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Understanding Food Inequality in the Philippines Using Engel Curves, Lorenz Curves, and Kernel Distributions

Nashrine B. Aliping, Mazel G. Pizarro, Paolo O. Reyes, and John Paolo R. Rivera

Alleviating poverty, characterized by income inequality and inequity, is a major developmental concern for developing economies. It is also the overarching goal of development organizations as in the United Nations' Millennium Development Goals (MDG) of 2015. In Southeast Asia, it has been tenacious that it is regarded as the basket case. In the Philippines, there is a perceptible unequal income distribution leaving Filipino households in the lower income deciles vulnerable to impoverished living conditions and depravity from basic necessities (Schelzig, 2005). These basic necessities (nonmonetary categories that define whether individuals are poor), according to the International Labor Organization (ILO) as cited by Schelzig (2005), are food, water and sanitation, health, education, and shelter. Likewise, income shocks have incapacitating effects to poor households (Albert & Ramos, 2010), compelling them to engage in risky schemes that pose negative and irreversible effects that would put them in a deeper state of poverty.

To give an overview of the state of poverty in the Philippines, according to the Philippine Statistical Authority (PSA) (formerly National Statistics

Office [NSO]) (http://psa.gov.ph), in 2014, the share of food and nonalcoholic beverages to total household expenditures is 41.2% (grew by 4.0% but showed a slowdown from its 5% growth in 2013). It can be taken that food takes a significant portion of income allocation among other priorities of consumption spending by (poor) households (Reyes, 2001).

With income inequality in the country, food inequality will also follow. This is possible through the income channel—households in the lower income deciles are most likely unable to afford decent food. Also, a decrease in real income indicates a reduced capacity of households to spend on food. Hence, households are obliged to concentrate household expenditure on food above other basic necessities—those enumerated by ILO.

The National Statistical Coordination Board (NSCB) (http://www.nscb.gov.ph) of the Philippines and PSA observes standard measures to assess the depth of poverty—poverty incidence, Gini coefficients, and income and expenditure ratios all relate to the traditional measures of welfare, which are income levels. In the Philippines, there are two official measures of poverty—poverty and food thresholds (Schelzig, 2005). In fact, according to Pedro, Candelaria, Velasco, and Barba (n.d.), estimated food threshold adjusted to the lower 30% of the income distribution, representing the poor segment of the population, is a gauge of poverty incidence through food consumption.

Establishing the link between poverty and hunger incidences, our main research questions are: (1) What are the factors that uphold this prevalence of food inequality? (2) Are the poverty reduction programs of the government effective in reducing the probability of a household experiencing hunger? To address these research questions, we have the following research objectives:

1. To understand the depth of food inequality in the Philippines by estimating Lorenz curves and Epanechnikov kernel densities at the regional and national levels;
2. To show the responsiveness of household food consumption to changes in various sources of household income by estimating Engel curves at the regional and national levels;
3. To show if the government's poverty reduction programs can address hunger incidence; and
4. To provide policy recommendations on how to reduce the incidence of hunger.

Our results can provide a framework for policymakers in improving program design and implementation. Results can also suggest alternative programs that can improve poor households' welfare and alleviate hunger incidence.

Poverty and Food Inequality

Poverty is a multifaceted concept. It is not restricted to simply being defined as the inadequacy of income. The concept evolves from the traditional definition through income as a gauge of individual welfare towards deprivation of basic capabilities (Sen, 1979) to a dynamic and complex situation capturing the idea of vulnerability and powerlessness—projected by the deprivation of access to other assets that is important for survival (Schelzig, 2005).

Albert and Molano (2009) discussed that in developing economies, poverty lines basically measure absolute poverty and are based on a fixed standard of welfare adjusted with respect to inflation. In the Philippines, the estimated poverty line is a representation of income needed to satisfy the minimal needs (food and nonfood) of a household. The food aspect is referred to as the food poverty line (FPL), which utilizes one-day menus that meet the required daily dietary needs and nominally valued at the least possible price. Alternatively, Pedro et al. (n.d.) estimated food threshold and poverty incidence using the food baskets across income groups. This is a comparative study between the estimated poverty incidence and food threshold between all income groups versus the bottom 30%. Results revealed that the food basket of the higher income group consists of food and other commodities that are more complex and expensive as compared to the lower 30%. For both studies, it can be deemed that nutritional intake and food basket composition are also relevant in defining poverty and measuring household welfare.

