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Poverty is multidimensional: But do we really need a multidimensional poverty index?

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Poverty is Multidimensional: But Do We Really Need a Multidimensional Poverty Index?

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Poverty is Multidimensional:
But Do We Really Need a Multidimensional Poverty Index?

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Abstract

The Philippines, just like many other developing countries, has measured poverty using one-dimensional monetary-based indicators, although poverty is multidimensional in nature. Various work on generating a multidimensional poverty index (MPI) has been undertaken using data from several countries, including that done by the United Nations Development Programme with the Oxford Poverty and Human Development Initiative. Several studies have also used national data for generating an MPI. The measurement of multidimensional poverty in the Philippines should depend on a careful investigation on whether there is much value added in producing a composite index of poverty. Just because poverty is multi-dimensional need not mean that its measurement should be. This study examines discusses various issues regarding the production of a MPI, from the choice of the underlying indicators for the index, the weights assigned to the indicators, as well as the aggregation process. It also reviews measurements on quality of life (happiness and well-being), on poverty and welfare (including multidimensional poverty) and on sustainable development. It examines various possibilities of an MPI for the Philippines based on several waves of household surveys (viz., the National Demographic and Health Survey, the Annual Poverty Indicator Survey, and the Family Income and Expenditure Survey) and several approaches on choices of indicators and weights. This paper also looks at the robustness of trends in the resulting MPI approaches, and some policy issues attendant to the measurement of multidimensional poverty, especially on its relationship with traditional income poverty measurement.

Keywords: multidimensional poverty; composite index; indicators; weights; aggregation

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Poverty is multidimensional:
But do we really need a multidimensional poverty index?

Jose Ramon G. Albert and Jana Flor V. Vizmanos*

1. Introduction

Economic growth is an important aspect of socio-economic development. Traditionally, the the health of an economy is measured as the percent rate of increase in real Gross Domestic Product (GDP), which, in turn, represents the value of a country's aggregate output (goods or services produced). When GDP is divided by total population, the resulting measure, called GDP per capita, represents the potential income of each person in the population if the aggregate income is equally shared. Neither GDP nor GDP per capita, however, provides a sense of how resources and wealth are allocated across a society. Despite such limitations, the usefulness of GDP as a measure of economic performance cannot be discounted as socio-economic development is intertwined with economic performance. Economic growth enhances a country's potential for reducing poverty and solving other social and environmental problems. The notion of development, especially sustainable development, is, however, much wider than that of economic growth (CGD, 2008; Soubbotina, 2004). Development comprises both the need and the means by which to provide better lives for people; development entails both economic growth as well as progress in overall quality of life — say, in terms of health, nutrition, education. Sustainable development is development that successfully balances economic goals with social and environmental ones. While some developing countries over the past half century have achieved high economic growth rates, narrowing the gap significantly between themselves and the prosperous countries, but many more developing countries are not catching up. Further, across the pages of history, we can find various examples of countries where economic growth was not necessarily followed by progress in development of the quality of life for the vast majority, where growth was achieved but at a cost of either greater inequality, higher unemployment, overconsumption of natural resources, loss of cultural identity, or a combination. Thus, we also need other measures to describe quality of life, progress and sustainable development, other than GDP or GDP per capita.

Many developing countries, including the Philippines, have been measuring and monitoring welfare (and poverty) in their respective societies, based on single money-metric terms, either from consumption or income data (UNSD, 2005). In recent years, the National Economic and Development Authority (NEDA) as well as the Philippine Statistics Authority (PSA) have made public pronouncements[1] that government is making steps to adopt a multidimensional measure of poverty, owing to the recognition of poverty as having dimensions beyond income poverty. Furthermore, consistent with the Filipino aspirations highlighted in AmBisyon Natin

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[1] http://www.neda.gov.ph/2015/11/03/ph-reiterates-a-multidimensional-perspective-in-poverty-reduction/ ; http://www.neda.gov.ph/2018/10/04/neda-wants-better-measurement-of-poverty/ ; https://www.unescap.org/sites/default/files/Session6.2.1_Philippines_Role_in_Developing_Indicator_Framework_and_SDG_Monitoring.pdf ; https://businessmirror.com.ph/psa-digs-deep-into-child-poverty-incidence-data/

2040 (NEDA 2015), the NEDA is also working toward the development of a Quality of Life Index (QLI) through the collection of data in a pilot survey[2].

This study aims to examine how much value added is there in producing such a measure of multidimensional poverty, and what would this entail. In the next section, we firstly review some measures of development beyond GDP, as well as describe the current measurement of welfare and poverty in the country. In the third section, we get into the mechanics of constructing a composite index for describing the multidimensional aspects of poverty. In the fourth section, we provide and discuss empirical findings of various approaches to generating a multidimensional poverty index (MPI) using waves of several household surveys of the PSA, viz., the FIES, the National Demographic and Health Survey (NDHS), and the Annual Poverty Indicator Survey (APIS). We end in the last section with a summary of learning lessons from this study.

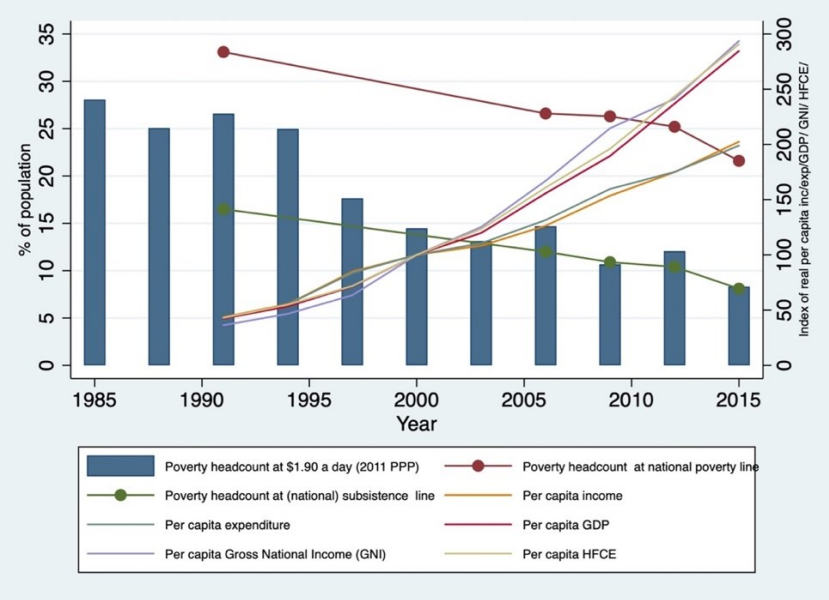
2. Measurements Beyond GDP

In 1990, the United Nations Development Programme (UNDP) released its first Human Development Report (UNDP, 1990). From then up to 2015, the world has made amazing advances in income growth (yielding an average annual GDP growth of 3.5 percent). Further, the world has reduced the proportion of persons with incomes less than $1.25 a day in 2005 purchasing power parity prices from 47 percent in 1990 to 14 percent in 2015; it has also improved the health, education, and living conditions of people across the world (UN, 2015a). Despite these gains, progress across and within countries has been uneven.

Economic growth, while important for poverty reduction, is not sufficient, as growth is not equivalent to sustainable development, to improvements in well-being, and to inclusive opportunities for social mobility. For instance, the Philippines has undergone a different economic growth trajectory in the past decade, but this economic growth has not yet translated into substantial income poverty reduction (**Figure 1**). We certainly need measures of progress in a broad sense other than indicators, such as the GDP, Gross National Income, or even the unemployment rate.

[2] https://www.philstar.com/headlines/2018/10/08/1858200/neda-poverty-index-chart-pinoy-standard-living

Figure 1 Trends in Real Per Capita based indicators of Income and Consumption (from the National Accounts and Household Surveys) and in Poverty Rates (based on International and National Poverty Lines)



Source: Philippine Statistics Authority (PSA)

2.1. Measures of Happiness and Well-being

Recognizing the limitations of the Gross National Income (i.e., which is GDP plus net primary income from abroad) as a measure of development, Bhutan's Former King Jigme Signye Wangchuck first conceived of the idea of measuring Gross National Happiness (GNH) in 1972. Since 2008, Bhutan has thus far conducted three GNH surveys covering all twenty districts (Dzonkhag) of the country (CBS and GNH Research 2015). The first GNH survey questionnaire collected data about living conditions and religious behavior of respondents. Later rounds of the GNH Survey used a shortened instrument, but the surveys retained questions on religious behavioral. The latest of the GNH Surveys was conducted in 2015, which suggested that 91.2% of the Bhutanese were happy, and that the index increased to 0.756 in 2015 from 0.743 in 2010. The measurement of GNH revolves around examining four pillars of happiness, viz.,

(1) promotion of equitable and sustainable socioeconomic development;
(2) preservation and promotion of cultural values;
(3) conservation of natural resources; and
(4) establishment of good governance.

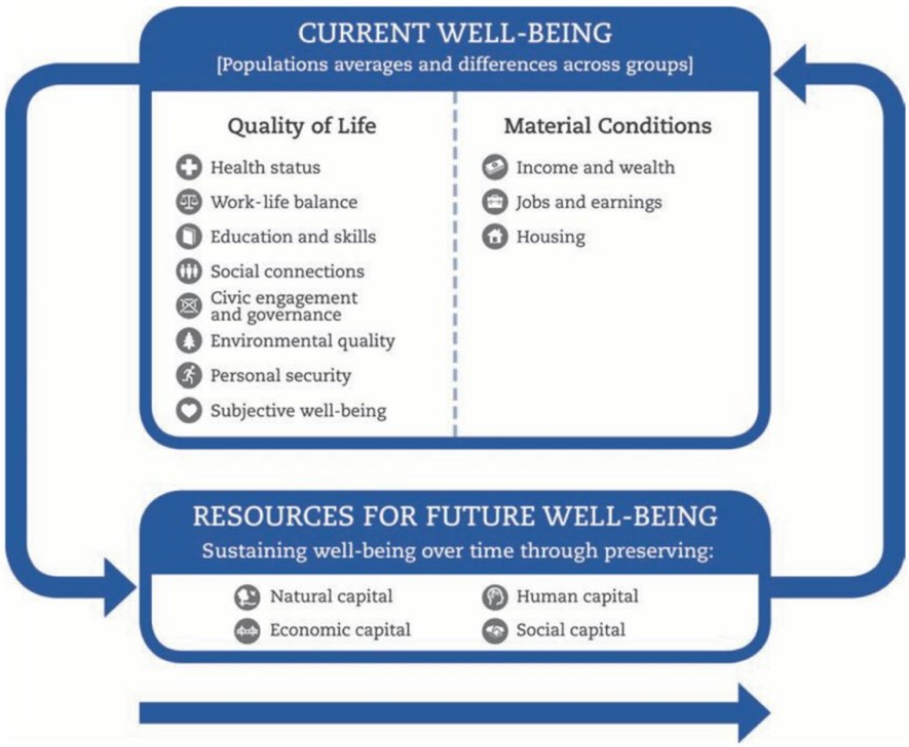
across thirty-three indicators on quality of life from nine domains:
(1) community vitality;
(2) Cultural diversity and resilience;
(3) Education;
(4) Health;
(5) Psychological well-being;
(6) Time Use;
(7) Living Standards;
(8) Ecological diversity and resilience;

(9) good governance.

The indicators comprising the GNH Index thus include socio-economic indicators on living standards, health and education as well as other aspects of quality of life, such as culture and psychological wellbeing (CBS and GNH Research 2015; Ura *et al*. 2012). Following ideas espoused in Alkire and Foster (2011), reports on the GHN identify four groups of people – unhappy, narrowly happy, extensively happy, and deeply happy, they explore the happiness people enjoy already, as well as suggest policies that can increase happiness and sufficiency among the unhappy and narrowly happy people. The GNH Index is disaggregated by meaningful sub-populations, such as men and women, as well as by district.

The idea to measure happiness has gained attention and interest among governments (both national and cities) and various organizations, even in the private sector. The OECD, for instance, has been publishing biennial reports since 2011 that discuss its examination of well-being and societal progress using the Better Life Initiative Index (OECD 2011). The conceptual framework of the index draws on the report of the Stiglitz-Sen-Fitoussi Commission (2009); it distinguishes between current and future well-being (**Figure 2**). Current well-being is described with two broad domains: material living conditions (income and wealth, jobs and earnings, housing conditions); and quality of life (health status, work-life balance, education and skills, social connections, civic engagement and governance, environmental quality, personal security and life satisfaction). Following the approach recommended by the UNECE-Eurostat-OECD Task Force on Sustainable Development (UN, OECD, Eurostat 2008), future well-being (or sustainability of well-being) is measured through indicators of different types of 'capital' that drive well-being over time (OECD 2015).

Figure 2 Structure of the Better Life Initiative Index.



