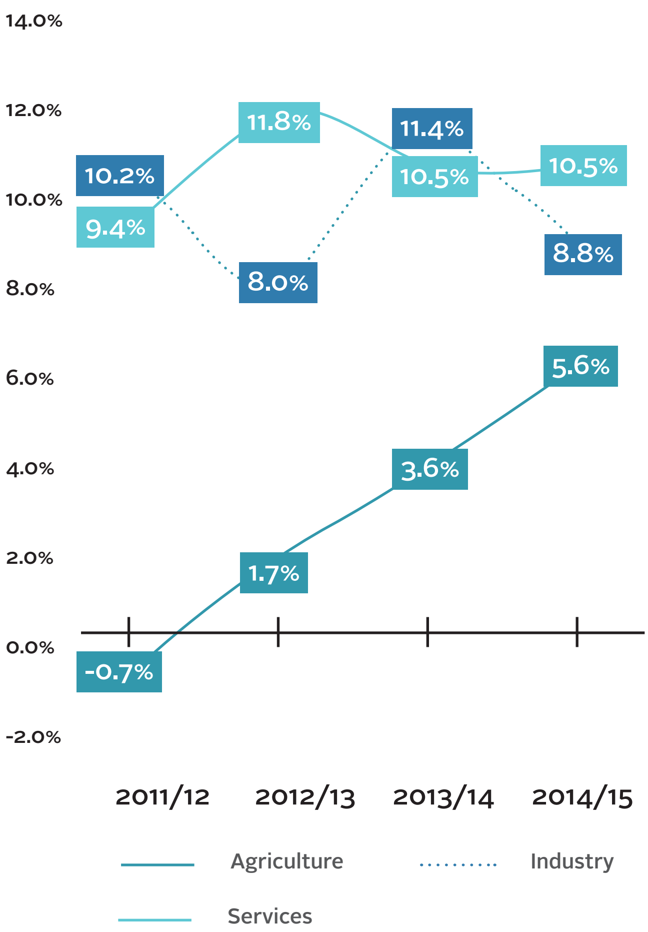
Sector contribution to real GDP growth (%)



Source: World Bank (2015a).

Figure 3.11

Sector growth rate (%)



Source: World Bank (2015a).

Although agricultural productivity has grown over the last five years, the potential of agriculture as a driver of rapid poverty reduction has yet to be fully unleashed. The agricultural sector has not grown at the same rate as the overall economy: agricultural growth stagnated at below 2 percent per annum in 2011/12 and 2012/13, before picking up in 2013/14 and 2014/15. This resulted in a decline in the sector's share in GDP, from 37 percent to 31 percent.[13] While this is to be expected during an economic transition in which the structure of the economy shifts from lower productivity agriculture to higher productivity manufacturing and service activities, agricultural potential in Myanmar remains below its potential. Around 54 percent of the country's sown areas is planted with paddy, but paddy yields in Myanmar remain among the lowest in the region, adversely affecting overall growth, farmer income and poverty reduction (World Bank, 2016). Well-managed irrigation schemes can yield around 4 tons per hectare in Myanmar, but most fields average around 2.5 tons per hectare. In contrast, the average per hectare yield in neighboring Thailand is 2.9 tons; in the Philippines, 3.7 tons; and in Vietnam, 5.6 tons.

Recommendation to update the welfare aggregate and poverty measures going forward

The joint assessment of poverty recommends that the Government of Myanmar consider revising and rebasing its poverty measure in order to better reflect the needs of the population in 2015. In most countries, poverty lines are revised from time to time to reflect the evolution of consensus regarding what constitutes poverty (Haughton and Khandkar, 2009; Ravallion, 2016). The definition of the basic minimum needs should evolve and be rebased in the face of growth in standards of living and changes within society. The objective of rebasing the poverty estimates is to align them to living conditions and needs in 2015.

Living conditions and the needs of the poor have indeed changed in three ways since poverty was first measured in 2004/05.

First, the share of food in a household's basket has declined while non-food items have become more diverse, raising the need to capture a greater diversity of non-food items. An increase in household expenditures over time influences both the share of food in the consumption basket as well as the type of food consumed. We indeed see evidence of improvements in living conditions reflected in the composition of expenditures: the share of food in the GoM et al (2007) aggregate was 69.4 percent in 2004/05 and 68 percent in 2009/10. In the bottom quintile, spending on food accounted for 74 percent of total expenditures in 2009/10. Using MPLCS data in 2015, we find that the share of spending going to food has further dropped to 62 percent on average and 67 percent among the bottom quintile. Among the bottom quintile, the share of spending on food is still higher as would be expected at 65 percent.[14]

14 These figures are estimated using the GoM et al (2007) methodology and the most comparable aggregate possible using the MPLCS data. They are estimated using democratic weights – i.e. they give the mean of the share, not the share of the mean.

Second, and related, the number and variety of goods has increased, particularly for household assets. The 2004/05 welfare aggregate excludes the welfare obtained from home assets, such as mobile phones and televisions. During this earlier time, ownership of these items was limited among all households and in particular among poorer households. The ownership and contribution to welfare of these goods has grown substantially over time. Our estimates suggest that these items have been more responsive to income growth than other components of the consumption aggregate.[15] Leaving these goods out of the consumption basket may result in a slower decline in measured poverty going forward.[16]

Third broad reforms have changed the spending patterns of households, as government resources to key services have increased allowing households to diversify the range of items they spend resources on. For example, between 2011/12 and 2013/14, the government quadrupled the budget on education (World Bank, 2015). The reforms are likely to allow households to diversify spending away from education.[17] Although out of pocket spending for education is still substantial, these change in policies are likely to reduce the burden of schooling for households, particularly among the poor. Reforms that affect the composition of household budget are also seen in other sectors, for example between 2009/10 and 2013/14, there was a nine-fold increase in Ministry of Health spending (World Bank, 2015). A revision of the poverty line to better reflect the non-food component of spending by households in current day Myanmar is needed.

Following acceptance of the recommendation to revise and rebase the national poverty measure, Part Two of the poverty assessment (forthcoming) will present a comprehensive poverty profile using a revised and rebased new poverty measure for Myanmar.

15 The elasticity of durables with respect to total expenditures is greater than 3.

16 Since these types of home assets tend to be owned in greater quantity and value by richer households, their omission is also typically associated with lower inequality figures.

17 The reforms include the elimination of primary and secondary school fees, the introduction of compulsory primary education, the hiring of more school teachers, the expansion of a stipend program to over 100,000 poor students and the provision of block grants to schools to support school needs.

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Technical Annexes

Technical Annexes

The Annexes provide greater technical detail on the poverty measures provided in the report. Annex A1 delves into the methodological differences between the two previous poverty measures produced in Myanmar. Annex A2 focuses on the construction of poverty trends over time; the main results as well as robustness checks are presented. Annex A3 presents the township coverage analysis in the household surveys (IHLCA I, II and MPLCS), Annex A4 compares questionnaires between IHLCA and MPLCS and, lastly, Annex A5 provides detailed explanations on how to construct comparable consumption aggregates over time for the imputation exercise.

Annex A1
Methodological Difference in Poverty Measurement in Myanmar

Poverty in Myanmar has previously been estimated using two different methodologies that were based on slightly different definitions of what it means to be poor, resulting in two estimates of poverty for 2009/10. Poverty was initially measured in Myanmar using consumption expenditures data collected from IHLCA-I in 2004/05. The Government of Myanmar and its development partners established a consumption aggregate to measure living standards, and s bsequently estimated a poverty line based on minimum needs in 2004/05. Using this benchmark and methodology, poverty was estimated to be 32.1 percent in 2004/05, subsequently dropping to 25.6 percent in 2009/10 (GOM et al, 2007 and GOM et al, 2011a). A poverty estimate based on 2009/10 standards of living was put forward by the World Bank in 2014. Using data from the IHLCA-II to construct a consumption basket and define minimum living standards, the World Bank estimated poverty to be 37.5 percent in 2009/10 (World Bank, 2014).

The two previous poverty estimates are based on the same data and the same time period. The estimates were however nested in slightly different definitions of what it means to be poor, resulting in differences in poverty rates. Due to the number of people in Myanmar living in difficult circumstances, small changes in definition can lead to large changes in poverty estimates. Poverty measurement requires some judgment calls and the differences in poverty estimates presented here reflect alternative decisions. A detailed discussion on the methodological differences between the GoM et al (2007) and World Bank (2014) approaches to poverty estimation is presented in Table A 1.1.

There are three key differences in methodology that can explain why one methodology estimated poverty in 2009/10 as being 25.6 percent, while the other estimated it to be 37.5 percent.

The first difference reflects the base year for anchoring the standard of living and definition of poverty. The GOM et al. (2007) methodology is based on a basket of goods consumed by the poor in 2004/05, while the World Bank methodology is based on a basket of goods consumed in 2009/10; the choice of base year by the World Bank was a reflection of using the most recent data available at the time of assessment.

The second difference between the GoM et al (2007) and World Bank (2014) methods reflects methodological choices, in particular how adult equivalence scales were applied. The most important difference between the poverty rates produced is the adjustment made to move from household to individual expenditures. Household surveys capture total consumption at the household level. Moving from household to individual welfare measures requires two steps: (i) choosing an equivalence parameter to represent the needs of different demographics in the population; and (ii) using normalization to adjust the poverty line after adjustment (Deaton and Zaidi, 2002; Ravallion 2015).

Using this two-step approach, differences in adult equivalence scales should not affect the level of poverty but should instead impact the profile. In the absence of normalization, however, estimated poverty declines with the application of an equivalence scale. (Ravallion, 2015). For example, using an equivalence scale that reduces the needs of children over those of adults, households with children are likely to be relatively better off than those consisting predominantly of adults. A primary difference between the methodologies presented above is that only the first step was applied in the previous estimates produced in GOM et al. (2007).