Poverty in the Philippines

With the recent global financial crisis in 2008, continuous severe natural calamities (i.e., Typhoon Haiyan, Bohol earthquake in 2013), and rising fuel and food prices, implementing programs aimed to reduce poverty is becoming extra challenging.

Table 1 shows that in 2012, a household with five members will need PHP 5,513.00 of monthly income to afford their minimum basic food requirements and PHP 7,890.00 monthly for their minimum basic food and nonfood requirements. This represents an increase of about 12.3% for both the food and poverty thresholds between 2009 and 2012. Such increases constitute average annual inflation of about 4.1% between 2009 and 2012. Similarly, the proportion of Filipino households in extreme poverty whose incomes are not sufficient to meet basic food needs stands at 7.5% (lower than the 7.9% and 8.8% estimates in 2009 and 2006, respectively).

Looking at poverty incidence, Table 1 shows that 19.7% of Filipino households were poor in 2012 (insignificantly lower than the 20.5% and 21.0% estimates in 2009 and 2006, respectively). Based on the figures and given the country's rapid population growth, although it can be seen that the proportion of poor households as been practically similar between 2006 and 2012, the estimated number of poor households has increased from 3.8 million in 2006 to 4.2 million in 2012.

Table 1. Full Year Thresholds, Incidences, and Magnitude of Poor

Year	2006	2009	2012
Monthly food threshold for a family of five (PHP)	3,878	4,908	5,513
Subsistence incidence (%)			
Families	8.80	7.90	7.50
Population	12.00	10.90	10.40
Magnitude of extreme (subsistence) poor (in millions)			
Families	1.60	1.55	1.61
Population	10.23	9.70	9.81
Monthly poverty threshold for a family of five (PHP)	5,566	7,030	7,890
Poverty incidence (%)			
Families	21.0	20.5	19.7
Population	26.6	26.3	25.2
Magnitude of poor (in millions)			
Families	3.81	4.04	4.21
Population	22.64	23.30	23.75

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Other poverty measures include the *income gap* (measures the amount of income required by the poor to get out of poverty in relation to the poverty threshold itself), *poverty gap* (mean shortfall from the poverty line, expressed as a percentage of the poverty line), and *squared poverty gap* (squares the poverty gap for each household putting more emphasis on observations that fall far short of the poverty line rather than those that are closer).

From Table 2, in 2012, the income gap was estimated at 26.2%—that is, on the average, a poor household with five members needed a monthly additional income of about PHP 2,067.00 to get out of poverty. Such

information is useful to determine the required budget to reduce poverty in the country. That is, suppose the state will provide cash transfer to all poor households in terms of what they would require to cross the poverty line, a total of PHP 124 billion in 2012 is needed to alleviate poverty, exclusive of targeting costs (Note: the budget allocated for conditional cash transfers [CCT] for 2012 is PHP 39.4 billion).

Table 2. Income Gap, Poverty Gap, and Severity of Poverty

Year	2003	2006	2009	2012
Income gap	27.7	27.5	26.2	26.2
Poverty gap	5.6	5.8	5.4	5.1
Severity of poverty	2.2	2.2	2.0	1.9

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Reyes, Tabuga, Mina, Asis, and Datu (2010) pointed out that poverty in the country is characterized by the glaring income inequality as seen in Figure 1. Illustrated in Figure 1 are the thematic maps of the 2012 income gap, poverty gap, and severity of poverty where red shades show higher gaps and are therefore comparatively worse off areas than green-shaded areas. The darker the red, the worse off the situation in that area is compared to the rest, and the darker the green shade, the better off. Provinces with higher income gaps and poverty gaps are concentrated more in Mindanao than in Luzon and Visayas. There are significantly higher poverty incidences in rural areas (Eastern Visayas, Zamboanga Peninsula, and Central Mindanao) compared to the National Capital Region (NCR), Cebu, and Davao. The map highlights the reality that poverty in the country is geographical suggesting calls for more programs in alleviating poverty in regions with significantly worse conditions.