Source: (OECD, 2015)

In the United Kingdom, the Office for National Statistics (ONS) developed a framework for measuring national well-being in 2010 consisting of 40 headline indicators from 10 domains. The domains identified by ONS were the natural environment, personal well-being, our relationships, health, what we do, where we live, personal finance, the economy, education and skills, and governance. The ONS conducted a national debate between November 2010 and April 2011 to find out 'what matters' to individuals and also to engage with experts on well-being who would provide insight into what to measure and how to measure it. The ONS collected over 30,000 responses during the debate which was conducted by holding events across the UK, an online debate and engaging with the public via a variety of social media.

In the Philippines, the Social Weather Stations (SWS) has been conducting surveys that ask respondents information on happiness and life satisfaction since 1991. Its latest Fourth Quarter 2017 SWS Survey that tracks happiness puts happiness of Filipinos at a record high of 94% reporting to be "very happy/fairly happy" with life in general (SWS 2018). Further, the SWS has been collecting data on happiness together with 44 other countries to generate the Happiness Index in the World Happiness Reports (SDSN 2018).

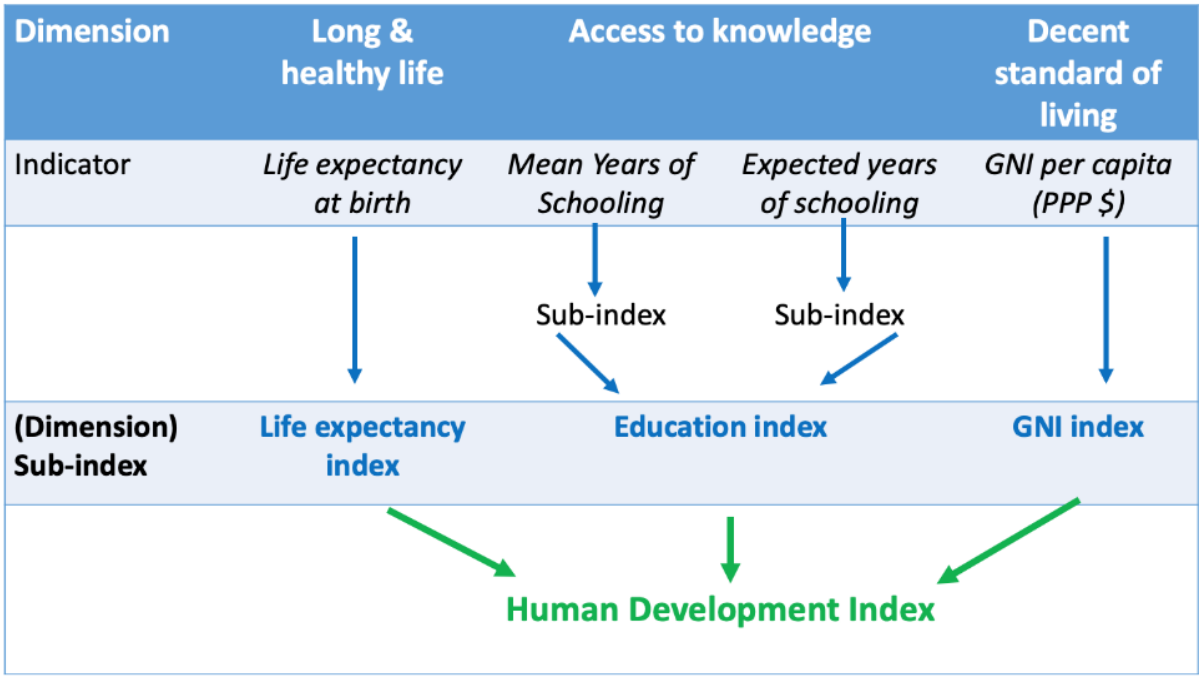
While there is growing interest in the idea to measure happiness even among official statisticians in the Philippines (Virola *et al*. 2010), most national statistics offices across the world however have not adopted the idea of measuring happiness and understandably so, since the framework for the system of national accounts (on which GDP and Gross National Income are based) itself has taken decades for countries to develop, while a concept like happiness has nuances across cultures. Unlike other measures of happiness and quality of life, the GNHI in Bhutan, for instance, involves religious behavior measurement components. Undoubtedly, the relative importance of the different dimensions of happiness and quality of life will vary if these were to be adapted in other countries. Further, the selection of indicators used to monitor achievements in the dimensions of these composite indices measuring happiness and quality of life may also differ when adopted across countries as there will be country specificities that consider culture, history and measurement challenges. For issues on the ultimate usefulness of measures of happiness or life satisfaction, see Graham (2009) and Wolfers (2008).

2.2. Measures of Development and Progress

In its Human Development Reports (HDRs) that have been released since 1990, the UNDP discusses the Human Development Index (HDI)[3], a summary measure of average achievement in key dimensions of human development, i.e., health, education and standard of living. The framework for HDI focuses on people, their opportunities and choices. The advantage of using the HDI is that it describes in a single measure how countries have performed in attaining overall human development. The disadvantage of the index is that, as any aggregate composite index (such as those that attempt to measure happiness and well-being), it does not allow us to see the relative importance of the different components of the index, or to understand why the value of the index changes over time.

[3] http://hdr.undp.org/en/content/human-development-index-hdi

Figure 3 Structure of the Human Development Index and Sub-Indices



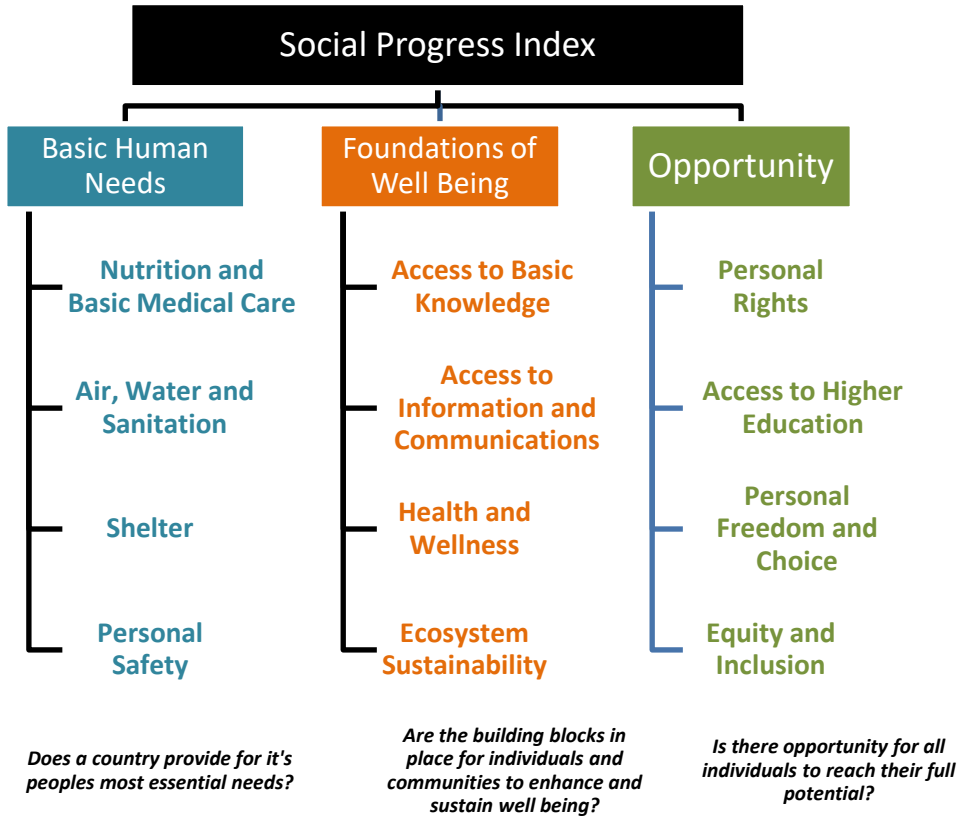
The health dimension of the HDI is assessed by life expectancy at birth, while the education dimension is measured by the mean of years of schooling for adults aged 25 years and expected years of schooling for children of school entering age. Finally, the standard of living dimension of HDI is measured by gross national income per capita. The scores for the three HDI dimension indices are then aggregated into a composite index by way of a geometric mean. The HDI enables comparison of countries with similar level of development but with different human development outcomes.

During the 2000 Conference of the International Association of Official Statistics on "Statistics, Development and Human Rights" held in Montreux, Switzerland, many official statisticians and experts across the world expressed concern about the usefulness of the HDI (OECD 2001). While there was recognition that the HDI is quite useful for advocacy, but it was criticized as not being as useful for policy since policy priorities will still have to be determined sectorally (Ravallion 2010). That is, as was earlier pointed out, when the HDI changes, an examination of the components of the HDI will still be necessary to determine what has changed and what has not. In addition, it has not been easy to justify how to put weights to the components of a composite index.

Another yardstick, the Social Progress Index (SPI)[4], has been developed by the Social Progress Imperative under the technical guidance of Professors Michael Porter from Harvard Business School and Scott Stern from the Massachusetts Institute of Technology. The SPI measures a comprehensive array of components of social and environmental performance and aggregates them into an overall framework. Similar with the HDI, the SPI is based upon social outcomes, which determines the level of social progress achieved within a particular country. The stark difference is on the inclusion of other indicators such as institutional, environmental, equity and inclusion factors, among others.

[4] http://www.socialprogressimperative.org/data/spi

Figure 4. Structure of the Social Progress Index.



The SPI is based on three dimensions, each with four components. These three dimensions include basic human needs (such as nutrition and basic medical care, water and sanitation, personal safety and shelter); foundations of well-being (indicated by access to basic knowledge, access to basic information and communication, health and wellness, and ecosystem sustainability); and opportunity (echoed by personal rights, access to higher education, personal freedom and choice, equity and inclusion). Each of the components of the three dimensions have a certain number of indicators that describe the components. All in all, fifty-four indicators are currently used to form the SPI.

However, there is also lot to be desired in the selection of the fifty-four indicators of the SPI. As in the case of other composite indicators, what justifies the selection and use of the fifty-four indicators in the SPI?

Equal weights are given to the indicators for each of the twelve components because as the SPI report says "there is no clear theoretical or empirical reason to weight any of the components more highly." For instance, the Access to Information and Communications component of the index has four indicators that include fixed broadband subscriptions, internet users, mobile telephone subscriptions, press freedom index. The Health and Wellness component considers six indicators which includes life expectancy, obesity, cancer death rate, deaths from HIV, deaths from cardiovascular disease and diabetes, and availability of health care. It is a puzzle why fixed broadband would be effectively given ¼ weight, but yet, life expectancy, would be giving a 1/6 weight. Why would cancer deaths be given the same weight as life expectancy, and deaths from HIV?

2.3. Traditional Poverty Measurement

To develop proper policy instruments for reducing poverty, a country must have a credible poverty measurement system. Three essential steps comprise traditional poverty measurement and diagnostics: (a) identifying an indicator of the welfare of households (and consequently all members of the household); (b) setting a poverty line, a minimum acceptable standard of that welfare indicator; and (c) aggregating the poverty data (Haughton and Khandker 2009; Albert 2008; UNSD 2005).

Welfare Indicator. Developing countries that measure poverty commonly use are monetary measures of welfare, either based on household income or household consumption. In the Philippines, the welfare indicator used in the official poverty measurement system is per capita income, sourced from the triennial Family Income and Expenditure Survey (FIES), conducted by the Philippine Statistics Authority (PSA).

While many developing countries use consumption/expenditure as their welfare indicator for poverty measurement (UNSD 2005), the Philippines uses income, as do China and Malaysia. The use of income data for poverty metrics has its strengths given there are fewer number of sources of income than the number of items for consumption/expenditure, thus, it is operationally easier to collect total income of a household. But using income also has limitations since income data is likely to be underreported due to memory recall biases, the reluctance of respondents to reveal accurate information due to tax purposes or because some income may be from illegal sources (Haughton and Khandker 2009). Furthermore, the accuracy of certain components of total income, such as agricultural income, cannot be assured as this would depend on when data collection was undertaken (i.e., whether before or after the harvest). The extent of biases in income measurement is, however, likely to be high on the upper tail of the income distribution, whose effect is not of particular concern in poverty measurement and analysis.

Analysts generally view consumption-based measures of poverty as providing a more adequate picture of well-being than those based on income, especially in low- or middle-income countries (Haughton and Khandker 2009; UNSD 2005). Typically, income fluctuates across months, and even from year to year. It also rises and falls in the course of one's lifetime whereas consumption remains relatively stable (and is thus viewed to be a better measure of permanent income than income itself). Further, consumption may be more accurately measured than income as survey respondents may be more able and willing to recall what they spent rather than what they earned, especially if more detailed questions jog or push the respondent's memory. The extent and direction of biases of reported expenditure is however unclear: the possibility of prestige bias on those in the lower-part of the expenditure distribution cannot be discounted.

There are also issues that complicate the aggregation of total expenditures, especially on how to account for consumption on durable goods, as well as how to measure the value of home production and home services.