The final difference between the GoM et al (2007) and World Bank (2014) methods reflects the choice of food consumption parameters. The World Bank (2014) food basket was based on the total amount that the household reported consuming over a fixed reference period. The GoM et al (2007) food basket was based by adding up the total amount purchased, consumed from in-kind and consumed from own-production over a fixed reference period. The GoM et al (2007) measure could technically equal total consumption over a fixed period if (i) a household consumes entirely from own-production/in-kind; and/or (ii) a household consumed the total amount purchased during the reference period. However, this is unlikely to be the case on average since non-perishable items purchased in relatively large quantities such as rice and oil, are unlikely to be fully consumed. These items may also be consumed and not purchased, through drawing upon stores of previous purchases. Therefore we would expect some differences between the GoM et al (2007) measure of food consumption and household reported food consumption.

Table A 1.1

Methodological approaches to poverty estimation in Myanmar

Component	GoM et al (2007)	World Bank (2014)
Food expenditures		
Quantities consumed	Based on total purchased, consumed in-kind and from own production in the last 7/30 days.	Based on total consumed in last 7/30 days.
Prices	Unit values estimated at the household, missing valued imputed upwards.	Unit values estimated at the household, missing valued imputed upwards.
Items included/excluded	Excluded alcohol. Excluded "other" non-quantifiable items.	Included alcohol. Included "other" non-quantifiable items.
Non-food expenditures		
Health	Excluded. Health elasticity of expenditure = 0.993.	Included. Health elasticity of expenditure = 0.9.
Education	Included, tuition expenditures excluded.	Included all expenditures.
Durables	Excluded. Some depreciation rates estimated using IHLCA-I were found to be positive.	Included. Depreciation rates estimated in Vietnam in 2010 were applied.
Housing	Included. OLS-based estimation of housing rents.	Included. OLS-based estimation of housing rents.
Poverty Line estimation		
Approach	Cost of Basic Needs	Cost of Basic Needs
Prices used	Imputed	Non-Imputed
Calories	2340	2300
Adult Equivalence		
Equivalence Scale	**Food**: alpha=0.7 for 0-14 years, 0.9 for female adults **Non-food:** alpha=0.3 for 0-14 years	**Food and Non-food:** Alpha=0.5 for 0-6 years
Economies of scale	Theta= 0.9	Theta= 1 (no economies of scale)
Normalization	No	Yes
Spatial Price Deflation		
Prices used	Food	Food and non-food.
Approach	Paasche, household level	Ratio of poverty lines, zone and urban level

Annex A2 Overview of Methods Used to Construct Poverty Trends in Myanmar

A2.1 Methodological Issues

A central objective of this poverty measurement exercise is to examine the evolution of poverty between 2004/05, 2009/10 and 2015. To compare poverty estimates over time, two principle components are required: (i) a measure of welfare that is comparable between 2004/05, 2009/10 and 2015 and (ii) a threshold —the poverty line—that can be updated over time with an appropriate adjustment for changes in the price of living.

Measures of welfare are sensitive to the design of the questionnaire used. The design of the questionnaires used to capture living conditions in Myanmar has changed over time. It should be noted that, while these changes in design reflect updates in survey methodology, they come at the non-trivial cost of comparability. As such, any benefit from updating a questionnaire over time needs to be carefully considered against the cost of reduced comparability over time.

Estimates of poverty in 2004/05 draw upon measures of consumption that were captured through the IHLCA-I questionnaire, fielded in two phases in November-December 2004 and May 2005. Poverty estimates in 2009/10 use a broadly comparable questionnaire, the IHLCA-II. There were some design differences between IHLCA-I and IHLCA-II that may affect comparability of the consumption aggregates from these surveys, but the two surveys were broadly comparable. The IHLCA-II was enumerated in December 2009-January 2010 and May 2010. Estimates of poverty in 2015 draw upon the MPLCS questionnaire. The three questionnaires differed in small but tangible ways that are likely to have consequences for the measured consumption aggregate and for poverty estimation.

In this section, we describe key comparability issues between the MPLCS, IHLCA-I and IHLCA-II that are likely to affect the consumption aggregate and measured changes in poverty over time. We first examine questionnaire design, then turn to sampling and finally discuss the implications for poverty measurement. The imputation approach used to construct comparable poverty estimates cannot overcome differences in sampling, but is a valuable tool for dealing with differences in questionnaire design.

A2.1.1 Differences in questionnaire structure

Small changes to the design of food consumption questions have been demonstrated to have substantial impacts on the measurement of food consumption (see for example Beegle et al., 2012). A conclusion of the body work addressing this issue is that it is difficult to state whether or not poverty has changed over time if the underlying questionnaires have changed how they ask about consumption. Box A 1 outlines evidence on how questionnaire design changes can influence reported food consumption and measured poverty.

Although the MPLCS mirrors the basic structure of the IHLCA food and non-food modules, design differences were introduced to reflect updates in survey methodology. In addition, the number of items was slightly shortened to reduce the length of the module devoted to consumption. This section describes in greater detail the changes that were introduced between the surveys by walking through the questions that lead in to the consumption aggregate, component by component.

Food aggregate

The MPLCS questionnaire and field implementation deviated from the IHLCA in multiple small but potentially important ways, notably: (i) the consolidation of items; (ii) a shift in recall periods for consumed items; and (iii) a shift from fixed to open recall periods for purchased items.[18]

i. **Consolidation of food items.** The IHLCA-I item list included 186 food items, while the IHLCA-II list included 228 food items. The MPLCS item list consisted of 184 food items. Food items removed were those that were consumed by less than 2 percent of households and which, among those 2 percent of households, accounted for less than 5 percent of consumption. Table A 4.2 lists the items that were included in the IHLCA-II but excluded from the MPLCS aggregate. The share of total food accounted for by each item is shown. Taken together, these items represent a 0.647 percent share of calories in the total calories of the basket. The largest share of calories in the basket among the dropped items is sunflower oil, accounting for 0.14 percent of total calories. For comparison, rice represents approximately 59 percent of total calories.

ii. **Reduction in the recall period for 46 perishable items, from 30 days to 7 days.** A shorter recall period tends to increase measured consumption. Therefore, measured growth in daily consumption of these 46 items may be upward biased due to recall differences.

iii. **Shift from a fixed recall period to an open recall period for reporting purchase of items.** A benefit of this shift is that it captures more household-level prices. This change however resulted in a loss of directly comparable data since this question was a component of the food aggregate underlying the official poverty estimates from 2004/05 and 2009/10.

18 A detailed overview of changes in the food and non-food modules of the questionnaire can be found in the Annex A4.

The IHLCA-II questionnaire includes three questions that capture consumption in the household, and a question that captures purchases: (i) the quantity consumed in the last 7/30 days; (ii) the quantity and value of food items purchased in cash; (iii) the quantity acquired through barter, gifts and loans; and (iv) the quantity consumed from home production. The consumption aggregate behind the GOM et al. (2007) poverty statistics for 2004/05 (based on data from the IHLCA-I) consists of components (ii), (iii) and (iv). An assumption of including purchased values is that the household consumed the total value of these products during the recall period of 7 or 30 days. The MPLCS survey only included questions (i), (ii) and (iii). This change substantially affects comparability of any consumption aggregate produced directly with the survey consumption module of the MPLCS using the method of the GOM et al. (2010).

Non-food components of the aggregate

The changes to the non-food components can be summarized into three categories: (i) a change in recall periods; (ii) a change in the aggregation of items; and (iii) the inclusion of additional questions regarding durables.

i. **Change in recall periods for some non-food items.** The change in recall periods for items such as education and travel for trips was necessitated by the implementation design of the MPLCS. The IHLCA was conducted twice a year, with a six-month recall, allowing for a twelve-month recall to be captured in the two waves of interviews. Since the MPLCS was conducted in a short time horizon over the course of three months, the recall for these less frequently consumed, "lumpy" non-food items needed to be adjusted accordingly.

ii. **Change in aggregation.** The aggregation of non-food items reflects a similar exercise to that conducted for food items. Infrequently consumed non-food items that comprised less than 5 percent of the household's basket among consumers were excluded.

iii. **Additional questions.** In the household asset module, the most significant question added to the MPLCS addressed the amount paid for the asset at the time of purchase. The addition of this question allowed for the calculation of depreciation rates based on changes in the value of the asset over time.

Box A 1: Questionnaire Design and Comparability of Consumption Aggregate

The importance of consistency in questionnaire design to measuring and comparing consumption and poverty over time cannot be overemphasized. While there are a number of examples to be drawn from country experiences (see, for example, Deaton and Kozel (2005) for the case of changing recall periods in India), some researchers have been able to demonstrate that even seemingly small differences in parameters such as recall period and number of consumption items reported can severely impact measured outcomes.

To investigate the effects of changes in questionnaire design on consumption and poverty estimates, Beegle and others (2012) conducted a controlled experiment in Tanzania. The objective was to see how changes in parameters such as recall periods, disaggregation of consumption, and collection methods (diary versus recall) might affect outcomes. Out of the same population, eight random samples of 500 households were selected and information logged by individuals in a 14-day daily diary was established as the benchmark against which comparisons were made. The samples were determined to be very similar across a range of demographic and other characteristics.

The researchers found substantial variations in estimates when altering questionnaire parameters. Information collected from a questionnaire using 14-day recall resulted in a mean consumption level that was 16 percent lower than the benchmark level using daily diary data. A 7-day recall approach produced results only 4 percent lower than the benchmark, but when the list of reported consumption items was significantly shortened, this difference increased to 28 percent. Variations in estimates of consumption translate directly into discrepancies in poverty measures. Using data from alternative questionnaires with varying recall and consumption list design parameters produced poverty rate measures ranging from 55 to 68 percent, compared to 47.5 percent using the benchmark data.

Jolliffe (2001) looked at two similar population subsamples in El Salvador, administering questionnaires to each that varied in only one parameter. One sample was given a questionnaire with 75 food and 25 non-food items, while the other received a list of 18 food items and 6 non-food items. The shorter list sought information on items consumed at a categorical level (e.g., cheese) whereas the long list asked about consumption of various types of items (e.g., types of cheese). The result was that the measured poverty rate was 46 percent higher using the short list of items compared to the long list.

These and other examples demonstrate that changes to questionnaire design must be approached with caution as variations in parameters can render measured results incomparable over time.

Source: World Bank (2015)

A2.1.2 Sampling

The discussion on sampling focuses on two differences between both IHLCA rounds and the MPLCS: the sampling frame and township covered.