National averages do not show the staggering urban and rural differences and also the regional variations. As emphasized by Schelzig (2005), national averages also do not indicate regional and provincial disparities, which are shown in Table 3. This corroborates that there is a need to employ well-designed policies that accounts for regional and provincial profile for a strategic distribution to potential key areas promoting a more socially and economically equal society. From Table 3, the regions with the lowest poverty incidence among families in 2006, 2009, and 2012 continue to be the rural areas of the National Capital Region (NCR), Central Luzon, and CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon). Meanwhile, rural areas like the Autonomous Region in Muslim Mindanao (ARMM),

Zamboanga Region, and Caraga consistently reported the highest poverty incidence among families. While it might seem that there were no significant changes in nationwide poverty conditions from between 2003 and 2012, data show that Caraga improved its poverty incidence significantly from 46.0% in 2009 to 31.9% in 2012.

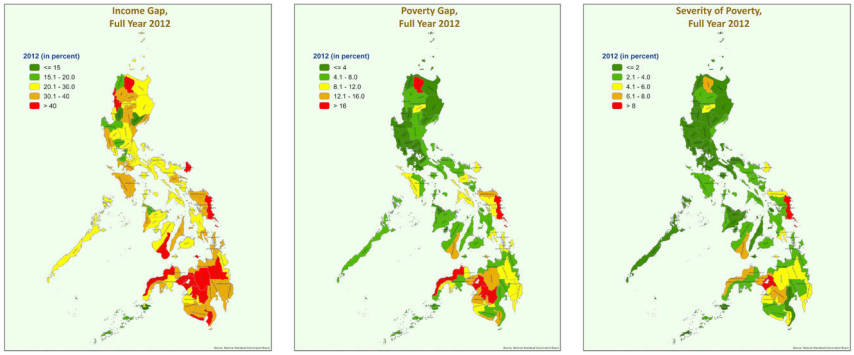


Figure 1. Thematic map of 2012 income gap, poverty gap, and severity of poverty. Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Table 3. Annual per Capita Poverty Threshold and Poverty Incidence Among Families

Region	Annual per Capita Poverty Threshold (PHP)				Estimated Poverty Incidence Among Families			
	2003	2006	2009	2012	2003	2006	2009	2012
Philippines	10,976	13,357	16,871	18,935	20.0	21.0	20.5	19.7
NCR	13,997	15,699	19,227	20,344	2.10	2.9	2.4	2.6
CAR	10,881	14,107	17,243	19,483	16.10	21.1	19.2	17.5
Ilocos	11,791	14,107	17,595	18,373	17.8	19.9	16.8	14.0
Cagayan Valley	10,350	13,944	17,330	19,125	15.2	21.7	20.2	17.0
Central Luzon	12,771	14,422	18,188	20,071	9.4	10.3	10.7	10.1
CALABARZON	12,394	13,241	17,033	19,137	9.2	7.8	8.8.	8.3
MIMAROPA	10,398	12,645	15,613	17,292	29.8	32.4	27.2	23.6
Bicol	11,476	13,240	16,888	18,257	38.0	35.4	35.3	32.3
Western Visayas	10,548	12,684	15,971	18,029	23.5	22.7	23.6	22.8
Central Visayas	11,798	13,963	16,662	18,767	32.1	30.7	26.0	25.7

Table 3 continued...

Eastern Visayas	9,850	12,520	16,278	18,076	30.2	33.7	34.5	37.4
Zamboanga Peninsula	9,642	12,743	16,260	18,054	40.5	40.0	39.5	33.7
Northern Mindanao	10,501	12,917	16,878	19,335	32.4	32.1	33.3	32.8
Davao	10,737	13,389	17,120	19,967	25.4	25.4	25.5	25.0
SOCCSKSARGEN	10,277	13,319	16,405	18,737	27.2	31.2	30.8	37.1
Caraga	10,355	14,324	18,309	19,629	37.6	41.7	46.0	31.9
ARMM	9,664	12,647	16,683	20,517	35.0	40.5	39.9	48.7

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Root causes of poverty. Although the Philippines has been vigilant in addressing poverty, it has been lethargic compared to other Southeast Asian economies that have been effective in reducing their respective poverty incidences. Even Cambodia, Indonesia, and Vietnam, whose annual real gross domestic product (GDP) growth rate is lower than the Philippines (United Nations [UN], 2010), have outperformed the country in reducing poverty for the past twenty years. This can be attributed to the slow growth of the economy accompanied by rapid population growth; hence, the country is subjected to a slow growth in per capita income. Nonetheless, even if an economy is experiencing high growth, the quality of growth is critical as economic growth may or may not be propoor. As explained by Aldaba (2009), if the economy failed to maintain a high level of sustained growth, it cannot generate the necessary employment that will allow the poor to combat poverty further widening the poverty gap.