Jogging memory from the use of detailed questionnaires may also have its limitation: respondents may suffer from information fatigue after hours of being asked detailed questions on their expenditures. The entire FIES module takes an average of five hours of interview per household, with the household visited twice—in July, to obtain the first semester information,

and in January of the following year to get the second semester information on family income and household expenditures (Albert 2008).

In most cases, we expect consumption poor households to also be income poor (and vice versa), but some consumption-poor households may have high income, and some income-poor households may have high consumption. Thus, it is far from clear whether income-based measures of poverty are less superior to consumption/expenditure-based measures of poverty. What is only clear is that there is no perfect indicator of well-being, and that each monetary measure of poverty has its strengths and limitations.

Poverty Lines. Poverty lines should represent what is required to purchase a bundle of essential goods (typically food and nonfood items) to maintain a minimal standard of well-being. While there have been attempts to adopting a standard methodology across countries in setting national poverty lines (UNSD 2005), but there has been no full consensus because of the belief that ultimately, national poverty lines are somewhat arbitrary and need to resonate with social norms. Typically, the food (component of the) poverty line is set with the cost of basic needs method, which entails determining the price of some nutritional benchmark through an artifice. In most countries, the artifice is a basket of generic food items, benchmarked to daily energy requirements of around 2100 kilocalories of energy per person (Albert and Molano 2009).

The differences in methodologies in the choice of a welfare indicator, the approach for data capture, and the setting of poverty lines across countries make cross-country poverty comparisons with national poverty lines contentious.

To monitor global poverty, the World Bank currently uses $1.90 in purchasing power parity poverty (PPP) 2011 prices. This poverty line essentially means converting the equivalent of one US dollar and 90 cents to a local currency based on 2011 PPP exchange rates and updating this by inflation. The PPP exchange rates essentially capture the cost of living difference among countries. But criticisms have been raised against this approach. For example, Reddy and Pogge (2008) point out that the use of the international poverty lines is not adequately anchored on the real cost requirements of purchasing basic necessities.

Aggregating Poverty Data. One of the typical aggregates of poverty data is poverty incidence, i.e., the proportion in poverty, which may be derived for both households or the entire population. The poverty incidence is a simple measure for assessing overall progress in reducing poverty. A weakness though of this poverty rate is that the depth or intensity of poverty experienced by poor people and poor households are not taken into account. Other poverty measures such as the poverty gap and poverty squared gap can be produced for such purposes. However, these indices, especially the poverty squared gap, are not easy to interpret; hence, they are hardly used for practical field work.

Official Poverty Statistics in the Philippines. According to Republic Act 8425 of 1997 (Social Reform & Poverty Alleviation Act), those who are "poor" are "individuals and families whose income fall below the poverty threshold as defined by the NEDA and/or cannot afford in a sustained manner to provide their minimum basic needs of food, health, education, housing and other essential amenities of life." Thus, this definition recognizes many dimensions of poverty, such as health, food and nutrition, water and environmental sanitation, income security, shelter and decent housing. The PSA (specifically, one of its predecessor statistical agencies, the National Statistical Coordination Board) has been releasing official poverty statistics based on the triennial FIES since 1985.

In the Philippines, the official food poverty line is estimated at urban and rural areas of each province by using a one-day food menu as an artifice for setting official poverty lines. These menus satisfy energy, and other nutrient requirements. The official poverty methodology consists of constructing the menus first with a national menu, rather than the previous approach of having varying menus across the regions, with provincial prices to satisfy a daily food requirement (Virola 2011). In addition, a constant Engle's coefficient is used in the current methodology for indirectly estimating the non-food component of the total poverty line across urban/rural areas in each province. This makes the estimation consistent across the country, compared to the previous methodology.

In 2012, official poverty statistics based on first semester income data sourced from the FIES were released and compared to the corresponding statistics for the first semesters of 2006 and 2009. A year later, poverty data were also generated sourced from the APIS, which is conducted by the PSA on non-FIES years. Prior to 2013, the APIS collected income and expenditure data, but using a less detailed questionnaire than the FIES. Although the 2013 APIS used more questions on income (than it used to) with its 19 pages of questions, the 2012 FIES income module used 24 pages of questions. However, even if APIS 2013 made use of the entire 24-page income module of FIES 2012, this would still not make the resulting income data from the APIS and FIES comparable since FIES also asks households detailed information on their expenditures before income questions are asked, using a questionnaire with a s length of 78 pages (that takes an average interview time of 5 hours to accomplish). The NEDA and PSA have compared the 2013 APIS-based poverty data, but trends cannot actually be obtained from the APIS and the FIES given the lack of full comparability of the survey instruments (Albert *et al*. 2015). At best, comparisons can be made within waves of a household survey, i.e., APIS with APIS, or FIES with FIES.

While traditional poverty statistics have been simple headline summaries of poverty conditions, they have their limitations. It is not enough to use poverty rates across areas (such as countries and regions within a country) for resource allocation, since total population varies across areas. In the Philippines, some areas such as the Autonomous Region of Muslim Mindanao (ARMM) may have very high poverty rates but the number of poor persons in ARMM is actually much smaller than in some regions where poverty incidence figures are lower but where the total population is much higher. Further, even as poverty rates for a population can be generated by assuming that all members in a poor household are poor, the disaggregation of poverty statistics by sub-groups, e.g., males and females, may not necessarily capture the actual differences in gender disparities given that intra-household differences are often not captured in traditional poverty measurement.

As has been pointed out earlier, poverty is a multidimensional phenomenon. Poor people view their poverty much more broadly than income or consumption poverty, to include lack of education, decent employment, health, housing, empowerment, personal security. In the next-subsections, we discuss the global indicators for monitoring sustainable development and the MPI. Some studies, e.g., Gwatkin *et al*. (2000); Filmer and Pritchett (2001) have also looked into developing a deprivation index, a weighted composite index of poverty indicators (largely asset data), by way of principal components analysis, and have used such an index instead to monitor (asset-based) poverty.

2.4. Measurement of Sustainable Development

Over the years, there has been recognition that not all development paths are sustainable. Various definitions of sustainable development have been developed (See, e.g. Pezzy, 1992 for a review). Behind these concepts and definitions is the recognition that economic development can erode human and natural capital. To be sustainable, development must provide for all assets (physical, human and natural capital) to grow over time—or at least not to decrease.

Thus, the World Bank has been examining "development diamonds" to examine the relationships among life expectancy at birth, gross primary (or secondary) enrollment, access to safe water, and Gross National Income per capita for a given country relative to the averages for that country's income group, i.e., low-income, lower-middle income, upper-middle-income, or high-income group (Soubbotina, 2004). Each of the four socio-economic indicators is put on an axis, then connected with bold lines to form a polygon. The shape of the resulting development diamond is then compared to a reference diamond, which represents the average indicators for the country's income group, each indexed to 100 percent. Thus, any point outside the reference diamond shows a value better than the group average, while any point inside signals below-average performance.

Further, the World Bank, as well as the United Nations[5], have been encouraging countries to account for changes in a country's natural capital (i.e. valuation of the environment) in calculations of the national accounts (particularly indicators such as GDP and the Gross National Income) in order to explore sustainable development issues. The Wealth Accounting and the Valuation of Ecosystem Services (WAVES) [6] partnership led by the World Bank aims to promote sustainable development by ensuring that natural resources are mainstreamed into development planning and national economic accounts. Several indicators such as genuine domestic savings rate and genuine domestic investment rate are also being monitored by the World Bank. These indicators adjust the traditional domestic saving rate and genuine domestic savings rate downward by an estimate of natural resource depletion and pollution damages (the loss of natural capital), and upward by growth in the value of human capital (which comes primarily from investing in education and basic health services). Recently, the World Bank has also come up with a human capital index that combines indicators of health and education into a measure of the human capital that a child born today can expect to obtain by her/his 18th birthday, given the risks of poor education and health that prevail in the country where s/he lives (Kraay 2018).

In September 2015, 194 countries, including the Philippines, committed to attaining the 17 Sustainable Development Goals (SDGs) and their 169 targets by 2030 (UN, 2015b). The SDGs aim to work on the unfinished agenda of the Millennium Development Goals (MDGs) that were launched in 2000, with a more ambitious set of targets. Over a year after the SDGs were launched, chief statisticians across the world agreed on an indicator framework of 232

[5] A major step towards accounting for natural capital in the national accounts came with the adoption by the UN Statistical Commission of the System for Environmental and Economic Accounts (SEEA) in 2012. This provides an internationally-agreed method to account for material natural resources like minerals, timber and fisheries. For more information, see https://seea.un.org/

[6] For information on the Wealth Accounting and the Valuation of Ecosystem Services Project of the World Bank, see http://www.worldbank.org/en/news/feature/2015/06/15/waves-faq

indicators[7] for monitoring the extent of meeting the SDGs, including the eradication of extreme poverty, but without resorting to using a composite index on sustainable development.

Further, the SDGs, particularly the first six global goals covering poverty reduction, as well as quality education for all, health and nutrition, gender equality, safe drinking water and safe sanitation:

Box 1. Goals 1 to 6 of the Sustainable Development Goals

SDG1	End poverty in all its forms everywhere
SDG2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
SDG3	Ensure healthy lives and promote well-being for all at all ages
SDG4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all
SDG5	Achieve gender equality and empower all women and girls
SDG6	Ensure availability and sustainable management of water and sanitation for all

suggest that poverty has many "forms" beyond mere monetary deprivation. The recognition of poverty as being multidimensional is rooted in viewing poverty as "capability failure" (Sen 1999). With poverty viewed as multidimensional, we can look into a range of specific indicators of capabilities including those relating to health, education, shelter, and access to basic amenities to capture the multiple deprivations of poor people. The key issue is whether income (or consumption) offers an adequate representation of this range of capabilities, and if it did, then there would not really be much value added for a separate measurement on multidimensional poverty. However, just because poverty is multi-dimensional need not mean that its measurement should be. The 232 global SDG indicators, for instance, or even subset of the available indicators forms a dashboard not only on sustainable development but also on multidimensional poverty.

2.5. Measuring Multidimensional Poverty

In 2010, drawing from methodological work done at the Oxford Poverty and Human Development Initiative (OPHI), the HDR introduced the MPI, an overall headline indicator of poverty that enables poverty levels to be compared across places and over time in order to see at a glance which groups are poorest and whether poverty has been reduced or has increased (UNDP 2010; Alkire and Foster 2011).

Subsequent HDRs since 2011 have released the UNDP estimates of multidimensional poverty, with adjustments documented in their methodological reports. In 2014, an innovative MPI (MPI-I) was also developed in the HDR to explore improvements in the original approach (MPI-O) to estimate MPI (Kovacevic and Calderon 2014). The 2014 and 2015 HDRs contained

[7] In March 2016, the United Nations Statistical Commission (UNSC) approved a list of 230 indicators for monitoring the SDGs. A year later, the UNSC revised the list to 232 indicators (https://unstats.un.org/sdgs/indicators/indicators-list/). See also the 2017 IAEG-SDGs report to the UNSC (https://unstats.un.org/unsd/statcom/48th-session/documents/2017-2-IAEG-SDGs-E.pdf)

both MPI-O and MPI-I estimates. The MPI-O was aligned with indicators used to track the Millennium Development Goals, the predecessor global agenda of the SDGs.

The UNDP and OPHI have recently developed a new version of the global MPI this 2018 with five of the ten indicators revised to align the MPI with the SDGs; the new estimates on global MPI take account of data coverage, communicability, comparability, disaggregation, and robustness (Alkire *et al*. 2018). The global MPI for 2018 covers 105 countries, which comprise nearly four-fifth (77 %) of the world's population (corresponding to 5.7 billion people); of this proportion, a quarter (23 %) of people (amounting to 1.3 billion) are identified as multidimensionally poor. In contrast, the World Bank's current estimate of the poor (earning less than the international poverty line of $1.90 in 2011 PPP prices) globally is about a tenth (10.1%). For the Philippines, the estimate of MPI poor based on the global MPI methodology is 7.4%, while the 2015 estimate of (consumption) poverty rate using the international poverty line is at 8.3%.

Multidimensional poverty measurement follows the same steps as traditional poverty measurement: choosing indicators to represent dimensions of deprivation; setting thresholds (or cutoffs) with these indicators and dimensions, and, aggregating the poverty data to summarize information on individual deprivations for the population. In order to further guide debates and designs of development policy, the MPI identifies deprivations across the same three dimensions of the HDI on health, education and living standards. Unlike HDI, the MPI is based on 10 indicators, two representing health (malnutrition, and child mortality), two are educational achievements (years of schooling and school enrolment), while six are indicators of "living standards" (including access to electricity, sanitation, safe drinking water, and proxies for household wealth, such as type of floor, cooking fuel, and some asset ownership). Each dimension is weighted equally, and within a dimension, each indicator is given equal weights. **Annex Table A-1** lists the ten indicators for the global MPI and their actual descriptions (including changes in the indicators across the years).