Differences in sampling are a concern for aggregate statistics, such as poverty, when the populations that are excluded from the frame (or that are more likely to be included) are systematically different from those that are included.

Sampling frame

A primary difference between the IHLCA and MPLCS surveys is the sample frame used. The sample frame is a complete listing of communities and households from which a sample can be drawn. The sample frame is thus a vital first step that defines the outline for the population being studied. An incomplete or inaccurate frame can give rise to non-sampling error, coverage or frame error. Census data are the main source of sampling frames and benchmark statistics for household surveys (United Nations Statistics Division 1986).

The sampling frame used in the IHLCA-I is described in substantial detail in the 2005 IHLCA Technical report (GOM et al., 2010). Since a recent census was not available in Myanmar at the time that the IHLCA-I had been conducted, the IHLCA-I, drew upon the most reliable population estimates available at that time. The IHLCA-II uses a modified sample design from the IHLCA-I. Notably, it retains a panel of 50 percent of households from the IHLCA-I. The panel component of the IHLCA-II allows it to directly assess the poverty and living standards dynamics of the same households over time, a considerable strength.

The sampling frame of the MPLCS is based on the 2014 Population and Housing Census of Myanmar, conducted by the Department of Population. The sample frame was based on preliminary results and maps from the Census, and included enumerated and non-enumerated populations living in conventional housing.

The population estimates emerging from the two surveys differ. Table A 2.1 shows the population and housing counts from the three surveys and from the 2014 Population and Housing Census. The MPLCS closely matches the household and population counts of the Census.[19] The divergence between the population coverage from IHLCA and the Census emerges from three sources: (i) demographic change between the conduct of the IHLCA-II in 2009/10 and the Census in 2014; (ii) differences between the population estimate used as the sampling frame and the Census; and (iii) the omission of townships (discussed in the next section). The divergence between the population estimates and distribution from the 2014 Census and the earlier Department of Population estimates may affect the comparability of the IHLCA and MPLCS surveys.

Township coverage

The omission of enumeration areas (EAs) due to concerns about security in field implementation is an issue that has been faced in multiple contexts. This omission can positively or negatively affect national- and state/region-level estimates if the areas that are not covered are systematically different from those that are included.

Due to concerns about security and transportation, 45 townships were not included in the IHLCA-I and IHLCA-II sample frames. In addition, wards and village tracts for which no household or population figures were available were dropped. At the time of enumeration, the estimated population that was not covered was 343,130 households, or approximately 1,787,708 individuals (GOM et al., 2010).

Changes in the security and conflict situation by 2015 allowed the MPLCS to be conducted in townships that had been considered inaccessible during the field

19 Small differences between the populations are likely attributable to differences in the definition of household in the MPLCS and the Census and due to a focus on conventional households. For this reason, the alignment of households is likely to be closer than the alignment of population.

Table A 2.1

Population and household counts from IHLCA-I and -II, Census, and MPLCS

Survey	Date	Population	Households
IHLCA-I	November – December 2004, May-2005	38,816,180	7,455,076
IHLCA-II	December 2009 – January 2010, May-2010	41,231,764	8,227,043
Census	Apr – 2014	49,136,352	10,877,832
MPLCS	January – April 2015	49,217,592	10,860,617

Notes:

a. Household and population counts for the IHLCA-I, IHLCA-II and MPLCS are based on the summation of final household and individual weights in the respective datasets.

b. The Census population counts are based on the final results from the Population and Housing Census published in 2015. The population count reflects the population living in conventional households, 47.9 million, and also includes the non-enumerated populations, 1.2m. It does not include the 2.3m individuals living in institutional households.

c. The Census household counts are based on the final results from the Population and Housing Census published in April 2015. The household count reflects conventional households, and does not include institutional households.

enumeration of the IHLCA-I and -II. As such, all townships in Myanmar were included in the master sample frame of the MPLCS. Exclusions were however conducted at an EA level. In particular, since national household surveys do not cover institutional populations, 2,077 special EAs related to institutions were excluded from the sampling frame, including four EAs related to monasteries and one EA that covered the Myanmar diplomatic persons living outside the country. In addition, non-enumerated EAs in Kayin (with a population of 69,753) and Kachin (with a population of 46,600) were excluded.

The Population and Housing Census allows us to assess how changes to the sample may affect comparisons of socio-economic characteristics between the MPLCS and IHLCA surveys. We do this in two ways. First, we examine the townships that were excluded from the IHLCA surveys to ascertain whether their measured socio-economic characteristics are systematically different from the Union and State or Region average. Second, we examine time-invariant population characteristics between the surveys and population to assess how changes in the sample may affect aggregate reported characteristics. A comprehensive assessment of the townships included in the MPLCS, but inaccessible from the IHLCA surveys, can be found in Annex A3.

A2.1.3 Implications of sample changes for comparison of IHLCA and MPLCS

The use of a different sample frame and township coverage in the IHLCA is likely to affect comparisons across the IHLCA and MPLCS.

The imputation approach employed in this assessment cannot restore sample comparability. An assessment of the sampling differences however suggests that the decline in poverty between 2004/05, 2009/10 and 2015 would likely have been more pronounced, since the areas covered in the IHLCA were somewhat better off than those that were unable to be covered at the time. The poverty estimates presented in this analysis therefore should be interpreted as covering the population of Myanmar that, due to lack of conflict, were accessible at the time of the IHLCA surveys.

A2.1.4 Implications of the comparability assessment for poverty measurement

The comparison of the IHLCA and MPLCS surveys suggests that the substantial differences between the two surveys will affect the comparability of poverty estimates produced over time. This assessment however does not invalidate the findings of either survey. For poverty measurement and the construction of consumption aggregates, such small but important changes in survey design are likely to preserve the ranking of individuals across the consumption distribution.

Box A 2: Use of Imputation Methods in Poverty Analysis

In the context of poverty analyses, imputation methods have found numerous applications to address data gaps and statistical inference problems across space and time. An early and notable example of the use of imputation methods to restore comparability in the face of incomparable surveys comes from India in the early 2000s. Changes in questionnaire design, among other factors, led to a lively debate on the extent and direction of change in poverty during the 1990s. Imputation methods suggested that the official estimates may have signaled a greater decrease in poverty than would have been implied had the consumption aggregates been fully comparable (Deaton and Dreze, 2002; Kijima and Lanjouw, 2003).

A number of studies have verified the use of imputation methods by comparing predicted poverty estimates directly with observed levels in contexts where data comparability is not a concern. Christiaensen et al. (2012) draw upon data from Vietnam and China during a period of rapid structural changes and marked poverty reduction. They use these challenging periods of reform to examine the conditions under which imputation-based models produce accurate and robust estimates of poverty reduction. Even in these demanding conditions, they find that they are able to predict consumption and estimated poverty well using a fairly parsimonious set of predictors. In a similar vein, Yoshida (2014) uses household data from two comparable survey rounds in Sri Lanka. He uses two methodologies for imputation—one based on Elbers, Lanjouw and Lanjouw (2003) and the other based on Rubin (1987)—to produce results comparable to those derived from the household survey.

The issues in comparability necessitate the use of statistical methods that have been developed to restore comparability in such circumstances. It should be noted that these methods are not first-best options for ensuring comparability; but are applied in the context of incomparable surveys. These methods are discussed in the next section.

A2.2 Introduction to Imputation Methods[20]

A lack of comparability of surveys is not unique to Myanmar. There is a vibrant research literature around survey methodology, resulting in continuous improvements in data collection approaches. It is therefore natural and encouraged for surveys to evolve over time, to take on board the lessons from the literature. Changes to surveys are also warranted as a country develops. For example, products that were previously unavailable or unattainable may play a greater role in purchasing patterns (e.g., infant formula and fortified products). Imputation models can be used in poverty estimation to support a restoration of comparability if there are sufficient comparable correlates of consumption expenditures in the survey rounds.

Imputation refers to the replacement of missing values with "plausible" values based on estimation methods and models. Imputation methods have a long history in statistics and economics and have been used to address a variety of missing data problems, see for example, Rubin (1976, 1987). Imputation has established itself as a particularly valuable tool in the field of poverty analysis (Box A 2). While originally conceived to fill data gaps within surveys, these methods have been extended to cross-survey imputation, where one survey is used to fill data gaps of another survey belonging to the same population. A review of these methodologies by Ridder and Moffit (2007) shows how widespread these applications have become also how they can be adapted to respond to different types of missing data problems situations of incomparability, such as that faced in Myanmar.

A more technical introduction to imputation methods is given in Annex A5.

A2.2.1 Application of imputation methods

We follow the following steps in the application of the imputation method:

Step 1: Identify Overlapping Variables. We identify household characteristics that are comparably defined across the IHLCA-I, IHLCA-II and MPLCS surveys.

Step 2: Model Estimation and Selection. We estimate a model of household consumption based on household characteristics in 2009/10 and 2004/05.

Step 3: Imputation and Validation. Once we are satisfied with the model, we estimate poverty and mean welfare using a multiple imputation technique.

20 This section and its annexes draws heavily upon a background paper by Badiani-Magnuson, Lanjouw, Prydz and van der Weile produced as part of the joint poverty assessment. The paper contains further technical detail on the analysis that is presented.

Step 1: Identify Overlapping Variables

To use imputation methods, we need correlates of consumption that are measured in a comparable manner. By implication, if the questions from the two surveys had been fielded at the same moment in time they would produce the same summary statistics. To identify correlates of consumption that are comparable across time, we reviewed the three household surveys and their survey manuals to ensure that the questions were both asked and fielded in a similar manner. Where code structures did not entirely overlap across surveys, we constructed variables that were as comparable as possible. Finally, we examined the survey statistics of the variables and, where necessary, compared the variables against the 2014 Population and Housing Census to assess whether the trends seen over time were reasonable.