The rapid population growth can also be looked into. Orbeta (2002) and Schelzig (2005) emphasized that high fertility is related to the decline in human capital investments, that is, an additional member of the family means the usually insufficient income and family resources are divided further. The rapid population growth impedes economic development for two interconnected reasons as per Schelzig (2005): (1) rapid population growth lessens per capita income, since the people, especially the poor cannot sacrifice basic commodities, their savings and the resource for investment in productive capacity reduced; and (2) the country's large population that is rapidly expanding exceeds the capacity of the industry to absorb new labor—more unemployed individuals, lower quality of employment. Even with many Filipinos working overseas, unemployment rates are still high

(Aldaba, 2009). With persistent government budget deficits and increasing labor force, rapid population growth needs to be addressed (Schelzig, 2005).

According to PSA, in 2013, the share of employment in agriculture to the total employment is 31%, where most of the laborers in this sector including the industry sectors, are considered poor. The Annual Poverty Indicator Survey (APIS) of the PSA, using the bottom 40% income range as a proxy for the poor, it revealed that more than half of the poor are employed in agriculture (i.e., laborers and farmers) (Schelzig, 2005). They are poor because they are working in jobs with low income and low productivity, and little is done to transform agriculture from subsistence to commercial farming. If these sectors are improved, it creates more meaningful and quality jobs to individuals who need it most (Aldaba, 2009).

Another contributory factor to the worsening of poverty is the persistence of economic inequality (income and welfare) that shrinks the positive effects of economic growth. According to Deininger and Squire (1998), an economy's initial land distribution has an effect on its succeeding expansion and on its human development. That is, an economy with a high land inequality will likely exhibit lower income growth and slower poverty alleviation than an economy with more equitable land distribution. Other than land inequality, income inequality is also pervasive. Data from the World Bank (http://data.worldbank.org/indicator/SI.POV.GINI) reported that the Philippines' Gini coefficient in 2012 is at 43.0 (decreased from 45.8 in 2006 and 46.8 in 1991). This indicates that unequal income distribution has improved and it is better than Malaysia (46.2 in 2009) and Singapore (47.8 in 2009). However, the Philippines did not fare better than other developing economies in Southeast Asia: Cambodia (31.8 in 2011), Indonesia (38.1 in 2011), Lao PDR (36.2 in 2012), Thailand (39.4 in 2010), and Vietnam (35.6 in 2012) fared better in the distribution of income.

However, Schelzig (2005) mentioned a problem for poverty measures—they are extremely sensitive to the poverty threshold. That is, a minor adjustment in the poverty line can have sizeable adjustments to the number of individuals deemed poor.

It has been underscored earlier that poverty is also a geographical matter due to the wide disparity in the standards of living and human development among regions and provinces. From the studies of Balisacan (2003) and Aldaba (2009), intraregional inequality contributed 82 percent of overall inequality. Hence, government policies on improving income distribution should be region-specific or province-specific.

Other causes of poverty Aldaba (2009) enumerated are recurrent negative economic shocks and exposure to risks (i.e., financial crises, natural disasters, social conflicts). Social conflicts worsen poverty incidence because

it hinders households from engaging in economic activities since they are displaced from their residences and sources of income. These conflicts also disrupt access to basic services, devastate transport systems, and perturb life in rural areas. Natural disasters also result to higher poverty incidences because it disturbs the poor's standard of living.

Antipoverty programs. Since the 1990s, there had been specific initiatives for poverty reduction. For instance, the Social Reform Agenda (SRA) focused on poverty alleviation and rural development for the disadvantaged economic and social groups. This set the foundation for the Social Reform and Poverty Act of 1997 (Republic Act [RA] 8425), which created the National Anti-Poverty Commission (NAPC), who acts as an advisory body in programs of social reform and poverty alleviation. It also institutionalized the basic sectors and nongovernment organizations' (NGO) participation, supports local government units in incorporating SRA, and encourages microfinance programs and institutions. One recent program launched in 2001 under the supervision of NAPC is the *Kapit-Bisig Laban sa Kahirapan* (KALAHI) program with projects including: rural projects, urban projects, social initiative projects, resettlement areas, and in conflict areas.