While the HDI uses aggregate country-level data, the MPI makes use of micro data from household surveys, which are then aggregated to a national measure of multidimensional poverty. That is, the MPI assesses poverty at the individual level. If someone is deprived in a third or more of the ten (weighted) indicators, then s/he is 'multidimensionally poor', and the intensity of her/his poverty is measured by the number of deprivations s/he is experiencing. Following the methodology of Alkire and Foster (2011), the MPI is calculated by multiplying the incidence of poverty (H) and the average intensity of poverty (A), with the latter averaged only among those considered poor. That is

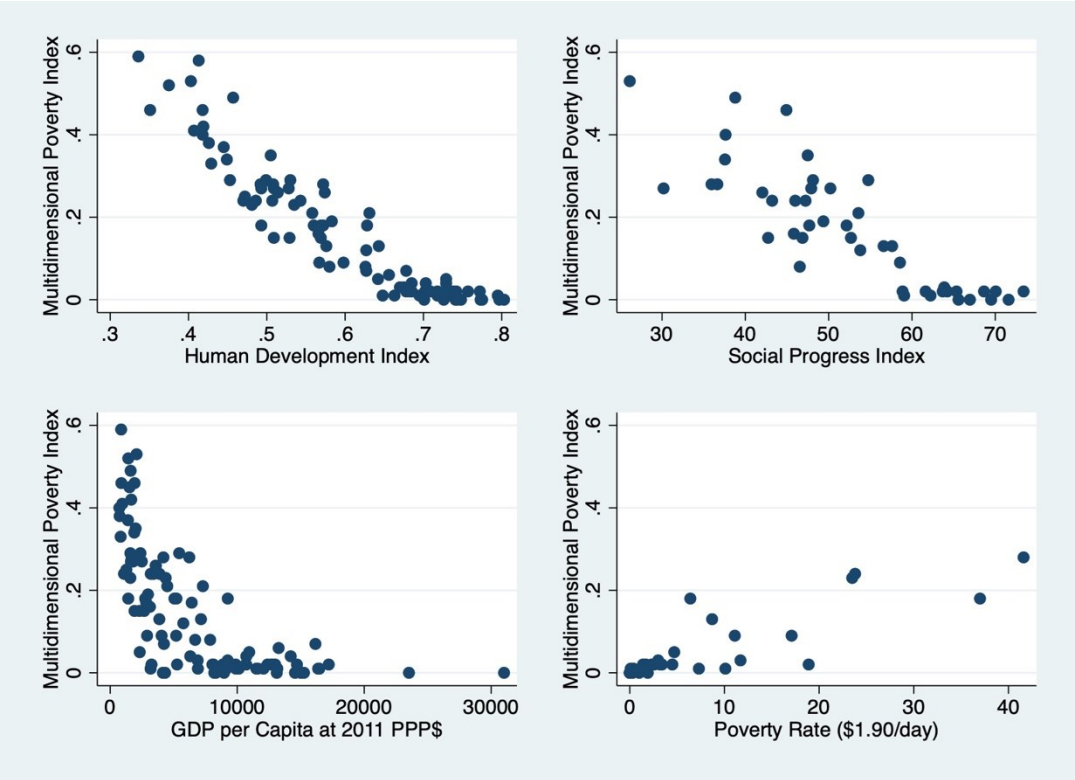
$$MPI = H \times A,$$

Thus, the MPI reflects both the share (or incidence) of people in poverty as well as the degree to which the poor people are deprived. The usefulness of the MPI methodology is that aside from generating the incidence of multidimensional poverty, it allows an examination of the prevalence (i.e., how many people experience overlapping deprivations) as well as the intensity (i.e., how many deprivations people experience at the same time) of deprivation, and for specific dimensions. Unlike the conventional monetary-based measures of poverty, the MPI enables policymakers to have information on various dimensions of poverty by showing interconnections among the various aspects where poor are actually deprived.

Datt (2017) pointed out that: "multidimensional poverty comparisons are sensitive to assumptions in relation to the choice of indicators, the weights assigned to the indicators, the dimensional (deprivation) and the overall poverty cut-offs, as well as the choice of the aggregate poverty measure." Another major issue regarding the MPI is that the indicators were chosen not necessarily because they are the best available data on each of the three broad dimension of poverty, but because the MPI methodology requires that a poverty analyst has all the indicators for exactly the same sampled person or sample household. That is, the indicators must all come from a single survey. Further, is there any extra value added policy use for the MPI given that when the MPI changes, we still need to examine the specific component dimensions and indicators, or are such measures going to be more useful for advocacy?

Figure 5 shows that the MPI, is very strongly correlated with the SPI, HDI, and even with monetary poverty rates, although there are a few outliers for the latter. This is somewhat expected since these composite indices involve indicators that are correlated with consumption or income, but these indicators, though, are not very likely to change much when there are economic fluctuations, such as global economic slowdowns or upswings in macro-economic performance. These indicators smooth out fluctuations in the MPI.

Figure 5 Multidimensional Poverty Index versus Human Development Index, Social Progress Index, GDP per capita and Poverty Rate (i.e., $1.25 per day) of 64 countries, various (recent) years.



Sources: Social Progress Imperative (http://www.socialprogressimperative.org/data/spi), United Nations Development Programme (http://hdr.undp.org/en/data), World Bank (http://data.worldbank.org)

Datt (2017) and Balisacan (2015) have also pointed out that recent trends in income poverty in the Philippines have been puzzling in the wake of fairly robust economic growth starting 2012, suggesting that there may be weaknesses in the current official poverty measurement system in the country. Related to this, Albert *et al*. (2017) suggested three reasons for the

seeming puzzle : (a) the incidence of growth has not been pro-poor (i.e., high levels of income inequalities have made economic growth largely benefit the high income classes, thus minimizing the effects of growth on reducing poverty); (b) the updating of official poverty lines (at the provincial urban/rural levels) by the PSA has overstated the cost of living in the country; (c) there has been divergence in national accounts-based and survey-based growth in per capita income and expenditure. The second reason is not a major explanation because trends in official poverty that the PSA releases do not differ from overall trends in World Bank's estimates of (consumption) poverty that involve international poverty lines of USD 1.9 per person per day in 2011 PPP prices (see Figure 1). The first and third reasons are also not mutually exclusive. Thus, while the puzzle about high GDP growth and the lack of income poverty reduction may actually be explained, and cannot be used to justify the need for a multidimensional measure of poverty in the Philippines. Birdsall (2011) suggests that here are three intrinsic reasons for multidimensional measure of poverty: "technical policy rationale (to contribute to more effective policies at the technical level); the conversation-changer rationale (to alter the discourse on what matters in the first place); and the advocacy rationale (to communicate better, whether to acquire new or stronger advocates for change, or to name and shame relevant actors)." That poverty is multidimensional coupled with the need to explore the interconnected links of the many dimensions of poverty, and the need to have better actions to yield better development outcomes are the central arguments for exploring an MPI, as is to be undertaken in the next sections.

3. Empirical approach for measuring multidimensional poverty

The previous section provided a review of various composite indicators of welfare, happiness, and progress. In this section we discuss the data and methodology used in this paper for the possible measurement of multidimensional poverty in the Philippines bearing in mind broad issues about construction of composite indices, viz., choice of indicators, weights and aggregation (Ravallion 2012; Ravallion 2011, Alkire et al. 2015; Birdsall 2011; Ferreira and Lugo 2013; and Bourguignon and Chakravarty 2003). We note that there is hardly any disagreement among poverty analysts that poverty is multidimensional, that traditional poverty measurement is imperfect, and that the multiple domains of deprivation are conceptually and often correlated. What experts seem to disagree on is how best to measure poverty: just because poverty is multidimensional need not mean we should measure it multidimensionally with a single index. There are other ways of communicating the multidimensional nature of poverty beyond a composite index such as through cross-tabulation dashboards and visualizations of these dashboards. The parsimony of composite indices, whether the MPI, HDI or measures of happiness, is appealing to some extent —reducing multiple dimensions into a single aggregate, but the meaning, interpretation and robustness of these indices needs probing for these to be useful and convey value added especially as each dimension/indicator component has measurement errors.

As was earlier mentioned, this study makes use of waves of three household surveys conducted by the PSA, viz., (a) the NDHS; (b) the FIES; (c) the APIS. It examines more closely the robustness of results across the different data sets used in the next section. Together with the Demographic and Health Survey or Multiple Indicator Cluster Survey of countries, the NDHS has been used as the data set for the global MPI (Alkire *et al*. 2018). The usefulness of this survey is that it has a wealth of health (and mortality) information, aside from education and asset data (of households and household members). Alternative MPI specifications to the global MPI value for the Philippines have been developed by Datt (2017), Bautista (2017) and Balisacan (2015) for the Philippines using either the APIS or the FIES. While the APIS and

FIES do not have anthropometric and mortality information, but these surveys have income and expenditure data and can thus be used to link monetary poverty data with nonmonetary dimensions of poverty (Ericta and Luis 2009; Ericta and Fabian 2009). As was pointed out earlier, income data in the APIS in recent years has become more detailed, leading the PSA to yield income poverty statistics from the APIS, though these statistics are incomparable to those sourced from the FIES (Albert *et al*. 2015). The APIS and FIES are also

The triennial FIES, the APIS and the quarterly Labor Force Survey (LFS) follow an integrated survey programme through a master sample design. Sample households across household surveys and survey rounds follow a rotation scheme, to minimize respondent fatigue. For the quarterly LFS, one rotation of the sample households is dropped every quarter and replaced by a new set of sample households from the respective sample areas. The FIES and APIS are riders to the LFS. For the quarters when the FIES is a rider to the LFS, a semester later, the same households are visited to get the second semester information for the FIES and also to conduct the LFS. Since the FIES and APIS are riders to the LFS, some of the household member information from the LFS (such as educational attainment and employment) may also be merged with the FIES and APIS to yield deprivation indicators (although employment is not used in the NDHS-based indicators for the global MPI).

The NDHS, FIES and APIS were designed to generate reliable estimates of indicators up to the regional level. Since these surveys are conducted for different purposes and vary in the deprivation indicators, even for the same variable of interest (e.g., food expenditure in APIS and food expenditure in FIES), comparisons of deprivation indicators and resulting MPIs have to be taken with a grain of salt.

3.1. Choice of Indicators and Dimensions

The choice of dimensions and indicators for the construction of any composite index is guided by a conceptual framework and data availability. Several implementations of multidimensional poverty measurement for the Philippines (e.g., Datt 2017, Bautista 2017, Balisacan 2015), including the global MPI (Alkire *et al*. 2018) make use of the three dimensions of poverty pertaining to education, health and standard of living (Annex Table A-1). In this paper, we continue making use of these three dimensions, partly to see the extent of consistency with results from these previous work, and partly to examine the robustness of trends if different indicators were to be used.

For the global MPI, the final list of 10 indicators covering the three dimensions (Annex Table A-1) were selected after a consultation process involving experts in all the three dimensions, an examination of data availability and of cross-country comparison issues (Alkire *et al*. 2018).

In this study, all indicators (shown in **Table 1**) used for constructing multidimensional poverty measures reflect socio-economic welfare. The choice of indicators, however, had to depend on indicator availability from the household survey being used. With multidimensional poverty aimed at expressing the joint distribution of deprivations across different dimensions, a key data consideration is the ability to examine deprivations across three dimensions of education, health and living standards for the same set of households or individuals. On one hand, this might seem to be a limitation, as there would be no way to combine information from other surveys. On the other hand, this can also be considered a strength as empirical results allow us to see interconnections among the component dimensions and indicators. Since the indicators

of deprivation varied in availability in the NDHS, FIES, APIS, the estimates of multidimensional poverty were expected to vary.

Table 1 Dimensions and Indicators of Deprivation Used in this Study

Dimension	Deprivation indicator	Indicator criteria : household is considered deprived if	NDHS	FIES*	APIS*
education	school attendance	any child aged 5-17 is not attending school		✓	✓
education	years of schooling	no member had educational attainment of elementary graduate or better	✓	✓	✓
health	child mortality	any child aged 0-5 died	✓		
health	food consumption	food expenditure is less than food poverty threshold		✓	✓
living standards	electricity	no electricity	✓	✓	✓
living standards	sanitation	toilet facility is not water-sealed, sewer septic tank/other depository, closed pit and/or shared with other households	✓	✓	✓
living standards	source of water	water source is not from community water system (own or shared), tubed/piped deep well (own or shared) or protected spring	✓	✓	✓
living standards	cooking fuel	household cooks with dung, wood or charcoal	✓		
living standards	housing materials (roof and walls)	housing materials for roof and walls are not strong	✓	✓	✓
living standards	tenure status	household resides in a housing unit/lot with no consent of the owner	✓	✓	✓
living standards	assets	household does not own a) a durable (e.g. television[123], radio[123], washing machine[23], refrigerator[23], stove/oven/ microwave oven[23], aircon[23], personal computer[23]) or communications asset (e.g. landline[123], mobile phone[123]) and b) a mobility asset (e.g., car/truck[123], motorcycle/tricycle/bicycle[123])	✓	✓	✓

Notes:
*= merged with data from Labor Force Survey (LFS);
[1] = available in NDHS;
[2] = available in FIES;
[3] = available in APIS

While the global MPI makes use of 10 indicators, only 8 are available in the NDHS. All of these eight NDHS indicators except the floor materials indicator were used in this study, together with two other welfare indicators, viz., housing materials (which is available in all three surveys) , and tenure status (which is also found in FIES and APIS).