The imputation approach has the best chance of identifying changes in poverty over time if these changes can be linked to changes in the observed independent variables (such as changes in housing conditions, asset ownership, and employment). Changes that are driven by exogenous shocks are not well captured by the observed data. We are therefore careful to exclude variables whose expansion is linked to rapid or substantial changes in market or availability, rather than linked to improvements in household economic circumstances. For example, ownership of mobile phones in Myanmar grew from 4 percent in 2009/10 to 33 percent in 2014 and 55 percent in 2015. The expansion of mobile phone ownership is reflective of substantial changes in SIM card prices, market deregulation and reform. We therefore do not include this variable in the analysis.

Table A 5.1 presents the variables that were included as potential correlates of consumption. The variables can be separated into the following categories: (i) household assets; (ii) housing; (iii) household demographics; (iv) employment; and (v) education. At the time the analysis was conducted, we were able to compare some variables within the first three categories to those reported in the Population and Housing Census.

Step 2: Model Estimation and Selection

The following modeling strategy is adopted to build our models. The two main models discussed below are presented in Table A 5.3.

First, we group the independent variables into sub-groups: demographics (household size, age composition, gender of the head of household), spoken language (by the head of household), education (of the head as well as other household members), employment (labor force status and sector of employment for the head of household), dwelling unit characteristics (roof, walls, flooring, access to electricity and safe drinking water, and use of cooking fuel), and asset ownership (rice cooker, refrigerator, fan, washing machine, stove, television, car, motorcycle, bicycle, etc.). Each of these groups of independent variables is regressed on (log) per adult equivalent household expenditure (with the urban dummy variable always included), which gives us a first idea of how the different types of variables rank as predictors of household expenditure. The dwelling unit characteristics and asset ownership variables rank as the strongest predictors, followed by demographics.

Next, we combine the groups of independent variables. Variables that cease to be significant are dropped from the model. All categories of variables are found to make an important contribution. Controlling for dwelling, asset and demographic variables, the education and employment variables significantly add to the goodness-of-fit of the model. Once variables from all groups are represented, we explore whether or not any further improvements in the goodness-of-fit can be obtained by including interactions with the urban dummy to account for urban-rural heterogeneities. Throughout the procedure, we assess for potential multi-collinearities and counter-intuitive regression coefficients. All regressions are weighted using survey weights for individuals. The result of this procedure is "Model 1".

Model 1 is estimated both to the 2004/05 and 2009/10 data, as well as to a pooled dataset combining the two aggregates, deflated to 2009/10 values. Our imputation-based estimates of poverty for 2015 will arguably be most precise when the model estimated to 2009/10 data (or 2004/05 data, or pooled data) carries over to 2015, i.e., when the model exhibits a reasonable degree of stability over time. With this in mind, we also look out for (economically significant) changes in regression coefficients between 2004/05 and 2009/10 estimates of Model 1. By trimming variables that fail this "model stability test" we obtain a second, significantly reduced model, "Model 2".

Our preferred model for imputation is Model 1 as it is the most stable across the surveys and poverty estimation methods. Nevertheless, it is important to account for the possibility that the rapid expansion in the availability of various household assets in Myanmar in recent years could reduce the stability in the relationship between asset ownership and overall welfare. We therefore also present results for Model 2, which relies on only a few asset variables that demonstrate stable coefficients between 2004/5 and 2009/10, notably owning a refrigerator, television and motorcycle.

Overall, the model coefficients are broadly consistent with expectations of how household characteristics vary with household welfare: (1) per adult equivalent consumption decreases with household size; (2) returns to education for the household head are positive; (3) agricultural and casual work is associated with lower consumption; (4) more advanced dwelling characteristics are associated with higher consumption; and (5) asset ownership is strongly positively correlated with consumption.

Step 3: Imputation and Validation

Once we are satisfied with the model, we estimate poverty using the multiple imputation technique described in A2.2.1.

For imputing trends in the GoM et al (2007) poverty estimates between 2009/10 and 2015, we have the choice of estimating our model using the 2004/05 survey, the 2009/10 survey or the two surveys pooled into one welfare aggregate. Because we are mainly interested in understanding the most recent trends (from 2009/10 to 2015) in poverty estimates with both GoM et al (2007) and World Bank (2014) method, our main results use models estimated using the 2009/10 aggregates and use these models to impute poverty for 2015 and 2004/05.

Imputations of missing consumption data from one survey to another typically assume that the estimated relationship between consumption and its predictors is stable over time—an assumption that cannot usually be tested directly. Although the list of food expenditure items expanded between 2004/05 and 2009/10, all other components of the expenditure modules of the IHLCA-I and IHLCA-II questionnaire are unchanged over time. We therefore assess the stability of the sign of coefficient estimates over time and constrain our covariates to only include those that display a high degree of stability across different model specifications. We identify the model with the highest predictive power and with the greatest stability of coefficients across time. The model is tested by imputing consumption forward (into 2009/10, on a model based in 2004/05) and backward (into 2004/05, using a model based in 2009/10). Forward and backward imputation allows us to validate the model to ensure that the estimates are robust to the choice of base year and model specification.

We are able to conduct these tests for the consumption aggregate from GoM et al (2007). We are unable to conduct this test using the consumption aggregate described in World Bank (2014). The World Bank (2014) aggregate is constructed using consumption in the last 7 and 30 days as the main food consumption indicator. As this question was asked in IHLCA-II but not in IHLCA-I, it is not possible to produce a comparable consumption aggregate using the World Bank (2014) methodology in IHLCA-I. We are thus unable to test assumptions one and two for the World Bank (2014) aggregate. In the next section we put forward three tests of assumptions one and two.

A2.2.2 Validation and robustness checks

We have conducted three validation and robustness checks that test the precision of the proposed methodology and models: (i) an indirect test of assumption one; (ii) a direct test of assumption one; and (iii) relaxing the time-invariant model assumption. The tests are conducted on the GoM et al (2007) aggregates for 2004/05 and 2009/10, so that imputed estimates can readily be assessed against official estimates based on survey data. [21]

First, in an indirect test of assumption one, we test the estimates from the imputation method against observed estimates from the surveys. The official poverty estimates from these surveys based on the GoM et al (2007) method show that poverty was reduced from 32.1 percent in 2004/05 to 25.6 percent in 2009/10. The imputed point estimates show trends in the same direction, although generally with a slightly slower pace, particularly for Model 2. The imputed estimates, however, are within the 95%-confidence intervals of official survey estimates, reassuring us that the model performs satisfactorily both in- and out-of-sample.

This validation exercise also helps us decide which of the three aggregates to use for imputing trends in the GoM et al (2007) poverty estimates between 2009/10 and 2015. Because of the better performance of the estimates

21 Further detail on these tests can be found in the background paper by Badiani-Magnuson, Lanjouw, Prydz and van der Weile. The paper contains further technical detail on the analysis that is presented.

imputed with the 2009/10 aggregate, and the fact that we are mainly interested in understanding the most recent trends in poverty estimates with both GoM et al (2007) and World Bank (2014) methods, we choose to present as our main results those based on the 2009/10 aggregate.

Second, to directly asses the validity of the assumption that the model is stable over time, we examine the stability of the sign and magnitude of coefficient in our models across the surveys. In the process of selecting the model where we exclude coefficients that demonstrate instability, we implicitly ensure that assumption one is satisfied. While the magnitudes of the coefficients vary, it is clear they are fairly stable across the surveys for most, although not all models.

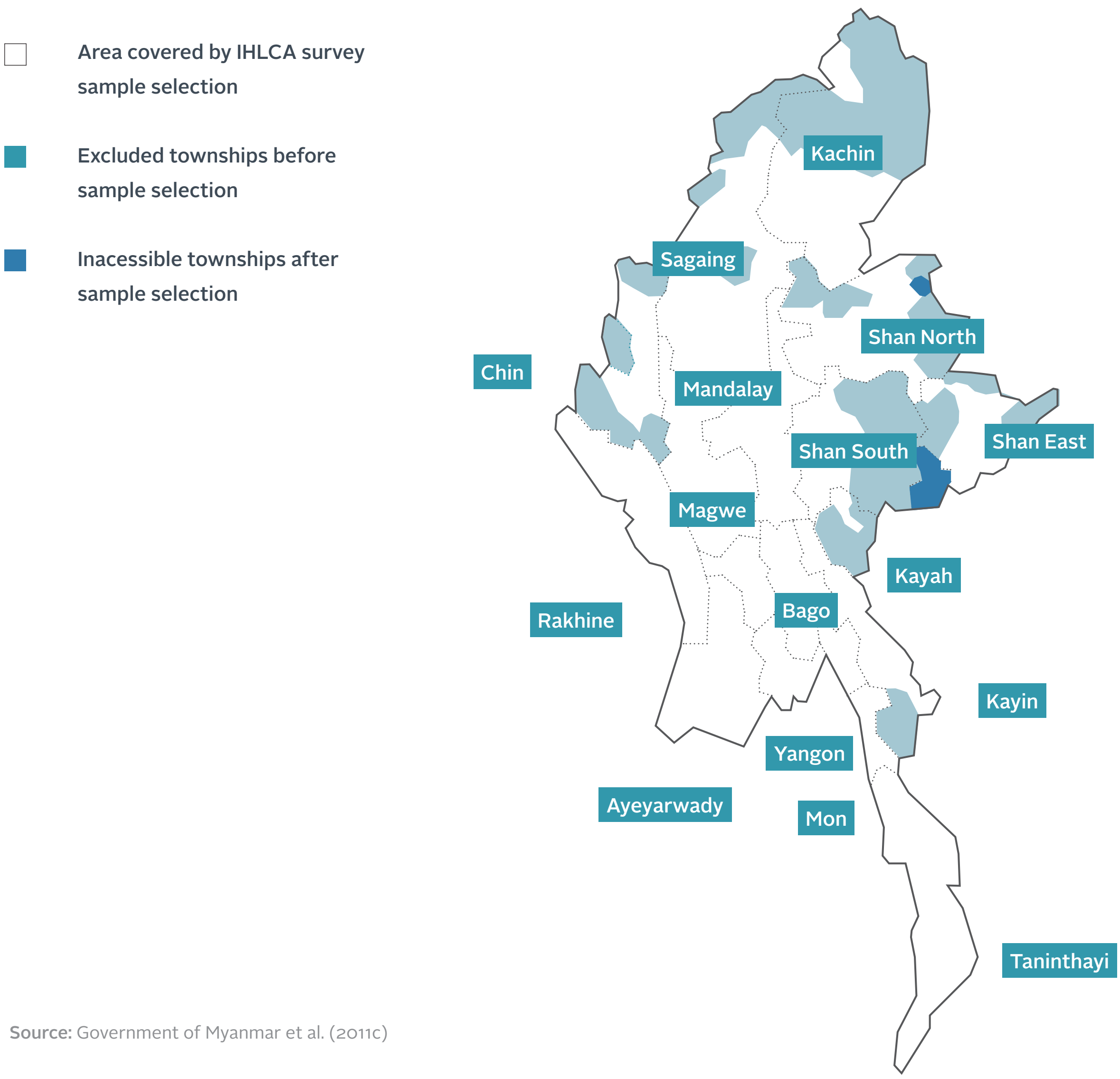
Third, we conduct a robustness check that relaxes the assumption of time-invariant coefficients. All imputation-based poverty estimates thus far have been obtained under the assumption that the model that describes household consumption expenditure is stable over time, such that a model estimated to data from 2009/10 can be applied to obtain estimates of poverty in 2015. We can relax this assumption by explicitly modeling selected regression coefficients as linear functions of time. The linearity of the time-trend is imposed by the fact that we only have two rounds of data on which to fit the model (2004/05 and 2009/10). When more rounds of data become available, more flexible functional forms for the time-varying regression coefficients could in principle be considered. For further details on this approach we refer the interested reader to Nguyen and van der Weide (2016) who put forward this approach and test it using a large set of countries.