The issues that accompany the government's poverty reduction programs are categorized into (1) policy issues, (2) institutional issues, and (3) resource issues.

Under policy issues, every president tends to introduce new programs without regard to previous and existing programs initiated by the previous president. Even successful programs were not continued since they were part of previous presidents' programs resulting into redundancies in plans, frameworks, targets, and waste of resources. Targeting mechanisms were also diverse, inefficient, and highly politicized that lead to weak implementation. It also led to inclusion/exclusion of intended beneficiaries and significant leakages to unintended beneficiaries of the programs.

Institutional issues include transitional problems, highly politicized programs, and political appointment of agency heads. In the representation of the basic sector, political matters often succeed even from the choice of representatives for the basic sector, target beneficiaries, and the budget allocation of the budget.

For resource issues, the government response was the establishment of the Poverty Alleviation Fund (PAF) in 1998 so that funds for poverty reduction will always be a part of the national budget (Schelzig, 2005).

The State of Food Inequality in the Philippines

Root causes of food inequality. Poverty incidence and hunger are also attributed to rising global food and energy prices. As such, more poor households are being pushed further below the poverty line. Low-income households are responding to these shocks by reducing the quantity and quality of food they consume. Households belonging to lowest-income household group are the most affected as evidenced by the households' consumption structure of Cororaton and Corong (2009) using a year 2000 social accounting matrix. It was found that poor households allocate almost half of their consumption expenditure in agricultural and food products. It is interesting to note that the allocation on these commodities drops significantly if households moved to higher income deciles where consumption shifts towards services.

Food security is now also a pertinent challenge confronting developing economies. For instance, Bangladesh faces food deficit problems because of the inadequacy of its agriculture—it has to import basic food commodities. Meanwhile, Cambodia and the Philippines are confronted with food inequality. Although both economies have the resources to produce sufficient food for their population, it is distributed unequally. According to World Vision (n.d.), food inequality also arises from the unequal distribution of profits from exports to those that contributed to the production process (i.e., manual laborers).

The root causes of food inequality are similar with the root cause of poverty incidence but with emphasis on the persistent stagnation and neglect to the agricultural sector. In managing problems of food security, the sustainable approach is to increase food production by encouraging and supporting investment in agriculture to enhance food supply (Adelman & Morris, 1967). That is, developing the agricultural sector is critical in supporting national economic growth that is propoor. One approach is to increase rice productivity. Based on the rice productivity simulation results of Cororaton and Corong (2009), there is an increase in the domestic production and decrease in the importation of rice if rice productivity is improved, thus reducing prices. This is a propoor solution for food inequality since this will be beneficial to poor households in the lower income decile, who are employed in the agricultural sector. By promoting agriculture, food security will also improve since poor farmers will have an increased access to food and income and lead to households' better nutrition and higher productivity (Yu, You, & Fan, 2009).

Anti–food inequality programs. The Philippines recognizes the importance of rice productivity. In 2002, it introduced the Hybrid Rice

Commercialization Program (HRCP), which promoted the production of hybrid rice seeds and encouraged their continued use by farmers (ensured that seeds are bought at a guaranteed price, distribution of the seeds to participating farmers are offered at half the procurement price, and government provided assistance by allocating money to participating farmers to compensate additional input costs). This program also offered credit with an installment payment scheme. However, the implementation of this program was inefficient and ineffective because the appeal of hybrid rice was discouraging. Participating farmers discontinued the use of hybrid rice because it is expensive and has to be acquired every planting season (Cororaton & Corong, 2009).

The Link Between Poverty and Food Inequality in the Philippines

It has been apparent that there is a stark relationship between poverty and food inequality that runs both ways. That is, poverty inhibits households to afford sufficient and quality food consumption. The obvious disparity between poverty incidences among regions is an indication of the unequal distribution of food among regions. However, the transmission mechanisms between the two constructs vary. The relationship from poverty to food inequality is more observable than that of the complex relationship of food inequality to poverty. The explicit relationship between food and poverty is through consumption and income measures.

Llanto (1996) explored on the sensitivity of Philippine rural and agricultural households to changes in income and price. Results have shown that these households are price inelastic to staples (cereals, fruits, vegetables) since these are easily accessible. It can be seen that food inequality and poverty are linked through the agriculture sector—the primary source of income for poor households. Increasing the sectors' productivity leads to the creation of employment opportunities for the poor, accompanied by fair distribution of income and factors of production, eventually uplifting them from poverty.