The selection of the 10 deprivation indicators for the global MPI was guided mainly by expert discussions on common practices, especially in the context of the MDGs and SDGs. The latter consideration suggests that the set of deprivation indicators varies across the three household surveys. For example, there are more deprivation indicators linked with standard of living in both FIES and APIS than in NDHS. Furthermore, APIS also collects information about the experience of hunger (but the manner of questioning was not the usual practice in CSOs that collect hunger data for the 2014 APIS). Coverage of households members for health insurance is also asked in APIS and NDHS, but the manner of asking in early years for the APIS was not for all household members. Due to the question wording issues, we opted not to consider using hunger and health insurance indicators for this study.

For the education dimension, two deprivation indicators are used in this study: (i) the years of schooling of household members (which is available across the three surveys) and (ii) current school attendance of school-age (i.e. aged 7-16 years) children (which is available in FIES and APIS through the LFS) . A household is considered deprived of education functionings for the first indicator if not one member of the household has completed basic education. For the second indicator, a household is deprived of educational functionings if it has a school-age child who is currently not attending school.

For health, four deprivation indicators used in this study are on child mortality, food expenditure, hunger and health insurance coverage. Child mortality is only available in NDHS, but it is proxied in APIS and FIES by other living standards indicators, viz., the lack of access to safely managed water supply and sanitation services (which is also available in NDHS). The experience of hunger is only available in APIS, but it is also proxied by food expenditure, especially if this expenditure is less than the food poverty threshold. The lack of health insurance by a household (available in NDHS and APIS) does not provide a pathway for the household to manage risks to welfare from illnesses.

For the living standards dimension, eight indicators are used. Two mentioned earlier, viz, access to clean water and to safe sanitation, proxy deprivation indicators on health. The remaining indicators measure access to electricity, quality shelter (floor and materials for roof and walls), clean energy for cooking, and assets (both mobility and non-labor assets, viz. durables or communication assets). The indicators on floor and on clean energy for cooking are available only in the NDHS. For this study, the deprivation indicators used was chosen to be parsimonious and fairly comparable over time (although across waves, some changes may have been made in survey instruments).

Datt (2017) also made use of indicators on employment, a dimension that is not in the global MPI. There is sufficient justification for this given the effect of employment on income and consumption. We also look into this separately to further examine robustness of estimates in multidimensional poverty measurement. We however look go beyond his use of indicators regarding unemployment, but also make use of indicators based on underemployment.

3.2. Choice of Weights

As regards the weights used to aggregate across indicators and dimensions for multidimensional poverty measurement, Decanq and Lugo (2013) provide a review of various approaches. Ravallion (2010; 2011; 2012) critiques the lack of an intrinsic meaning of the associated weights in the MPI (and even the HDI) as regards prices, which are used to add the components of consumption expenditure (or, incomes used to finance consumption) [8]. Current implementations of MPI generally adopt equal weights or a natural variant, viz., the nested equal weights approach, where each dimension is given equal weight, then all indicators within the dimension are also given equal share of the dimension weight. These approaches implicitly assumes specific tradeoffs between the constituent components of welfare. The use of equal weights and variants, or even the use of ad hoc weights is unable to explain ordering of households according to multidimensional welfare, nor is it readily apparent how this is done with the use of such weights. An extra amount of one component can offset the change in another component and leave the index unchanged, but such tradeoffs are hardly stated, explained and communicated explicitly.

A statistical approach for the assignment of weights involves the use of principal components analysis (PCA)[9]. Several studies such as Gwatkin *et al*. 2000; Filmer and Pritchett 2001 use

[8] Under the law of one price, and given relatively weak assumptions on consumer preferences, the relative prices are equal to the rate at which consumers— regardless of their income levels and allowing for different utility functions—are willing to trade one such component of the index (e.g., safe drinking water) for another (e.g., an asset such as television)

[9] PCA is a multivariate statistical method that is primarily used to reduce a large set of correlated variables into a smaller set of uncorrelated variables while retaining as much of the variation in the original dataset as possible. From an initial set of n correlated and standardized variables, X_1 through to X_n, PCA creates m uncorrelated indices or components, where each of the m new variables or variates is called a principal component (PC). Each PC is a linear weighted combination of the initial variables:

$$PC_1 = \sum_{j=1}^{n} a_{1j} X_j$$

$$PC_2 = \sum_{j=1}^{n} a_{2j} X_j$$

$$\vdots$$

$$PC_n = \sum_{j=1}^{n} a_{nj} X_j$$

Standardized variables mean that the variables have a mean of zero, and unit variance; if the variables are unstandardized, they can be readily transformed into standard units by subtracting the mean and dividing the result by the standard deviation of the variable. PCA amounts to rotating the original standardized variable space to a point where the variance of the new variate (PC) is maximized.

- The first PC is that unit length linear combination) of the initial variables X_1 through to X_n that has the maximum variance among all unit length linear combinations of X_1 through to X_n.
- The second PC is that unit length linear combination. of the original variables X_1 through to X_n that is uncorrelated with the first PC and has maximum variance among all among all unit length linear combinations of X_1 through to X_n that are uncorrelated with the first PC.
- The third PC is that unit length linear combination of the initial variables X_1 through to X_n that is uncorrelated with the first two PCs and has maximum variance among all among all unit length linear combinations of X_1 through to X_n that are uncorrelated with the first two PCs.
- …

PCA to (standardardized units of) welfare indicators for deriving a "deprivation index" from the first principal component. However, we merely make use of the re-scaled factor loadings of the first principal component on the pooled sample from a particular survey as the alternative weights for the indicators to generate the multidimensional poverty measures.

3.3. Identification of the Poor and Aggregation of Poverty Data

Aside from the choice of indicators and the selection of weights for the indicators, another important issue in measuring multidimensional poverty is the identification and aggregation process. Given the various indicators, how should the poor be identified, and how can deprivations across households (or individuals) and dimensions be put together into a single measure of multidimensional poverty?

As pointed out in Datt (2017), the identification of the multidimensional poor may be done two ways: (a) the use of the cross-dimensional cut offs specified in terms of the minimum percentage of (weighted) dimensions a person (or household) must be deprived in for the individual (or household) to be considered poor (see Alkire and Foster 2011; UNDP 2010; Alkire *et al*. 2018); (b) the union approach where a person (or household) is considered multidimensionally-poor if deprived in any dimension (Balisacan 2015).

Both approaches assume that each of the m dimensions of poverty characterize the state of well-being of n individuals (or households). An individual (or household) i, where i=1,…,n, is viewed to be deprived in dimension j, where j=1,…,m, if the person (or household) falls below some predetermined threshold z_j for that dimension. That is, let x_{ij} represent the individual (or household) i's actual achievement in dimension j, then this person (or household) is considered deprived in dimension j if

$$x_{ij} < z_j$$

Let I_{ij}be a binary (0-1) variable that denotes whether or not individual (or household) i is deprived in dimension j. That is,

$$I_{ij} = \begin{cases} 1 & if\ x_{ij} < z_j \\ 0 & otherwise \end{cases}$$

Further, let w_j be weights for the j[th] dimension of poverty, where $0 < w_j < 1$ and $\sum_{j=1}^{m} w_j$. The overall deprivation score for each individual (or household) can be calculated as the sum of the weighted deprivation scores

$$c_i = \sum_{j=1}^{m} w_j I_{ij}$$

With the cross-dimensional cut-off approach, we can calculate censored deprivation scores of all the n individuals (or households) can be calculated using this identification function:

$$c_i(k) = \rho_i(k)\, c_i$$

- The last PC is that unit length linear combination. of the original variables X_1 through to X_n that is uncorrelated with the first n - 1 PCs and has maximum variance among all among all unit length linear combinations of X_1 through to X_n that are uncorrelated with the first m - 1 PCs.

where $\rho_i(k)$ is a binary (0-1) variable denoting whether (or not) individual or household *i* is deprived in at least k-fraction of the weighted dimensions, i.e.,

The multidimensional poverty index (MPI) is defined as the average of the censored deprivation scores of the total population

$$M(k) = \frac{1}{n}\sum_{i=1}^{n} c_i(k) = \frac{1}{n}\sum_{i=1}^{n} \rho_i(k)\, c_i = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{m} w_j I_{ij}\, \rho_i(k) .$$

The MPI can be also conveniently rewritten as

$$M(k) = \frac{q}{n}\left[\sum_{i=1}^{n} \frac{1}{q}\, c_i(k)\right]$$

where *q* is the total number of poor people, i.e.,

$$q = \sum_{i=1}^{n} \rho_i(k)$$

Thus, the MPI can be viewed as the product of H (the headcount ratio) and A (the intensity A of poverty) where the latter is the average deprivation score of poor people. Because of this decomposition of MPI, the index is also considered an adjusted headcount ratio, where A serves as an adjustment that accounts for the breadth of poverty.

While Alkire and Foster (2011) allow the cross-dimensional cut-off to range from the minimum weight of any dimension to 100 percent, the global MPI (UNDP 2010; Alkire *et al*. 2018) sets the cut-off at one-third.

On the other hand, for the union approach, the multidimensional poverty measure is written much more simply as

$$M(Union) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{m} w_j I_{ij}$$

where the poor are identified by reference to a cross-dimensional cut-off specified in terms of the minimum percentage of (weighted) dimensions a person must be deprived in for him/her to be considered poor

The difference between the multidimensional poverty incidence measures for the cross-dimensional cut-off and the union approach is that while the union approach counts all deprivations of all individuals, the cross-dimensional cut-off approach counts the deprivations of only those who are deprived in at least k-fraction of all weighted dimensions. The union approach asserts the essentiality of all deprivations.

Further, when transfers are made from a more to a less deprived person, the poverty measure increases for the union approach. In this paper, we make use of multidimensional poverty measures from both a cross-dimensional cut-off of one-third as well as union-based approach:

4. Empirical Results

Estimates of the MPI, as well as multidimensional poverty headcount (H), and average deprivation intensity experienced by the poor (A), and other multidimensional poverty measures using the (old) approach for the global MPI estimation are given in **Table 2**, together with the average annual rate of change of these statistics for the period covered by the 2017 NDHS, 2013 NDHS and 2008 NDHS data.

Table 2 Multidimensional Poverty Measures from the Global MPI Approach*

Measures of Multidimensional Poverty from the Global MPI	Year			Annual rate of change, %		
	2017	2013	2008	2017-2013	2013-2008	2017-2008
Multidimensional Poverty Index (MPI = H*A)	0.021	0.033	0.035	-9.74	-2.25	-5.09
Headcount ratio (H): Population in multidimensional poverty (%)	4.3	6.3	6.8	-8.82	-2.27	-4.74
Intensity (A) of deprivation among the poor (%)	49.1	51.9	51.2	-1.41	0.02	-0.62

Note: Calculations of authors' using data sourced from NDHS, PSA.
*= 2014 approach to estimation of Global MPI

In 2017, the proportion in multidimensional poverty is estimated at 4.1 percent using the (old) approach for the global MPI. This is just half of the World Bank's estimate (8.3%) of the proportion of Filipinos in consumption poverty who spend less than $1.9 in PPP 2011 prices[10]. This estimate is a reduction of 4.7 percent per year in the period from 2008 to 2017. If we consider instead the reduction of the adjusted headcount estimate, the rate of change is similar at 5.1 percent. Both these rates of change are faster than the corresponding annual drops (3.7 percent, and 1.4 percent, respectively) in the World Bank estimate of consumption poverty incidence in the Philippines and in the official income poverty headcount in the period from 2009 to 2015. While monetary poverty is technically not comparable to multidimensional poverty from NDHS (using the MPI approach), it is interesting to note that estimates of monetary headcount poverty are not decelerating as much as the estimates of headcounts for multidimensional poverty for roughly the same periods.

The extremely poor, i.e., persons with half of the weighted deprivations, range from half to two-thirds of the multidimensional headcount in the period from 2008 to 2017. Just like headcount poverty, the proportion in severe poverty has reduced in the same period. Beyond poverty, we can also look into distributional issues. The entire population may be broken down into those in multidimensional poverty (who experience at least a third of total weighted deprivations), those vulnerable to poverty, and those with no deprivations (**Table 3**). Across time, those with no deprivations has been increasing from about 15 percent of the population in 2008 to more than double this proportion nine years later. Further, the use of a lower cross-dimensional cut-off of a fifth, rather than a third, increases the estimated poverty headcounts by 53% to 66%.