Annex A3
Township Coverage and Implications for Poverty Estimation

Due to concerns about security and transportation, 45 townships were excluded from the IHLCA-I and IHLCA-II sample frames. The excluded and inaccessible areas can be seen in Figure A 3.1. In addition, wards and village tracts for which no household or population figures were available were dropped. At the time of enumeration, the estimated population that was excluded was 343,130 households, or approximately 1,787,708 individuals (GOM et al., 2010).

Figure A 3.1

Map of the excluded and inaccessible areas in the IHLCA-I and IHLCA-II



Source: Government of Myanmar et al. (2011c)

The 2014 Myanmar Population and Housing Census was enumerated in the townships that were excluded in the IHCLA sample. This dataset allows us to make some simple comparisons of townships that were excluded from the IHCLA sample and those that were included. The Census collected rich data on the characteristics of households. Many variables, such as age, sex ratios, household size, asset ownership and dwelling characteristics are strongly correlated with the overall material wellbeing of households. For example, areas where most people use electricity for lighting are likely better off than areas which mainly rely on candle light or kerosene as the predominant source of lighting. Principal component analysis of the Census data confirms such general relationships.

Comparison of Included and Inaccessible Townships

Comparisons of townships that were included and inaccessible from the IHLCA sample can help to assess whether the areas omitted were systematically different than those that were included, and thus provide some indication of the direction and magnitude of the bias caused by township coverage. It also provides an opportunity to verify the share of the population excluded from IHLCA sample.

Table A 3.1 compares the key characteristics of townships that were included in the IHLCA with those of townships were omitted. For simplicity, the characteristics of the townships are grouped with those that are associated with the township being relatively better or worse off. A measure of overall welfare is also summarized in a single index, produced with principal component analysis across all the characteristics displayed. Table A 5.3further breaks down the comparison state by state. All measures are weighted by the township population size. It is clear that across nearly all variables assessed and across all states/regions with excluded townships, characteristics associated with being "better off" (electricity access, asset ownership, etc.) are higher in areas included in the IHLCA sample frame than in those left out of the sample frame. This would suggest that the townships excluded were likely worse off, and, as such, poverty estimates may be higher if all townships could be included in the sample. It is however not possible to give a precise estimate of the magnitude of this effect. The overall populations in omitted townships suggest that the share of population omitted from the sample frame is 4.8 percent, similar to the estimate provided in the IHCLA-I technical documentation (GOM et al., 2010).

Table A 3.1

Census summary statistics for townships included and inaccessible in the IHCLA sample frame

Variable	Included	Inaccessible	Difference
Number of townships	285	45	
Population total	47,885,192	2,394,708	
Welfare index	0.35	-2.00	-2.34
Characteristics associated with being better off			
Literate	0.91	0.54	-0.37
Advanced housing	0.18	0.16	-0.01
Advanced toilet	0.76	0.47	-0.29
Advanced roof	0.64	0.67	0.02
Advanced Walls	0.38	0.49	0.10
Advanced Floor	0.16	0.14	-0.02
Lighting (electricity)	0.34	0.22	-0.12
Drinking water (purified)	0.11	0.04	-0.07
Advanced Cooking stove	0.17	0.05	-0.12
TV	0.51	0.40	-0.11
Phone	0.05	0.04	-0.01
Mobile phone	0.34	0.25	-0.09
Computer	0.04	0.02	-0.02
Internet	0.07	0.02	-0.05
Motor vehicle	0.42	0.54	0.12
Characteristics associated with being worse off			
No education	0.15	0.56	0.41
Primary education or no education	0.61	0.81	0.20
Any disability	0.05	0.05	0.00
Housing simple	0.41	0.41	0.01
Toilet simple	0.24	0.50	0.27
Roof simple	0.34	0.32	-0.03
Wall simple	0.51	0.49	-0.02
Flooring simple	0.32	0.43	0.11
Lighting (candle)	0.20	0.26	0.06
Cooking (simple)	0.67	0.87	0.19

Note: Weighted by population size. See Table A 3.3 for details by states/regions with inaccessible townships.

Examination of Overlapping Time Invariant Characteristics

An analysis of overlapping and time-invariant characteristics demonstrates how changes in sample design may affect poverty rates. We conduct an analysis of completed education using a birth cohort analysis. In Table A 3.2, we focus on individuals born between 1975 and 1989; further cohorts and disaggregation are displayed in Table A 3.4.

These individuals were: (i) 25 to 39 years old at the time of enumeration in the Census in 2014; (ii) 26 to 40 years old at the time of enumeration in the MPLCS; and (iii) 20 to 34 years old at the time of the enumeration of the IHLCA-II.

The profile of adult education in the MPLCS closely matches the profile of education for the same population from the Census. A deviation however can be seen at the lower end of the education distribution: the MPLCS has a slightly greater share of individuals with no education. This can be seen most starkly in the Coastal region, and may be attributable to the inclusion of non-enumerated populations in this area.

The profile of the adult population in the IHLCA diverges from the Census in a stable manner across the three birth cohorts. In all three cohorts, the sample appears to be more educated (with more high school-educated people) than portrayed in the Census and the MPLCS. The higher share of individuals educated at a high school level and above can be seen across all agro-ecological zones for all birth cohorts.

This analysis supports the conclusion of the township coverage analysis, notably that the sample frame changes will likely affect poverty comparisons.

Table A 3.2

Education by birth cohort, comparison across IHLCA, MPLCS and 2014 Census

Completed Education/ Birth Year	1975-1979			1980-1984			1985-89		
	IHLCA	Census	MPLCS	IHLCA	Census	MPLCS	IHLCA	Census	MPLCS
No Education	0.07	0.12	0.14	0.07	0.11	0.14	0.05	0.1	0.13
Primary (Grades 1-5)	0.41	0.46	0.46	0.34	0.43	0.42	0.3	0.38	0.33
Middle (Grades 6 to 9)	0.22	0.21	0.18	0.22	0.21	0.19	0.21	0.21	0.22
High (Grades 10 to 11) and above	0.3	0.21	0.22	0.37	0.25	0.26	0.43	0.31	0.32

Table A 3.3

Census summary statistics for townships included and excluded in IHCLA sample frame

Table shows weighted mean of national and state/region aggregates, and the differences in these values for excluded townships.