The extent of research and studies conducted has been substantial and extensive, but none of which were able to discuss the notion of food inequality per se. As such, this research gap is the main agenda of this study.

Operational Framework and Methodology

Estimating the Lorenz Curve and the Epanechnikov Kernel Model

In addressing the first research objective of estimating Lorenz curves and

kernel densities to understand the depth of food inequality in the Philippines on a national and regional level, the 2007 Annual Poverty Indicator Survey (APIS) on household food consumption expenditures generated by the PSA was analyzed. The APIS is a nationwide sample survey designed to gather comprehenisve information on household socioeconomic profiles. It aims for relevant information for the assessment of poverty alleviation programs and the design of policies intended to reduce poverty. It is conducted in the years when the Family Income and Expenditure Survey (FIES) is not being conducted.

The adequate sample of nationwide data contained in the APIS allows for the generation of distribution diagrams and measures of living standards in the Philippines for both the national and regional levels. These diagrams and measures aim to provide comparable and quantifiable indicators of social well-being that will facilitate interregional comparisons. However, Jao, Ng, and Vicente (2000) argued that since well-being is a multifaceted idea, the attempt to capture its definition into one encompassing indicator remains to be the major limitation of this study. Hence, we used per capita food consumption expenditure as the limited proxy measure of the construct well-being. Given the nature of the data set, only household-level data on consumption expenditure is available; the conversion of household data into per capita consumption expenditure involved some degree of arbitrariness. Although equivalence scales for such conversion are available in the literature, they are similarly limited by their inconsistency and subjectivity (Jao et al., 2000).

According to Tullao (2009), aside from household income, another major index that is commonly utilized in measuring absolute poverty is the households' food consumption. The National Food Research Council (NFRC) has measured the minimum food required to be consumed daily by a typical household. The food threshold is the lowest income needed to purchase the minimum food requirements based on the physical constitution of an ordinary Filipino, abundance of cheap alternative food, climate of the country, and other factors (see Table 1 for the actual amount). Because a major part of a household's expenditure is allocated on food, the food consumption index is a valuable measure of absolute poverty. Note that the poverty threshold based on food will be lower than the poverty threshold based on income.

To analyze personal income statistics, a Lorenz curve can be estimated. It is a diagram to show the relationship between population groups and their respective income shares. It plots the cumulative proportion of individuals in the population vis-à-vis the cumulative proportion of welfare measure, such as income or consumption expenditure, belonging to these individuals

(Kakwani, 1981; Jao et al., 2000; Todaro & Smith, 2006). Although it is not an inequality index, it is a useful graphical device used to represent and analyze the size distribution of individual welfare measures. Here, instead of using the Lorenz curve as an illustration of the incidence of unequal distribution of income, we use it to illustrate inequality in food distribution.

The cumulative proportion of individuals in the population vis-à-vis the cumulative proportion of food consumption expenditure belonging to these individuals were plotted to generate the Lorenz curve for the Philippines and its regions (see Fig. 2). The number of food recipients is plotted on the horizontal axis, not in absolute terms but in cumulative percentages. Meanwhile, the vertical axis shows the share of total food consumption received by each percentage of the population. It also is cumulative up to 100% (i.e., both axes are equally long). The entire figure is enclosed in a square, and a diagonal line, shown by line segment 0*A*, is drawn from the lower left corner of the square to the upper right corner. At every point on that diagonal line, the percentage of food received is exactly equal to the percentage of food recipients (egalitarian line or the line of equality). The egalitarian line represents perfect equality in size distribution of food wherein each percentage group of food recipients is receiving the same percentage of the total food. The Lorenz curve is shown by the curve 0*BFGA*.

We use the Lorenz curve to show the quantitative relationship between the percentage of food recipients and the percentage of the total food they consumed in a given time period. Todaro and Smith (2006) discussed that the higher the deviation of the Lorenz curve from the line of equality, the greater the degree of food inequality. The extreme case of perfect inequality—a situation in which one household receives all of the food while everybody else receives nothing—would be represented by the congruence of the Lorenz curve with the bottom horizontal and right-hand vertical axes. The greater the degree of inequality, the closer is the Lorenz curve to the bottom horizontal axis.