[10] See World Bank PovCalNet http://iresearch.worldbank.org/PovcalNet/povOnDemand.aspx

Table 3 Share of Population by Poverty and Vulnerability Status

Proportion of population	2017	2013	2008
in multidimensional poverty (who have higher than 33.32% intensity of deprivations)	4.3	6.3	6.8
in severe poverty (with intensity higher than 50%)	2.3	4.2	4.5
who experience 20-33.32% intensity of deprivations	4.9	8.4	10.4
who experience more than 0 but less than 20% intensity of deprivations	58.7	68.2	67.6
with no deprivations (intensity=0)	32.1	17.1	15.2

Note: Calculations of authors' using data sourced from NDHS, PSA.
*= 2014 approach to estimation of Global MPI

The contribution of the component dimensions of MPI for the global MPI approach is given in **Table 4**. From 2008 to 2017, significant declines in the deprivation indicators related to education, health and living standards dimension can be observed, though the improvement in many living standards indicators, especially access to electricity and access to safe sanitation appears to be more significant in the second sub-period 2013-17. Throughout the entire period from 2008 to 2017, improvements in information assets (especially mobile phones) are consistently observed. Overall, since most deprivation indicators are improving over time, we expect multidimensional poverty to decline, as has been registered in Table 3, but clearly, how the MPI reduces depends upon the changes in the joint distribution of the deprivation indicators, as well as the weights for the component dimensions and indicators of the MPI.

Table 4 Incidence of Deprivation (in %) from the Global MPI Approach* : 2008-2017

Dimension	Indicator/ Sub-Indicator	2008	2013	2017
Education	E1: deprived in years of schooling	2.3	3.5	3.8
Health	H1: deprived in child mortality	1.9	3.0	2.9
Living Standards	**Deprived in Overall Living Standards**	62.6	74.2	74.0
	LS1: deprived in electricity	6.5	12.1	14.9
	LS2: deprived in sanitation	21.8	29.5	30.6
	LS3: deprived in source of water	7.0	9.6	10.1
	LS4: deprived in floor quality	7.3	9.3	8.5
	LS5: deprived in cooking fuel	49.4	62.7	64.8
	LS6: deprived in assets	33.2	39.3	40.6
	information asset-deprived (do not own tv, radio, celphone, or landline)	2.9	5.7	9.5
	livelihood-deprived	55.0	59.5	58.1
	mobility asset-deprived (no car/truck, motorcycle/tricycle, bicycle)	44.7	52.0	53.2

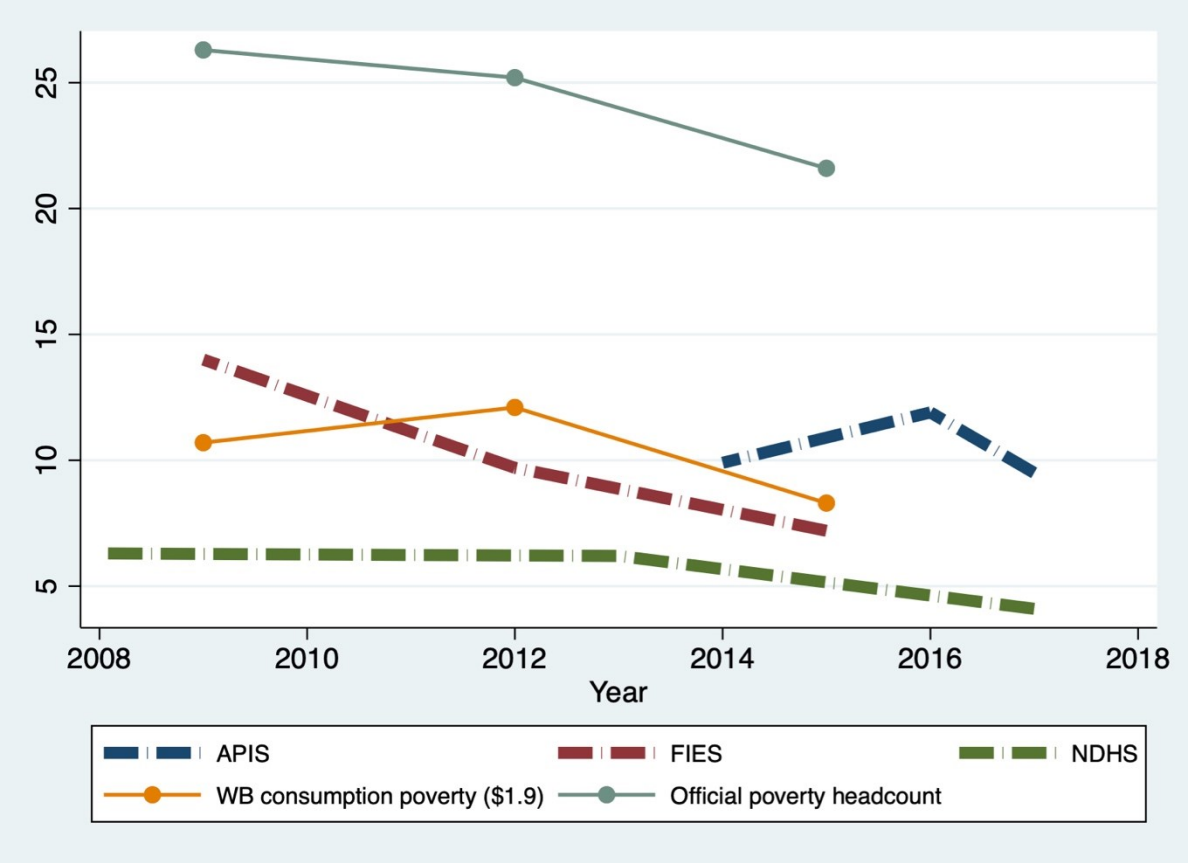
Note: Authors' calculations' using data sourced from NDHS, PSA.
*= 2014 approach to estimation of Global MPI

In the next sections, we look further into trends of multidimensional poverty measures, including the adjusted headcount (i.e. the MPI), resulting from the use of indicators listed in Table 1 and compare patterns with those generated from the global MPI. We also carry out examination of the robustness of underlying patterns generated if alternative weights to the nested-equal weights approach, viz., based on PCA are used.

4.1. Trends

Trends in multidimensional poverty headcount estimates based on the indicators identified in Table 1 are shown in **Figure 6**, together with estimates of monetary poverty headcounts in the period 2008 to 2017. All the three surveys suggested a reduction in multidimensional poverty headcount, but the levels of estimates of the headcount, and annual rates of change are survey-dependent. APIS yielded a 10.0% reduction in multidimensional poverty headcount from 2016 to 2017; FIES had a 2.3% annual reduction from 2009 to 2015, while NDHS yielded a 4.6% reduction per year. The reduction in the FIES multidimensional poverty headcounts, which are the least reduction across the three surveys, are midway that of the rates of reduction suggested by World Bank poverty estimates and official poverty rates. If one were to expect that economic growth should yield significant poverty reduction, it appears that the length of the survey instruments in the FIES is likely seriously eroding the quality of monetary poverty information and other aggregate information being generated (Albert *et al*. 2017), even non-monetary indicators that are used for the MPI generation in this study. Except for 2012, the FIES multidimensional poverty headcounts are fairly comparable to the World Bank estimates of consumption poverty.

Figure 6 Multidimensional Poverty Headcount and Monetary Poverty Headcounts



Notes: (i) Multidimensional Poverty Headcounts are authors' calculations' using data sourced from NDHS, PSA; (ii) World Bank consumption poverty rates were obtained from Povcalnet http://iresearch.worldbank.org/PovcalNet/povOnDemand.aspx ; (iii) Official poverty headcount sourced from PSA website https://psa.gov.ph/content/poverty-incidence-among-filipinos-registered-216-2015-psa .

Using the multidimensional poverty lens, the quality of life in the Philippines appears to be consistently improving though the resulting estimates and reduction in estimates are not robust, suggesting that the measurement crucially depends on the choice of indicators. Even when the indicators are fairly comparable as in the case of the FIES and APIS, the results vary considerably on account of the way the indicator is generated in the surveys. The expenditure module in APIS is far simpler and shorter in length than the corresponding module in FIES. However, it is interesting to notice that regardless of whether we look into monetary poverty or multidimensional poverty aggregates, the reduction is mostly more evident in later years, consistent also with results from the global MPI approach.

When traditional poverty measures, whether based on income- or consumption, are generated, these are also presented through a poverty profile which describes the major facts on poverty (Albert 2008; Haughton and Khander 2009; Albert *et al*. 2015). A poverty profile also illustrates the pattern of poverty to see it varies by various subpopulations, such as geography (urban or rural, regions, and so on), community characteristics (villages with and without a public school), and household and individual characteristics (for example, educational attainment of adult members or employment of household head). For instance, income poverty by regions in recent years suggests, Metro Manila has had the lowest (income) poverty rate across the regions at less than five percent of the population (followed by Calabarzon and Central Luzon), while the Autonomous Region of Muslim Mindanao (ARMM) has the highest (income) poverty headcount at more than half of the population (followed by Caraga, Eastern Visayas and Soccsksargen).

Annex Table A-2 lists selected multidimensional poverty measures by region using the FIES and APIS data. The multidimensional poverty headcounts based on FIES for the regions correlate very strongly with the APIS-based measures, as well with the income poverty profiles for the regions. Poverty is found to be worst in ARMM (at about a third of the population) according to the FIES-based multidimensional poverty measurement, and least in Central Luzon and Metro Manila, Calabarzon and Ilocos at under five percent. For the APIS-based multidimensional poverty measures, ARMM still has the highest poverty headcounts while the least headcounts are in Ilocos, Central Luzon, Calabarzon and Metro Manila.

Estimates of various poverty measures, viz., the official income poverty headcount, as well as the multidimensional poverty headcount, and MPI as of 2015 are provided in **Annex Table A-3**. These statistics, computed from 2015 FIES data, are given by economic sector of employment of the household head, as well as by geographic area (region and urban/rural location) for 2015, together with the contribution of the subpopulations to the poverty measures. The poverty profiles are fairly similar when seen from any of the three poverty measures. In both income- and multidimensional poverty measures, the largest concentration of poverty is in agriculture (at least half of the poor population), in rural areas (about three quarters of the population, and in Bicol, Western Visayas, Central Visayas, Soccsksargen, and ARMM regions. While accounting for about 12.5% of the country's population, Metro Manila contributes only about 5% or less to total poverty. These empirical results are expected since among subpopulations where the income-poor are concentrated, it is likely that the income poor are also deprived of services, especially health and education, in part because of the interlinkages of governance, geography and the provision of services.

As pointed out in earlier sections, the MPI, an adjusted headcount measure, is decomposable for the dimensions of the index. The decomposition by dimensions shown in **Table 6** allows for an identification of the relative contribution of each dimension to the aggregate

multidimensional poverty measure. For the APIS, health is the standard of living dimension that contributed the most to multidimensional poverty estimates, while for NDHS, education had the biggest contribution. For FIES, living standards or education surpassed the contribution of health. That the results are not robust is not surprising as indicators are not available across all the three surveys. The seemingly most comparable set of indicators are from the FIES and APIS. However, since expenditure is of less detail in the APIS, the food expenditure-based indicator (which proxies health and nutrition) may have had much less variability in the FIES than the corresponding one in the APIS. Consequently, this may have had led to the varying results on the contributions of the dimensions to MPI estimates across surveys.

Table 5 Contribution to MPI by Dimension

Data Source	MPI	Percent Contribution of Dimension to MPI		
		Education	Health	Living Standards
2017 APIS	0.028	20.8	46.8	32.4
2016 APIS	0.039	22.0	45.8	32.1
2014 APIS	0.059	19.7	46.8	33.5
2015 FIES	0.045	47.4	1.9	50.7
2012 FIES	0.057	47.4	1.4	51.2
2009 FIES	0.047	52.0	0.7	47.3
2017 NDHS	0.019	40.2	33.3	27.3
2013 NDHS	0.030	38.0	33.1	29.6
2008 NDHS	0.031	38.7	31.6	30.1

Notes: Authors' calculations' using data sourced from APIS, FIES, and NDHS, PSA

While there should be correlation between multidimensional poverty and monetary poverty, the relationship is not expected to be one-to-one. Some of those who are not deprived in monetary terms may have other deprivations, and those who may have deprivations in some monetary dimensions (such as education or health) need not be poor in income or consumption. However, we would expect that a substantial proportion of Filipinos who are from the lower part of (per capita) income distribution should be considered MPI poor or MPI vulnerable. Further, a substantial share of the upper part of income distribution should be without deprivations.