	National/Total		Chin		Kachin		Kayah		Kayin		Sagaing		Shan	
		(Diff)		(Diff)		(Diff)		(Diff)		(Diff)		(Diff)		(Diff)
	Incl.	Excl.	Incl.	Excl.	Incl.	Excl.	Incl.	Excl.	Incl.	Excl.	Incl.	Excl.	Incl.	Excl.
Number of Townships	286	44	5	4	10	8	1	6	6	1	33	4	34	21
Population total (thousands)	47,885	2,394	302	268	2,139	292	128	303	1,689	255	6,489	320	6,224	1,658
Welfare index	0.35	-2.34	-0.03	-3.36	0.75	-2.97	3.38	-3.87	-0.35	-1.16	-0.89	-3.69	0.66	-2.29
Positive characteristics														
Literate	0.91	-0.37	0.83	-0.08	0.93	-0.12	0.86	-0.07	0.75	-0.07	0.95	-0.30	0.71	-0.30
Advanced housing	0.18	-0.01	0.06	-0.04	0.16	-0.09	0.34	-0.14	0.16	-0.00	0.12	-0.08	0.35	-0.14
Advanced toilet	0.76	-0.29	0.91	-0.38	0.87	-0.23	0.95	-0.12	0.71	-0.14	0.74	-0.58	0.69	-0.25
Advanced roof	0.64	0.02	0.85	-0.30	0.75	-0.30	0.85	-0.05	0.66	-0.12	0.61	-0.25	0.84	-0.09
Advanced walls	0.38	0.10	0.83	-0.41	0.35	-0.03	0.73	-0.10	0.68	-0.09	0.33	-0.11	0.49	0.03
Advanced Floor	0.16	-0.02	0.02	-0.01	0.16	-0.09	0.28	-0.14	0.09	0.01	0.10	-0.08	0.31	-0.12
Electric lighting	0.34	-0.12	0.18	-0.06	0.30	-0.11	0.68	-0.35	0.29	-0.15	0.25	-0.18	0.36	-0.09
Purified drinking water	0.11	-0.07	0.00	0.00	0.10	-0.08	0.17	-0.16	0.11	0.02	0.03	-0.02	0.13	-0.09
Advanced cooking stove	0.17	-0.12	0.01	-0.01	0.05	-0.04	0.39	-0.31	0.11	-0.09	0.09	-0.08	0.17	-0.09
TV	0.51	-0.11	0.34	-0.17	0.63	-0.23	0.69	-0.26	0.48	-0.08	0.43	-0.17	0.57	-0.13
Phone	0.05	-0.01	0.07	-0.05	0.07	-0.03	0.06	-0.03	0.04	-0.02	0.04	-0.03	0.05	-0.00
Mobile phone	0.34	-0.09	0.25	-0.20	0.40	-0.19	0.48	-0.37	0.26	-0.07	0.22	-0.16	0.35	-0.02
Computer	0.04	-0.02	0.03	-0.02	0.04	-0.02	0.06	-0.04	0.03	-0.01	0.02	-0.01	0.03	-0.01
Internet	0.07	-0.05	0.02	-0.02	0.05	-0.02	0.08	-0.07	0.02	-0.01	0.03	-0.03	0.04	-0.02
Motor vehicle	0.42	0.12	0.39	-0.23	0.77	-0.27	0.73	-0.18	0.45	0.03	0.58	-0.28	0.69	-0.04
Negative characteristics														
No education	0.15	0.41	0.22	0.09	0.12	0.15	0.18	0.09	0.31	0.06	0.11	0.34	0.38	0.33
Primary education or no education	0.61	0.20	0.58	0.09	0.51	0.07	0.50	0.14	0.70	0.05	0.66	0.17	0.70	0.16
Any disability	0.05	0.00	0.09	-0.02	0.04	0.01	0.06	-0.00	0.07	0.00	0.04	0.00	0.04	0.01
Simple housing	0.41	0.01	0.12	0.38	0.42	0.14	0.24	0.09	0.19	0.05	0.42	0.11	0.42	-0.01
Simple toilet	0.24	0.27	0.08	0.38	0.13	0.22	0.05	0.12	0.28	0.14	0.26	0.55	0.30	0.22
Simple roof	0.34	-0.03	0.11	0.31	0.24	0.24	0.15	0.03	0.34	0.11	0.36	0.27	0.15	0.09
Simple wall	0.51	-0.02	0.16	0.41	0.64	0.04	0.26	0.09	0.21	0.06	0.65	0.12	0.50	-0.03
Simple flooring	0.32	0.11	0.06	0.39	0.28	0.23	0.06	0.21	0.15	0.04	0.36	0.12	0.40	0.06
Candle lighting	0.20	0.06	0.24	0.11	0.29	0.15	0.15	0.10	0.45	0.00	0.16	0.12	0.16	0.04
Simple cooking	0.67	0.19	0.92	0.05	0.68	0.25	0.57	0.31	0.65	-0.12	0.81	0.16	0.74	0.15

Table A 3.4

Education, by birth cohort and agro-ecological zone

Birth Cohort	No Education			Primary			Middle			High			Above		
	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS
1990-94	0.08	0.04	0.08	0.32	0.25	0.3	0.26	0.33	0.27	0.18	0.35	0.21	0.16	0.02	0.15
1985-89	0.1	0.05	0.13	0.38	0.3	0.33	0.21	0.21	0.22	0.15	0.28	0.17	0.16	0.15	0.15
1980-84	0.11	0.07	0.14	0.43	0.34	0.42	0.21	0.22	0.19	0.12	0.2	0.14	0.13	0.17	0.12
1975-79	0.12	0.07	0.14	0.46	0.41	0.46	0.21	0.22	0.18	0.1	0.16	0.11	0.11	0.14	0.11
1970-74	0.14	0.08	0.16	0.46	0.43	0.46	0.22	0.25	0.19	0.09	0.13	0.1	0.09	0.11	0.09

No Education

Birth Cohort	Hills			Dry			Delta			Coastal			Yangon		
	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS
1990-94	0.2	0.05	0.15	0.04	0.02	0.05	0.05	0.01	0.02	0.08	0.13	0.14	0.03	0.02	0.01
1985-89	0.24	0.07	0.24	0.05	0.02	0.11	0.07	0.01	0.06	0.11	0.16	0.22	0.03	0.01	0.03
1980-84	0.27	0.1	0.27	0.06	0.03	0.09	0.08	0.02	0.1	0.11	0.18	0.19	0.04	0.02	0.03
1975-79	0.3	0.11	0.26	0.08	0.04	0.13	0.09	0.03	0.08	0.12	0.16	0.18	0.04	0.01	0.02
1970-74	0.33	0.14	0.31	0.09	0.05	0.17	0.09	0.03	0.13	0.12	0.19	0.21	0.05	0.02	0.02

Primary

Birth Cohort	Hills			Dry			Delta			Coastal			Yangon		
	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS
1990-94	0.41	0.34	0.4	0.37	0.31	0.31	0.41	0.34	0.4	0.37	0.31	0.31	0.22	0.09	0.18
1985-89	0.48	0.39	0.46	0.42	0.33	0.33	0.48	0.39	0.46	0.42	0.33	0.33	0.28	0.14	0.17
1980-84	0.52	0.41	0.49	0.46	0.34	0.45	0.52	0.41	0.49	0.46	0.34	0.45	0.33	0.15	0.3
1975-79	0.56	0.52	0.58	0.52	0.38	0.46	0.56	0.52	0.58	0.52	0.38	0.46	0.32	0.2	0.29
1970-74	0.54	0.51	0.55	0.52	0.44	0.47	0.54	0.51	0.55	0.52	0.44	0.47	0.34	0.23	0.33

Table A 3.4

Education, by birth cohort and agro-ecological zone (contd)

Middle

Birth Cohort	Hills			Dry			Delta			Coastal			Yangon		
	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS
1990-94	0.25	0.36	0.27	0.27	0.37	0.31	0.25	0.33	0.3	0.28	0.31	0.28	0.23	0.27	0.19
1985-89	0.21	0.25	0.16	0.2	0.23	0.2	0.2	0.21	0.22	0.23	0.21	0.22	0.22	0.14	0.27
1980-84	0.19	0.24	0.11	0.19	0.22	0.19	0.2	0.25	0.2	0.21	0.23	0.16	0.24	0.18	0.23
1975-79	0.17	0.21	0.1	0.19	0.22	0.22	0.19	0.21	0.2	0.2	0.21	0.21	0.28	0.25	0.24
1970-74	0.18	0.26	0.16	0.21	0.23	0.17	0.22	0.26	0.19	0.23	0.24	0.18	0.26	0.25	0.26

High and Above

Birth Cohort	Hills			Dry			Delta			Coastal			Yangon		
	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS	Census	IHLCA	MPLCS
1990-94	0.28	0.34	0.3	0.34	0.36	0.33	0.29	0.32	0.28	0.28	0.24	0.26	0.52	0.62	0.62
1985-89	0.25	0.39	0.23	0.31	0.42	0.29	0.25	0.38	0.26	0.25	0.32	0.23	0.47	0.72	0.54
1980-84	0.2	0.31	0.2	0.24	0.34	0.22	0.2	0.32	0.2	0.21	0.25	0.21	0.39	0.65	0.44
1975-79	0.17	0.24	0.18	0.19	0.27	0.15	0.16	0.23	0.14	0.16	0.25	0.16	0.35	0.53	0.46
1970-74	0.13	0.19	0.09	0.17	0.2	0.18	0.14	0.19	0.13	0.13	0.13	0.15	0.35	0.51	0.39

Annex A4
Differences Between IHLCA and MPLCS questionnaires

Table A 4.1

Differences between the IHLCA and MPLCS food modules

No.	Issue/ Approach	IHLCA	MPLCS	Anticipated implication
1	Recall	7 days for 149 items (IHLCA-I) 7 days for 182 items. (IHLCA-II) 30 days for 37 items (IHLCA-I) 30 days for 46 items (IHLCA-II). Non-perishable items such as rice, oil, flour.	7 days for all items	A shorter recall period tends to increase measured consumption. Therefore, measured growth in daily consumption of the 46 items that had a 30-day recall period in the IHLCA-II may be upward biased due to recall differences.
2	Number of Items	186 (IHLCA-I) and 228 (IHLCA-II)	184	The items that were removed were consumed by fewer than 2% of households and, within those households, accounted for less than 5% of consumption. Households could still respond to consuming these items using the "other" category. Examining these items in the IHLCA, the removal of these items from the consumption aggregate makes no impact on measured poverty.
3	Recall of items and disaggregation	**7 days Recall (IHLCA-II)** 16 items (Pulses, beans, nuts and seeds) 11 items (Meat, dairy, eggs) 37 items (Fish and other seafood) 11 items (Roots and tubers) 31 items (Vegetables) 21 items (Fruit) 14 items (Spices and condiments) 12 items (Other food products) 5 items (Alcoholic beverages) 24 items (Food and beverages taken outside home) **30 days Recall** 13 items (Rice and cereals) 10 items (Oil and fats) 5 items (Milk Products) 18 items (Other Food Items)	**7 days Recall** 9 items (Rice and cereals) 14 items (Pulses, beans, nuts, and seeds) 9 items (Roots and tubers) 15 items (Meat, dairy, eggs) 40 items (Fish and other seafood) 27 items (Vegetables) 18 items (Fruits) 7 items (Oil and fats) 14 items (Spices and condiments) 27 items (Other food products) 4 items (Alcoholic beverages) Separate module for food away from home	Having a shorter recall would normally increase reported daily consumption. However, greater aggregation can reduce measured expenditures. Unclear what the implications of this are for poverty measurement.