We also graphed kernel estimates using the Epanechnikov kernel model (or the Gaussian kernel model) (see Fig. 3). It is used to provide more information about inequality similar to Lorenz curves and is useful in locating the poverty line, which can provide insights to the proportion of the poor in a specific territory (Jao et al., 2000). From Figure 3, there is no noticeable difference between the plotted Epanechnikov density estimates and the plotted results when employing the Gaussian kernel estimator. This similarity in the results using different kernel estimators has made choosing only one of the kernel models sufficient. However, it does not follow that the choice of the kernel estimator will always have no significant dissimilarity in the results (Jao et al., 2000).

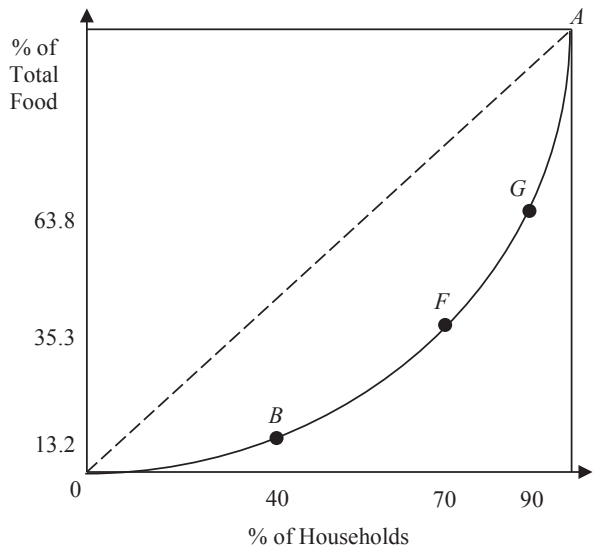


Figure 2. A hypothetical Lorenz curve.
Source: Tullao (2009).

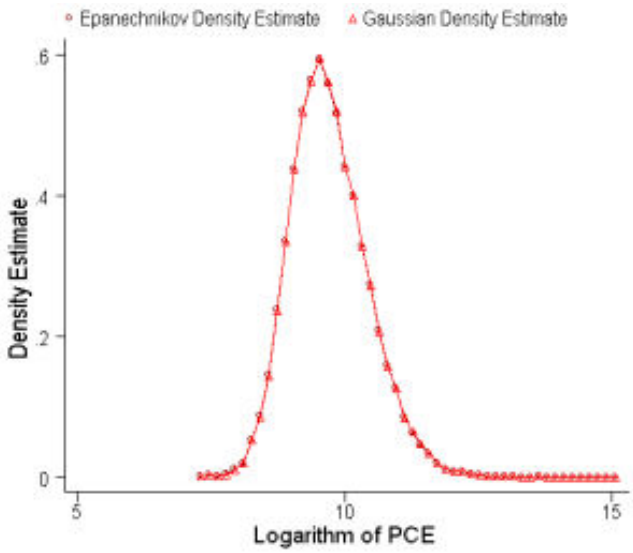


Figure 3. Kernel density estimates: Epanechnikov and Gaussian.
Source: Jao et al. (2000).

From Figure 3, the natural logarithm of the poverty line can be labelled approximately below 10. Densities that are more to the right of the poverty line indicate less poverty. Hence, according to Jao et al. (2000), as Lorenz curves are helpful in illustrating inequality, kernel densities can give an insight on the poverty incidence per area.

Estimating the Engel Curve

In addressing the second research objective of showing the responsiveness of household food consumption to changes in various sources of household income, we estimate a representative Engel curve for the Philippines. According to Besanko and Braeutigam (2002) and Chai and Moneta (2010a), an Engel curve relates the amount of a commodity purchased to the level of income, holding constant the prices of all goods. There are two varieties of Engel curves, according to Chai and Moneta (2010a): (1) the budget-share Engel curves, which describe how the proportion of household income spent on a good varies with income, and (2) those that describe how real expenditure varies with household income. Using the concept of Engel curves, we can show whether Filipino households conform to the best-known single result of Engel's law stating that the poorer a household is, the larger the budget share it has on nourishment.