Table 7 gives a breakdown of Filipinos by (per capita) income clusters (see Albert *et al*. 2018) and by multidimensional poverty or vulnerability status in 2015 according to the FIES. Among the income poor, only a fifth (20.3%) are MPI-poor, but three-quarters (76.7%) are MPI-vulnerable and the remaining 3.0% are without deprivations. While among those who are low-income but not poor[11], nine-tenths (89.4%) are either MPI-poor or MPI-vulnerable, and the remaining proportion (10.6%) are found to be without deprivations. Of the non-lower income group (which comprises about two -fifths of all Filipinos), one-twentieth (6.%) have at least 20% deprivations (either MPI-poor or MPI-vulnerable), although the bulk of this is among the lower middle-income cluster.

[11] Those with per capita income higher than the poverty threshold, but lower than twice the poverty threshold (as per Albert *et al*. 2018).

Table 6 Distribution of Filipinos by (Per capita) Income Cluster and by MPI-Poverty or Vulnerability Status: 2015

Income Cluster	MPI poor	MPI-vulnerable with 20.0% - 33.3% deprivations	MPI-vulnerable with 0%-20.0% deprivations	Not MPI vulnerable, i.e. with 0% deprivations	Total
Poor	4.4	5.3	11.3	0.7	21.6
Low income but not poor	2.3	5.9	24.6	3.9	36.8
Lower middle income	0.4	1.8	17.2	7.0	26.4
Middle income	0.0	0.2	5.5	4.5	10.2
Upper middle income	0.0	0.1	1.3	2.3	3.7
Upper income but not rich	0.0	0.0	0.3	0.8	1.1
Rich	0.0	0.0	0.1	0.3	0.4
Total	7.2	13.2	60.3	19.3	100.0

Notes: Authors' calculations' using data sourced from FIES, PSA

Similarly, when we examine the APIS data, we would expect few of the poorest in income distribution to be viewed as not having any multidimensional deprivations, and likewise have few MPI-poor among those from the topmost of per capita income distribution. Based on the 2017 APIS, we find only 6.0 percent of those in the bottom (per capita) income quintile being considered MPI-not vulnerable (**Table 8**). Further, among the top three quintiles, only a tenth (9.8%) are found to have at least 20% deprivations (i.e. being MPI poor or MPI-vulnerable with 20-33 percent deprivations).

Table 7 Distribution of Filipino households by (Per capita) Income Quintile and by MPI-Poverty or Vulnerability Status: 2017

Income Quintile	MPI poor	MPI-vulnerable with 20.0% - 33.3% deprivations	MPI-vulnerable with 0%-20.0% deprivations	Not MPI vulnerable, i.e. with 0% deprivations	Total
Lowest quintile	4.1	3.3	11.4	1.2	20.0
Second lowest quintile	1.7	2.0	13.1	3.2	20.0
Middle quintile	1.4	1.3	12.8	4.5	20.0
Second to the richest quintile	1.5	0.6	11.8	6.1	20.1
Richest quintile	0.9	0.2	9.0	9.9	19.9
Total	9.5	7.4	58.2	25.0	100.0

Notes: Authors' calculations' using data sourced from APIS, PSA

4.2. Robustness

We further explore the issue of robustness of the empirical results by looking into two weighting schemes discussed earlier (the nested equal weights and weights obtained from principal components analysis). The results are shown in **Table 9** for the indicators across the three waves of surveys employed in this study. Both weighting schemes examined here are fixed over time. Notable differences in estimates of multidimensional poverty measures are observed across the two sets of weights (as in the empirical findings of Datt 2017, who also tried out alternative weighting schemes for MPI estimation). We notice that the measures using

PCA-based weights are much higher (twice to triple) compared to those using nested equal weights for both the FIES and APIS. Further, for the FIES data, the multidimensional poverty headcounts using PCA-based weights are fairly similar (and, in fact, even slightly higher) estimates of the proportion in poverty, compared to the official poverty headcounts. The PCA-based multidimensional poverty headcount estimates dropped only by about one percentage point from 2009 to 2012, while the estimates from 2012 to 2015 reduced by four percentage points. Interestingly, this reduction is similar also to the decreases (in percentage points) for the official (income-based) poverty headcounts during the same period. The lack of robustness in use of composite indices confirms typical expectations and findings that such indices are crucially dependent upon the choice of indicators, and the weights used for these indicators, and put serious question on whether we may be actually observing the precise quantity of signals in multidimensional poverty changes across time.

Table 8 Multidimensional Poverty Measures Using Nested Equal Weights (NEW) and Principal Components Analysis (PCA)-Based Weights: 2008-2017

(a) FIES

Multidimensional Poverty Measure	2015 FIES		2012 FIES		2009 FIES	
	NEW	PCA	NEW	PCA	NEW	PCA
Multidimensional Poverty Index (MPI = H*A)	0.028	0.126	0.039	0.149	0.059	0.160
Headcount ratio: H Population in multidimensional poverty (%)	7.2	25.1	9.7	28.9	14.0	29.9
Intensity A of deprivation among the poor (%)	39.6	50.1	40.1	51.7	42.3	53.5
Proportion (in %) multidimensionally vulnerable to poverty (who experience more than 0 but less than 20% intensity of deprivations)	60.3	34.3	59.1	34.0	53.1	33.1
Proportion (in %) multidimensionally vulnerable to poverty (who experience 20-33.32% intensity of deprivations)	13.2	21.3	15.9	21.8	18.1	22.2
Proportion (in %) of the population with no deprivations (intensity=0)	19.3	19.3	15.4	15.4	14.9	14.9
Proportion (in %) of the population in severe poverty (with intensity higher than 50%)	1.0	10.5	1.4	13.4	3.5	14.7
Contribution of education dimension to multidimensionally poor (in %)	47.4	9.9	47.4	10.8	52.0	17.1
Contribution of health dimension to multidimensionally poor (in %)	1.9	0.0	1.4	0.0	0.7	0.0
Contribution of living standards dimension to multidimensionally poor (in %)	50.7	90.0	51.2	89.1	47.3	82.9
total number of sampled households	41,539	41,539	40,168	40,168	38,400	38,400

Notes: Authors' calculations' using data sourced from FIES, PSA

(b) APIS

Multidimensional Poverty Measure	2017 APIS		2016 APIS		2014 APIS	
	NEW	PCA	NEW	PCA	NEW	PCA
Multidimensional Poverty Index (MPI = H*A)	0.045	0.086	0.057	0.106	0.047	0.112
Headcount ratio: H Population in multidimensional poverty (%)	9.5	18.0	11.9	21.3	9.9	23.1
Intensity A of deprivation among the poor (%)	47.4	47.9	47.8	49.7	47.2	48.5
Proportion (in %) multidimensionally vulnerable to poverty (who experience more than 0 but less than 20% intensity of deprivations)	58.2	38.3	58.1	38.9	59.0	35.9
Proportion (in %) multidimensionally vulnerable to poverty (who experience 20-33.32% intensity of deprivations)	7.4	18.8	9.0	18.7	9.0	18.9
Proportion (in %) of the population with no deprivations (intensity=0)	25.0	25.0	21.1	21.1	22.1	22.1
Proportion (in %) of the population in severe poverty (with intensity higher than 50%)	3.7	6.5	4.9	9.1	4.0	9.2
Contribution of education dimension to multidimensionally poor (in %)	20.8	7.8	22.0	8.0	19.7	5.9
Contribution of health dimension to multidimensionally poor (in %)	46.8	5.2	45.8	5.0	46.8	4.6
Contribution of living standards dimension to multidimensionally poor (in %)	32.4	87.0	32.1	86.9	33.5	89.5
total number of sampled households	9,732	9,732	10,295	10,295	7,831	7,831

Notes: Authors' calculations' using data sourced from APIS, PSA

5. Summary and Policy Implications

With income poverty reduction being meager in the Philippines in recent years despite strong economic growth suggests that that economic growth has not been inclusive (Albert et al 2014). This study shows that multidimensional measures of poverty indicate a far bigger decline in poverty than what can be observed from income or consumption poverty metrics, whether seen from official statistics or the poverty rates estimated using international poverty lines. However, the multidimensional measures are not robust, both in levels, in the reductions, and in the contributions of the dimensions. The empirical results in the estimation fundamentally depend on the choice of the data source, the component indicators used, as well as the selection of weights for the indicators.

There is unanimity in recognition that poverty is multidimensional, and that having a single indicator of poverty, whether based on income or consumption data, will in no way fully capture the complexity of poverty. Having a single composite index for summarizing multidimensional poverty may seem attractive, as in the case in measuring progress and quality of life, but it is unclear how such a composite index for multidimensional poverty can really contribute to better thinking about poverty, or better policies for eradicating poverty.

The MPI component indicators are a combination of data on stocks and flows, and of inputs to economic well-being and social development outcomes, which makes the composite index appear like a fruit salad that combines apples, oranges, grapes, and other fruits. The global MPI and its variants do not put a dimension on labor and employment, although there is nothing that stops analysts from using a different set of dimensions (see, e.g. Datt 2017). When generating composite indices, the fundamental question are (a) whether the entire exercise adds "apples and oranges" ; (b) if so, what fruits should be mixed? (c) and in what proportions? In measuring income or consumption poverty, an analyst relies on economic theory, which says that under certain conditions market prices provide the correct weights for the aggregation of the monetary indicator. For composite indices such as the MPI, HDI and SPI, no consensus exists on how the multiple dimensions and indicators should be weighted to form the index. That these indices add up fundamentally different things in a rather arbitrary way suggests this may not necessarily be the way to refine poverty measurement even if current methodology is imperfect especially in capturing the multidimensional nature of poverty.

While we have to recognize that there are important aspects of welfare that cannot be captured in the proportion of persons with consumption less than $1.90 per person per day (in PPP 2011 prices), or even with the official income poverty rates released by NSOs such as the PSA, but neither can everything be put into a single index, whether the MPI, or even the HDI or SPI. These composite indices can certainly be used for policy advocacy to show disparities across countries, or disparities within countries, but ultimately, policies will have to examine the specific components of these indices.

Government is well advised to tread carefully in its decision to generate an official measure of multidimensional poverty. Should it continue with its decision, the PSA and NEDA should work out a communication plan for explaining a change in the indices to be generated, and how this measurement system ultimately relates with the official income poverty measurement. If the communication strategy will merely attempt to show changes in the components of the indices, then this may not be helpful.

The generation of multidimensional measures of poverty may, however, be justified from the perspective that poverty is not static, and neither should its measurement, especially given the various risks to future poverty that people face, and the intersections of the various dimensions of poverty with traditional poverty measurement(see Table 8). Toward this end, if government decides to start working on a multidimensional poverty measure, it is important to decide the specific data source for the actual measurement. Given that APIS already makes use largely of the FIES income schedule, and that PSA generates poverty statistics from the half semester income data of the APIS, there may be some opportunities of exploring the wealth of welfare indicators in the APIS to relate monetary poverty with multidimensional poverty. The use of indicators, such as experience of hunger, and non-coverage of health insurance, other than those used in this study, may also be looked into. The estimation of multidimensional poverty, however, might be best left not to the PSA itself, but to research institutions in order not to confuse the public about the different estimates of multidimensional poverty headcounts, and official income poverty headcounts. Clearly, this study suggests that multidimensional poverty estimation has linkages with income (and consumption) poverty, but the results are not robust. Further, this study also suggests that economic growth in recent years has translated to better quality of life, both in income and non-monetary measures and that government will need to find ways of not only ensuring inclusive prosperity amidst growth, as well as examine prospects for improving current understanding of the many dimensions of poverty so that as we continue our economic growth path, no person will be left behind.

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Annex Table A-1 Dimensions and Indicators of the Multidimensional Poverty Index.

Dimension	Indicators (and weights)	2018	2014	2010
Education	a) Years of schooling (1/6)	Deprived if no household member **aged ten years or older** has completed **six years** of schooling.	Deprived if no household member has completed **five years** of schooling.	Deprived if no household member has completed **five years** of schooling.
	b) Child school attendance (1/6)	Deprived if any school-aged child is not attending school up to the age at which he/she would complete class 8[a].	Deprived if any school-aged child is not attending school up to the age at which he/she would complete class 8[a].	Deprived if any school-aged child is not attending school up to the age at which he/she would complete class 8[a].
Health	a) Child mortality (1/6)	Deprived if any child has died in the family in the **five-year period preceding the survey**.	Deprived if any child has died in the family.	Deprived if any child has died in the family.
	b) Nutrition (1/6):	Deprived if any person **under 70 years of age** for whom there is nutritional information is undernourished [b2].	Deprived if any adult or child for whom there is nutritional information is malnourished [b1].	Deprived if any adult or child for whom there is nutritional information is malnourished [b1].
Standard of Living	a) Electricity (1/18)	Deprived if the household has no electricity.	Deprived if the household has no electricity.	Deprived if the household has no electricity.
	b) Sanitation (1/18)	Deprived if the household's sanitation facility is not improved (according to SDG guidelines) or it is improved but shared with other households. (A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared. If survey report uses other definitions of 'adequate' sanitation, we follow the survey report.)	Deprived if the household's sanitation facility is not improved (according to MDG guidelines), or it is improved but shared with other households. (A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared.)	Deprived if the household's sanitation facility is not improved (according to MDG guidelines), or it is improved but shared with other households. (A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared.)