No.	Issue/ Approach	IHLCA	MPLCS	Anticipated implication
4	Unit Measurement of Food Items	Pre-coded units with conversion from non-standardized units in the field into standardized units. Non-standardized units were measured in the household by enumerators. Conversion to standardized units was conducted by enumerators	Open units for responses, with conversion from non-standardized to standardized units in the field. Non-standardized units were measured by supervisors at the local market, and the conversion table was estimated while conducting the community questionnaire. Conversion was conducted by supervisors.	Unclear what the implications of this are for poverty measurement. Accurate conversion from non-standardized units to standardized units is vital for appropriate measurement of quantities.
5	Question Structure for consumed, own-production and gifts/in-kind	1. During the last 7 days, what was the quantity of [ITEM] consumed? During the last 7/30 days: 2. What was the quantity of [ITEM] received in kind? 3. What was the quantity of [ITEM] that your household consumed from home production?	During the last 7 days: 1. What was the quantity of [ITEM] consumed in the last 7 days? 2. How much came from own production? 3. How much came from gifts and other sources? (not from purchase)	These questions are comparable in the way they are asked.
6	Question Structure for purchased items	During the last 7/30 days: What was the quantity of [ITEM] bought in cash? How much did members of your household spend in cash?	When was the last time you or other members of your household purchased [ITEM]? (1) Past Day (2) Past Week (3) Past 30 days (4) More than 30 days ago (5) Never What was the quantity and what did you spend?	The IHLCA question on purchased items was used for two sources of information: as a component of the food aggregate and to provide unit level prices. The MPLCS question was intended to capture prices through purchased consumption – and to allow for flexibility in the time horizon for these purchases. The flexible time structure allows for more prices at a household level to be collected than the fixed structure of the IHLCA question. It cannot however be used in a comparable way to measure purchases over the same time horizon as the IHLCA, unless the recall period matches up.
7	Consumption Away from Home	24 food and beverage items that were purchased, own-produced, or consumed as a gift/in-kind with 7 days recall	Monetary value (purchased and in-kind) of food consumed away from home for breakfast, lunch, dinner and other (including snacks, drinks) with 7 days recall	This change in survey design may reduce the reported food consumed away from home.

Table A 4.2

Food items included in IHLCA but excluded from MPLCS

Item number	Description	Food share as a fraction of World Bank (2014) basket
q53006	Maize seeds (dry) Ticals	0.000305106
q53007	Flour Rice Ticals	7.32537E-05
q53008	Flour Wheat Ticals	3.66428E-05
q53009	Other cereals	0
q53011	Sorghum Pyi	1.8873E-05
q53012	Millet Pyi	0.000187124
q53013	Wheat Pyi	0.000118338
q51003	Pepyinq	0.000406041
q51008	Black gram (Matpe)	0.000222679
q51013	Cashew nuts	5.43656E-05
q51215	Ngashwe	0.000141457
q51426	Sub	0
q51428	Fresh pepper/ sweet pepper	8.77561E-06
q51429	Cat tongue	0
q51430	Kha We	9.49857E-05
q51431	Citrics	1.92268E-05
q51307	Arrow root	4.74845E-05
q51310	Palawpenan	0.000224436
q51303	Yams	7.14106E-05
q51506	Rambutan (Kyetmouk)	3.70527E-05
q51509	Custard Apple	6.61326E-06
q51510	Mangosteens	9.9039E-05
q51513	Pear	8.07312E-06
q51517	Sunkist	3.08564E-05
q51518	Jackfruit	1.86898E-05
q51519	Strawberry	5.71244E-07
q51612	Cloves	0
q51613	Mustard seeds	1.16508E-05
q51712	Bean curd (brown)	3.31624E-05
q53105	Sunflower oil	0.001403484
q53106	Ghee	2.13105E-07

Item number	Description	Food share as a fraction of World Bank (2014) basket
q53108	Pork fat	0.000243356
q53109	Rice bran oil	0
q53110	Margarine	0
q53202	Milk powder	0.000106781
q53204	Domestic condensed milk Ticals	1.26747E-05
q53205	Formula milk for infants Tin/Pkt	0.000155155
q53302	Coffee (grinded or beans) Ticals	1.19507E-06
q53313	Non-dairy creamer Packet	0.001058696
q53318	Potato chips Packet	0.001213632

Table A 4.3

Comparison of Non-Food Items in the IHLCA and MPLCS

No.	Issue/ Approach	IHLCA	MPLCS
1	**Recall**	30 days for 50 items (IHLCA-I and -II) 6 months for 49 items (IHLCA-I) 6 months for 52 items (IHLCA-II)	30 days for 40 items 6 months for 12 items 12 months for 17 items
2	**Disaggregation of Items**	**30 Days Recall (IHLCA-II)** 10 items (Energy for household use) 2 items (Water) 8 items (Personal Apparel) 4 items (Medicines/drugs (Including traditional medicine)) 8 items (Local transport (daily travel excluding that for health and education)) 18 items (other non-food items) **6 Months Recall (over 2 rounds, capturing an overall 12 month period)** 9 items (Clothing and other apparel) 7 items (Home equipment) 7 items (House rent and repair) 11 items (Health, including traditional medicine) 9 items (Education, including pre-school and adult education) 5 items (Travel/trips (Overnight travel excluding health and education) 4 items (Other)	**30 Days Recall** 9 items (Energy for household use) 3 items (Water) 8 items(Personal apparel-cosmetics) 3 items (Medicines/drugs, including traditional medicine, not including medicines counted in Section 3b, Q15) 6 items ((Local transport (daily travel excluding that for health and education)) 11 items (Other non-food items) **6 Months Recall** 7 items (Clothing and apparel) 5 items (Home equipment) **12 Months Recall** 6 items (House repairs and expenses) 3 items of Travel/trips (overnight travel excluding for health and education) 8 items (Other expenses)
3	**Question Structure**	Purchased; Own-Produced; Gift/In-Kind	Purchased; Own-Produced; Gift/In-Kind

Annex A5

Building Comparable Poverty Estimates Over Time, Technical Details

A5.1 Theory: imputation methods

We adopt a standard imputation approach that is commonly used in the case of missing data.[22] When a variable of interest is missing altogether in a given data set, one can still proceed with imputing this variable provided that a second data set representative of the same population is available that does contain the variable of interest. This second data set is needed to identify a prediction model that can be used to generate the imputed values in the primary data set. A prerequisite is that the two data sets share a set of covariates that are sufficiently correlated with the missing variable.

We use the following standard linear regression model for log of household expenditure per capita: where x denotes a vector of independent variables (e.g., variables on demographics, education, employment, housing conditions, asset ownership) including the constant, u denotes a vector of independent errors with zero expectation, and the subscripts i and t indicate household i and time t. The superscript 'T' indicates matrix transpose.

$$\ln(y_{ti}) = x_{ti}^{T} \beta_t + u_{ti}$$

We have three data sets collected at different times: the IHLCA-I (2004/2005), IHLCA-II (2009/10) and the MPLCS (2015) survey data. All three surveys contain the regressors of interest x, but only some surveys contain the consumption aggregates of interest:

i. The IHLCA-I and IHLCA-II contain the consumption aggregate corresponding to the GOM et al. (2007) method.

ii. The IHLCA-II contains the information needed to construct the consumption aggregate using the World Bank (2014) method. The World Bank (2014) method cannot be applied to the IHLCA-I survey due to key variables being missing in the IHLCA-I.

The objective of the imputation exercise is to use the above model, estimated using the IHLCA-I, IHLCA-II and MPLCS data to impute household expenditure backwards and forwards. We then use the imputed expenditure data to derive comparable poverty estimates.

22 This section draws heavily on Douidich et al. (2015).

This approach relies on two principal assumptions that are tested with the data available.

Assumption one: The model is time-invariant, meaning that $\beta_t = \beta$.

The expenditures model is estimated using one time period (for example, using 2009/10 data) and then adopted for imputation in another time period (for example, imputed into 2004/05 or 2015). Under assumption one, this disconnect should have no impact on the results since the model underlying the data used for estimation and the model underlying the data used for imputation are the same. If the assumption does not hold and the model is in fact subject to variation over time, then ignoring this variation will introduce model error.

This model can be tested with access to more than one household survey with comparable consumption aggregates. Since we have two broadly comparable rounds of IHLCA data in 2004/05 and 2009/10, we are able to test this assumption in multiple ways, discussed in greater depth below.

Assumption two: The error term u is homoscedastic and normally distributed.

This assumption can be relaxed by allowing for non-normality in a number of ways. For example, one could draw the errors from the empirical distribution of residuals (as in Filmer and Pritchett, 2001, and Elbers et al. 2003), or one could fit a mixture distribution of errors (as in Elbers and van der Weide, 2014). Heteroscedasticity could also be accommodated in a number of ways, such as working with a random coefficient model or modeling the error variances more directly (Elbers et al., 2003).

We start off with a model that is based on assumptions one and two, then assess to what extent the data supports these assumptions. If the imputation-based estimates are consistent with the survey direct estimates for the available years, then one could make a case for not adding further flexibility to the model. If the imputation-based estimates are however not consistent, assumptions must be revisited sequentially in order to identify the source of the discrepancy. Incorrectly assuming normality of the error terms can, for example, introduce bias when estimating poverty or inequality (Elbers and van der Weide, 2014). In our case, a model based on assumptions one and two fits the data well as empirical results will show.

Conducting the imputation

We describe here the approach used to apply imputation methods to obtain poverty estimates in more detail. Define $W(y,m;z)$ as a welfare indicator that can be expressed as a function of all household expenditures y, household size m and some poverty line z. Our objective is to estimate the expected value of this welfare indicator, $E[W]$ given the sample of households. If we observe expenditures for the households in the sample, then the standard estimator for $E[W]$ would be the sample direct estimator. For headcount poverty, this direct estimate would take the form:

$$\widehat{H}_t = \sum_i w_{it}\, m_{it}\, 1(y_{it} < z_t) / \sum_i w_{it}\, m_{it}$$

Where 1(.) denotes the standard indicator function that equals *1* if the argument is true, and *0* otherwise, and where w denotes the household sampling weights. Other sampling design parameters will feature in the estimation of statistical precision, notably sampling error. We denote the estimate of the sampling variance by $U_n^{(0)}$ which declines with the sample size n.