Dimension	Indicators (and weights)	2018	2014	2010
	c) Safe Drinking water (1/18)	Deprived if the household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk from home, roundtrip. (A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within a 30-minute walk (round trip). If survey report uses other definitions of 'safe' drinking water, we follow the survey report.)	Deprived if the household does not have access to safe drinking water (according to MDG guidelines) or safe drinking water is more than a 30-minute walk from home roundtrip. (A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within a distance of 30 minutes' walk (roundtrip).)	Deprived if the household does not have access to safe drinking water (according to MDG guidelines) or safe drinking water is more than a 30-minute walk from home roundtrip. (A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within a distance of 30 minutes' walk (roundtrip).)
	d) Floor (1/18)	Deprived if the household has inadequate **housing**: the **floor is of natural materials** or the **roof or wall are of rudimentary materials**. (i.e., if floor is made of mud/clay/earth, sand or dung; or if dwelling has no roof or walls or if either the roof or walls are constructed using natural materials such as cane, palm/trunks, sod/mud, dirt, grass/reeds, thatch, bamboo, sticks, or rudimentary materials such as carton, plastic/ polythene sheeting, bamboo with mud/stone with mud, loosely packed stones, uncovered adobe, raw/reused wood, plywood,	Deprived if the household has a dirt, sand, or dung floor.	Deprived if the household has a dirt, sand, or dung floor.

Dimension	Indicators (and weights)	2018	2014	2010
		cardboard, unburnt brick or canvas/tent.)		
	e) Cooking fuel (1/18)	Deprived if the household cooks with dung, wood or charcoal.	Deprived if the household cooks with dung, wood or charcoal.	Deprived if the household cooks with dung, wood or charcoal.
	f) Assets ownership (1/18)	Deprived if the household does not own more than one of these assets: radio, TV, telephone, **computer, animal cart**, bicycle, motorbike or refrigerator, and does not own a car or truck.	Deprived if the household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck.	Deprived if the household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck.

Notes:

[a] = Data source for age children start primary school: United Nations Educational, Scientific and Cultural Organization, Institute for Statistics database, Table 1. Education systems

[b1] = Adults are considered malnourished if their BMI is below 18.5 m/kg2. Children are considered malnourished if their z-score of weight-for-age is below minus two standard deviations.

[b2] = Adults 20 to 70 years are considered malnourished if their Body Mass Index (BMI) is below 18.5 m/kg2. Those 5 to 20 are identified as malnourished if their age-specific BMI cutoff is below minus two standard deviations. Children under 5 years are considered malnourished if their z-score of either height-for-age (stunting) or weight-for-age (underweight) is below minus two standard deviations from the median of the World Health Organization 2006 reference population. In a majority of the countries, BMI-for-age covered people aged 15 to19 years, as anthropometric data was only available for this age group; if other data were available, BMI-for-age was applied for all individuals above 5 years and under 20 years.

Annex Table A-2 Intensity of Deprivation, Multidimensional Poverty Headcount and Proportion of Population Deprived in Living Standards, Education and Health Dimensions : 2009-2017
(a) FIES

Region	FIES 2015					FIES 2012					FIES 2009				
	intensity	headcount	living standards deprived	education deprived	health deprived	intensity	headcount	living standards deprived	education deprived	health deprived	intensity	headcount	living standards deprived	education deprived	health deprived
Ilocos Region	35.5	3.6	74.4	15.4	0.1	36.7	3.7	77.4	16.1	0.3	38.8	5.8	80.7	22.4	0.1
Cagayan Valley	38.5	4.7	68.9	15.3	0.3	37.7	6.9	81.2	18.2	0.2	39.5	10.8	77.8	30.9	0.1
Central Luzon	36.0	2.1	64.3	14.0	0.1	36.9	3.7	70.8	19.1	0.1	40.7	4.3	69.7	25.2	0.0
Bicol Region	38.3	8.7	84.8	18.5	0.1	39.1	10.4	87.4	21.2	0.1	42.8	19.6	87.3	38.2	0.1
Western Visayas	40.1	9.8	86.9	16.1	0.1	40.8	11.7	87.7	18.9	0.1	42.4	20.3	89.9	31.6	0.0
Central Visayas	39.3	8.1	80.7	19.0	0.4	40.1	12.6	84.8	21.6	0.3	43.0	20.8	84.2	34.6	0.3
Eastern Visayas	39.1	9.2	83.6	20.8	0.2	38.7	15.2	87.8	26.7	0.2	41.8	21.4	85.3	40.3	0.2
Western Mindanao	40.7	12.4	84.7	21.6	0.5	42.2	19.0	87.7	27.7	0.7	43.6	29.7	87.8	44.3	0.5
Northern Mindanao	39.6	7.7	82.5	18.3	0.3	40.8	9.8	82.4	24.9	0.3	41.1	16.2	84.5	35.0	0.2
Southern Mindanao	39.7	8.0	77.5	18.4	0.1	41.2	12.0	82.3	24.0	0.1	43.6	17.7	83.1	36.5	0.5
Central Mindanao	40.3	15.1	84.4	22.9	0.1	41.1	18.5	88.1	28.3	0.3	43.6	20.2	86.7	35.3	0.1
NCR	36.8	2.4	78.6	11.0	0.1	36.1	3.2	81.7	14.8	0.0	36.9	3.2	82.2	18.6	0.0
CAR	38.7	3.9	82.3	13.9	0.2	37.8	4.9	86.5	18.1	0.1	39.7	8.6	85.7	25.6	0.1
ARMM	41.8	29.3	97.8	35.8	0.0	41.6	37.2	98.5	43.8	0.1	43.3	40.6	96.7	53.7	0.0
CARAGA	39.6	7.3	78.5	20.8	0.4	39.7	10.9	87.2	24.2	0.2	41.1	15.6	87.8	32.8	0.2
CALABARZON	37.2	3.2	76.8	13.3	0.1	37.5	3.8	82.0	18.4	0.1	40.3	6.7	79.9	24.5	0.0
MIMAROPA	42.4	11.4	79.7	20.2	0.2	42.8	17.0	84.6	24.0	0.2	44.8	23.5	85.7	37.8	0.1
PHILIPPINES	39.6	7.2	79.0	17.0	0.2	40.1	9.7	83.1	21.3	0.2	42.3	14.0	82.9	30.8	0.1

Notes: Authors' calculations' using data sourced from FIES, PSA

(b) APIS

Region	APIS 2017					APIS 2016					APIS 2014				
	intensity	headcount	living standards deprived	education deprived	health deprived	intensity	headcount	living standards deprived	education deprived	health deprived	intensity	headcount	living standards deprived	education deprived	health deprived
Ilocos Region	40.0	4.9	63.3	6.5	4.3	41.6	5.7	67.2	7.6	3.7	42.0	17.3	73.1	10.3	3.9
Cagayan Valley	42.8	11.7	55.6	14.9	5.1	42.5	13.0	61.2	10.2	8.1	43.4	12.2	59.4	9.1	7.5
Central Luzon	45.5	5.2	58.1	6.4	1.8	44.8	5.0	64.8	7.5	5.5	40.4	7.4	65.4	9.2	2.9
Bicol Region	45.8	8.6	67.4	7.5	4.9	44.6	8.9	76.5	13.0	4.0	48.7	37.3	84.0	13.4	5.6
Western Visayas	48.5	23.6	80.1	12.1	6.0	51.3	34.4	85.0	12.9	7.0	50.3	28.2	83.4	12.0	7.5
Central Visayas	53.2	31.2	85.2	16.0	6.4	48.9	31.3	84.2	11.1	8.6	51.6	34.6	75.2	12.5	12.0
Eastern Visayas	47.4	23.8	79.9	7.9	11.7	50.1	31.6	81.6	13.8	14.9	49.8	40.9	86.3	15.1	15.9
Western Mindanao	47.3	27.7	84.2	13.5	7.7	46.3	37.0	84.0	18.7	10.2	47.8	36.7	80.5	10.7	11.8
Northern Mindanao	49.7	35.1	79.3	16.2	10.4	50.3	36.5	89.0	14.3	14.4	49.7	36.5	78.8	10.9	19.9
Southern Mindanao	47.2	30.0	84.9	11.9	10.6	49.0	24.8	76.3	13.1	13.7	48.9	27.6	82.7	10.3	10.5
Central Mindanao	47.1	22.4	75.0	10.4	8.7	50.3	27.0	77.5	13.4	6.5	49.2	35.8	79.8	12.0	9.1
NCR	52.2	36.9	82.0	15.3	12.4	52.9	31.3	81.6	17.2	9.2	46.1	10.4	80.0	5.4	2.2
CAR	41.7	8.3	78.5	5.7	3.5	44.6	9.6	77.5	6.3	3.3	45.9	14.5	78.4	11.0	4.3
ARMM	43.3	13.1	77.3	8.6	8.6	46.1	24.5	84.5	10.4	11.1	50.3	58.1	95.8	19.0	2.6
CARAGA	46.6	51.7	92.3	17.9	4.0	58.7	68.7	98.1	43.0	14.0	49.0	24.1	74.0	12.5	6.6
CALABARZON	47.3	29.7	80.6	13.8	10.2	46.4	23.7	72.6	11.8	9.1	45.6	11.7	70.2	7.2	2.3
MIMAROPA	48.3	19.1	71.8	10.5	4.6	54.1	41.9	86.4	15.2	16.8	50.9	36.8	80.2	9.3	7.6
PHILIPPINES	47.9	18.0	74.2	9.9	6.3	49.7	21.3	77.7	12.4	7.8	48.5	23.1	76.7	10.0	6.6

Notes: Authors' calculations' using data sourced from APIS, PSA

Annex Table A-3 Income Poverty and Multidimensional Poverty Profiles by Various Subpopulations: 2015

Subpopulation	Total Population	Percent Contribution	Income Poverty Headcount	Percent Contribution	MPI headcount	Percent Contribution	MPI (in %)	Percent Contribution
a. Sector of Employment of Head								
Agriculture	25,449,931	29.9	43.3	56.0	15.7	62.4	45.8	50.6
Industry	13,332,916	15.7	20.8	14.1	6.4	13.3	25.6	14.6
Services	31,633,201	37.1	12.4	19.9	3.3	16.1	15.7	22.5
Not employed	14,787,919	17.4	13.3	10.0	3.6	8.2	17.2	12.3
b. Region								
Ilocos Region	5,136,000	5.1	13.1	3.1	3.6	2.5	20.3	4.2
Cagayan Valley	3,497,900	3.4	15.8	2.5	4.7	2.3	18.9	2.7
Central Luzon	11,098,900	10.9	11.2	5.7	2.1	3.2	10.8	4.3
Bicol Region	6,032,100	5.9	36.0	9.9	8.7	7.2	35.6	8.3
Western Visayas	7,704,399	7.6	22.4	7.9	9.8	10.4	38.5	11.5
Central Visayas	7,446,800	7.3	27.6	9.4	8.1	8.3	29.3	8.3
Eastern Visayas	4,537,200	4.5	38.7	8.0	9.2	5.7	31.2	5.8
Western Mindanao	3,759,323	3.7	33.9	5.8	12.4	6.4	39.7	5.4
Northern Mindana	4,706,700	4.6	36.6	7.8	7.7	5.0	27.3	4.9
Southern Mindana	4,963,100	4.9	22.0	5.0	8.0	5.5	31.4	5.7

Subpopulation	Total Population	Percent Contribution	Income Poverty Headcount	Percent Contribution	MPI headcount	Percent Contribution	MPI (in %)	Percent Contribution
Central Mindanao	4,599,200	4.5	37.3	7.8	15.1	9.5	43.8	7.5
NCR	12,651,700	12.5	3.9	2.3	2.4	4.2	11.1	5.2
CAR	1,783,500	1.8	19.7	1.6	3.9	1.0	20.9	1.4
ARMM	3,706,900	3.7	53.7	9.1	29.3	14.9	75.9	10.4
CARAGA	2,716,700	2.7	39.1	4.8	7.3	2.7	28.1	2.9
CALABARZON	14,127,200	13.9	9.1	5.9	3.2	6.3	13.3	6.8
MIMAROPA	3,089,300	3.0	24.4	3.4	11.4	4.9	37.1	4.8
c. Location								
Rural	57,982,846	57.1	29.8	78.9	9.7	77.4	33.0	74.3
Urban	43,574,077	42.9	10.6	21.1	3.8	22.6	16.3	25.7
PHILIPPINES	101,556,923	100.0	21.6	100.0	7.2	100.0	26.1	100.0

Notes: Authors' calculations' using data sourced from 2015 FIES, PSA