We now examine the case where we do not see expenditures; in this case we will be working with imputed expenditure data instead. In this case, sampling error is no longer the sole source of error. The imputation-based estimator will also be subject to modelling error. Imputing the expenditure data multiple times for the sample of households is a practical way of taking into account this source of error. In each imputation round, we draw a new set of model parameters and household errors from their estimated distributions and use these to impute expenditure. If we repeat this R times, we obtain R simulated data sets, and consequently R estimates of the headcount poverty rate. The imputation-based estimator takes on the following form:

$$\widetilde{H}_t^{(r)} = \sum_i w_{it}\, m_{it} 1(\widetilde{y}_{it}^{(r)} < z_t) / \sum_i w_{it}\, m_{it}$$

Where $\widetilde{y}^{(r)}$ denotes the simulated expenditures from imputation round r. We denote the estimated sampling variance associated with $\widetilde{H}_t^{(r)}$. An estimate of the total variance (or standard error), which accounts for both sampling error and model error, can be obtained by appealing to the law for total variance:

$$var[\widetilde{H}_t^{(r)}] = E[var[\widetilde{H}_t^{(r)} | \widetilde{y}^{(r)}]] + var[E[\widetilde{H}_t^{(r)} \mid \widetilde{y}^{(r)}]]$$

$$\cong \frac{1}{R} \sum_{\mathrm{r}} U_n^{(r)} + \frac{1}{R} \sum_{\mathrm{r}} (\widetilde{H}_n^{(r)} - \breve{H}_t)$$

The first component in this variance decomposition captures the sampling variance while the second component captures the contribution to the variance due to model or imputation error.

We conducted our empirical application of the imputation methods using Stata's MI package. A more detailed treatment of the multiple imputation (MI) approach can be found in Rubin (1987).

A5.2 Data underlying Survey-to-Survey imputation

Table A 5.1

List of considered variables

	2004/05	2009/10	2015
Household Assets			
Rice Cooker	0.09	0.15	0.28
Generator	0.07	0.09	0.09
Fan	0.10	0.12	0.20
Refrigerator	0.05	0.08	0.15
Air Conditioner	0.01	0.01	0.03
Washing Machine	0.01	0.02	0.04
Radio	0.10	0.24	0.24
Television	0.24	0.38	0.52
DVD	0.12	0.32	0.47
Satellite	0.03	0.04	0.11
Computer	0.01	0.01	0.03
Stove	0.24	0.24	0.29
Bike	0.44	0.42	0.37
Motorcycle	0.10	0.23	0.45
Boat	0.07	0.05	0.04
Car	0.02	0.02	0.04
Housing			
Thatch roof	0.56	0.47	0.32
Tin roof	0.42	0.51	0.66
Thatch/bamboo walls	0.61	0.54	0.57
Wooden walls	0.24	0.30	0.26
Concrete walls	0.14	0.16	0.18
Bamboo flooring	0.31	0.26	0.25
Wood flooring	0.57	0.62	0.56
Concrete flooring	0.12	0.12	0.19
Electric lighting	0.21	0.27	0.34
Firewood as cooking fuel	0.92	0.93	0.81

	2004/05	2009/10	2015
Household Demographics			
Household size	6.20	5.97	5.49
Age of head	50.95	53.40	51.16
Female head	0.16	0.17	0.18
Share of elderly	0.09	0.10	0.11
Share female	0.52	0.52	0.53
Employment			
Share of workers in wage work	0.34	0.43	0.41
Share of permanent wage workers	0.17	0.17	0.20
Share of casual wage workers	0.16	0.19	0.20
Share of those above 15 who are working	0.46	0.49	0.45
Share of heads working	0.73	0.69	0.70
Share of heads working for a wage	0.22	0.27	0.29
Share of heads working for a casual wage	0.11	0.13	0.14
Child labor indicator	0.05	0.06	0.06
Non-Farm business indicator	0.38	0.33	0.44
Number of those above 15 in agriculture	1.56	1.54	1.03
Number of those above 15 in industry	0.27	0.30	0.37
Number of those above 15 in services	0.86	0.97	0.83
Number of those above 15 not working	1.76	1.54	1.66
Education			
Head education level	2.79	3.18	2.83
Share above 15 less than primary	0.43	0.30	0.42
Share above 15 with primary or less	0.63	0.54	0.61
Share above 15 with middle or less	0.82	0.76	0.81
Share above 15 with high or above	0.18	0.24	0.19
Share above 15 with above high	0.06	0.08	0.07

Table A 5.2

Comparison of education across surveys

Education of household head						
	Percent at level			Cumulative		
	IHLCA-I 2004/05	IHLCA-II 2009/10	MPLCS 2015	IHLCA-I 2004/05	IHLCA-II 2009/10	MPLCS 2015
No Education or Only Monastic	30.5	15.9	27.1	30.5	15.9	27.1
Less than Primary	19.1	23.5	21.1	49.7	39.4	48.1
Primary (Grade 5)	19.1	26.2	20.9	68.8	65.6	69.0
Less than Middle	14.6	15.0	14.3	83.4	80.6	83.4
Middle (Grade 9)	4.1	5.2	4.0	87.5	85.8	87.4
Less than High	5.9	7.0	5.8	93.4	92.8	93.3
High (Grade 11)	3.0	3.6	2.5	96.4	96.4	95.8
Above High	3.6	3.6	4.2	100.0	100.0	100.0

Education of household members aged 15 and above						
	Percent at level			Cumulative		
	IHLCA-I 2004/05	IHLCA-II 2009/10	MPLCS 2015	IHLCA-I 2004/05	IHLCA-II 2009/10	MPLCS 2015
No Education or Only Monastic	21.4	9.8	20.3	21.4	9.8	20.3
Less than Primary	21.8	20.6	22.1	43.2	30.4	42.4
Primary (Grade 5)	19.7	23.8	18.7	62.9	54.2	61.2
Less than Middle	14.9	16.0	15.0	77.8	70.2	76.2
Middle (Grade 9)	4.7	6.1	5.2	82.5	76.3	81.4
High (Grade 10 or 11)	11.6	16.2	11.3	94.1	92.4	92.7
Above High	5.9	7.6	7.3	100.0	100.0	100.0

A5.3 Models Used in Survey-to-Survey Imputation

Table A 5.3

Consumption models using GoM et al (2007) aggregate, 2009/10 data

	Model 1 β / se	Model 2 β / se	Model 3 β / se
Urban (dummy variable)	-0.020 (0.03)		
Household Demographics			
Household size == 1	0.556*** (0.02)	0.601*** (0.02)	0.606*** (0.02)
Household size == 2	0.348*** (0.01)	0.371*** (0.01)	0.373*** (0.01)
Household size == 3	0.280*** (0.01)	0.301*** (0.01)	0.300*** (0.01)
Household size == 4	0.202*** (0.01)	0.219*** (0.01)	0.221*** (0.01)
Household size == 5	0.136*** (0.01)	0.150*** (0.01)	0.151*** (0.01)
Household size == 6	0.100*** (0.01)	0.108*** (0.01)	0.108*** (0.00)
Household size == 7	0.062*** (0.01)	0.066*** (0.01)	0.066*** (0.01)
Education			
Education (head): Above high school	0.032* (0.02)	0.060*** (0.02)	0.053*** (0.02)
Employment			
Head working	0.059*** (0.01)	0.056*** (0.01)	0.055*** (0.01)
Workers in casual employment (yes/no)	-0.038*** (0.01)	-0.054*** (0.01)	-0.052*** (0.01)
Head in agriculture	0.081*** (0.01)	0.062*** (0.01)	0.059*** (0.01)
Workers in agriculture (number)	-0.009*** (0.00)		
Workers in industry (number)	-0.030*** (0.00)		

	Model 1 β / se	Model 2 β / se	Model 3 β / se
Spoken Language			
Shan	-0.164*** (0.01)	-0.177*** (0.01)	-0.181*** (0.01)
Other, Local	-0.068*** (0.01)	-0.070*** (0.01)	-0.069*** (0.01)
Other, Foreign	-0.027 (0.01)	-0.022 (0.01)	-0.018*** (0.01)
Housing			
Tin Roofing	0.047*** (0.01)	0.049*** (0.01)	0.049*** (0.01)
Concrete Walls	0.048*** (0.01)	0.054*** (0.01)	0.049*** (0.01)
Wood Flooring	0.064*** (0.01)	0.066*** (0.01)	0.065*** (0.01)
Concrete Flooring	0.046** (0.01)	0.064*** (0.01)	0.065*** (0.01)
Electric lighting	0.008 (0.01)		
Firewood as cooking fuel	-0.009 (0.01)	-0.021 (0.01)	-0.026*** (0.01)
Household Assets			
Rice cooker	0.017 (0.01)		
Fan	0.041** (0.01)		
Refrigerator	0.121*** (0.02)	0.191*** (0.02)	0.170*** (0.02)
Television	0.083*** (0.01)	0.111*** (0.01)	0.107*** (0.01)
DVD	0.015 (0.01)		
Stove	0.042*** (0.01)		
Car	0.212*** (0.02)		
Radio	0.048*** (0.01)		0.045*** (0.01)
Motorcycle	0.083*** (0.01)	0.095*** (0.01)	0.084*** (0.01)
Interactive Variables			
Urban # Household size == 1	0.097 (0.05)		
Urban # Household size == 2	0.158*** (0.03)	0.143*** (0.03)	0.146*** (0.02)

	Model 1 β / se	Model 2 β / se	Model 3 β / se
Urban # Household size == 3	0.065*** (0.02)	0.048** (0.02)	0.054*** (0.02)
Urban # Household size == 4	0.068*** (0.02)	0.055*** (0.01)	0.057*** (0.01)
Urban # Household size == 5	0.030 (0.02)	0.021 (0.02)	0.021* (0.01)
Urban # Head in agriculture	-0.081*** (0.02)		
Urban # Workers in industry (no)	0.006 (0.01)		
Urban # Concrete Walls	0.119*** (0.02)	0.146*** (0.02)	0.144*** (0.01)
Urban # Wood Flooring	-0.013 (0.02)		
Urban # Concrete Flooring	0.012 (0.03)		
Urban # Electric lighting	0.003 (0.02)		
Urban # Firewood as cooking fuel	-0.002 (0.02)		
Time Trend Interactions			
Radio with time trend			-0.000 (.)
Satellite			0.097*** (0.02)
Satellite with time trend			-0.000 (.)
Constant	12.724*** (0.02)	12.726*** (0.02)	12.724*** (0.02)
R2	0.429	0.408	0.414

* p < 0.05, ** p < 0.01, *** p < 0.001

Model 1 and 2 estimated on 2009/10 IHLCA-II aggregate. Model 3 is estimated on pooled data of IHLCA-I and IHLCA-II, expressed in real terms by deflating aggregates by poverty line.

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