We estimated the Engel curve using the 2007 APIS following the general functional form given by Equation 1:

$$FC_i = \beta_0 + \beta_1 RENT_i + \beta_2 WAGES_i + \beta_3 AGRI_i + \beta_4 INDSTRY_i + \beta_5 SRVCS_i \beta_6 OTHR_i + \beta_7 CONAB_i + \beta_8 INTRST_i + \beta_9 DIV_i + \beta_{10} GAMB_i + \varepsilon_i \quad (1)$$

where

FC_i is the total food consumption of household *i*;

$RENT_i$ is the income of household *i* from rental of nonagricultural lands;

$WAGES_i$ is the income of household *i* from salaries and wages;

$AGRI_i$ is the income of household *i* from agricultural activities;

$INDSTRY_i$ is the income of household *i* from industrial activities;

$SRVCS_i$ is the income of household *i* from services activities;

$OTHR_i$ are other income not elsewhere classified;

$CONAB_i$ is the cash receipts, support, etc. of household *i* from abroad;

$INTRST_i$ is the income of household *i* from interest-earning activities;

DIV_i is the income of household *i* from dividends;

$GAMB_i$ is the net winnings of household *i* from gambling; and

ε_i is the stochastic disturbance term that captures all other variables not included.

We hypothesize that the source of food inequality is income inequality. To determine the source of food inequality, the various sources of household income that influences food consumption is identified.

By a priori, all income variables must have a positive relationship with food consumption by income effect—the change in the amount of goods or services that a consumer would buy as purchasing power changes, holding all prices constant (Besanko & Braeutigam, 2002). However, the shapes of Engel curves depend on various consumer demographic characteristics. An Engel curve reflects income elasticity and indicates whether a good is normal or inferior. Empirical Engel curves are close to linear for some goods, and highly nonlinear for others. According to Besanko and Braeutigam (2002), for normal goods, the Engel curve is positively sloped (as income increases, quantity demanded increases). Most Engel curves feature saturation properties in that their slope tends to diminish at high income levels suggesting that there exists an absolute limit on how much expenditure on a goodwill rise as household income increases (Chai & Moneta, 2010b). This saturation property has been linked to slowdowns in the growth of demand for some sectors in the economy, causing major changes in an economy's sectoral composition (Pasinetti, 1981).

The Engel curve presented in Equation 2 faces the problem of endogeneity—arising as a result of measurement error, simultaneity, omitted variables, and sample selection errors (Gujarati & Porter, 2009). It is deemed that income is endogenous with respect to educational attainment as per Mincer (1974)—income distribution is related to age as well as varying amounts of education and on-the-job training among workers. To address endogeneity, there is a need to provide structural equations to explain the movement of the various sources of income. Hence, the data in Equation 2 are predicted values of a separate regression of the various sources of income against educational attainment (Mincer, 1974).

Heteroscedasticity, inherent in cross-section data, also plagues estimation of Engel curves, wherein as income increases, the difference between actual observation and the estimated expenditure level tends to increase dramatically. As such, the Engel curve and other demand function models fail to explain most of the observed variation in individual consumption behavior (Lewbel, 2006). Given this, variables other than current prices and current total expenditure must be systematically modeled if even the broad pattern of demand is to be explained in a theoretically coherent and empirically robust way (Deaton & Muellbauer, 1980).

Gujarati and Porter (2009) explained that heteroscedasticity does not cause ordinary least squares (OLS) coefficient estimates to be biased, although it can cause the variance of OLS estimates to be biased (possibly above or below the population variance). That is, in the midst of heteroscedasticity, the estimated relationships among variables are still unbiased, but standard errors are biased resulting to biased inference through hypothesis testing.

To investigate the statistical significance of the various sources of household income on food consumption, the 2007 APIS is analyzed using the generalized method of moments (GMM) estimation. This methodology is used to address heteroscedasticity, which makes use of the orthogonality conditions to allow for efficient estimation (Baum, Schaffer, and Stillman, 2003; Hansen, 1982).

The GMM method is preferred because of its robustness to differences in the specification of the data generating process (DGP), and it also automatically addresses endogeneity. According to Greene (2003), under the GMM, a sample mean or variance estimates its population counterpart regardless of the underlying process. It has flexibility from unnecessary distributional assumptions (e.g., normality) made this method appealing. However, it has accompanying costs—if more is known about the DGP (e.g., specific distribution), then the method of moments may not make use of all of the available information. Hence, the natural estimators of the parameters of the distribution based on the sample mean and variance becomes inefficient. Alternatively, the maximum likelihood estimation (MLE) can be employed, which utilizes out-of-sample information and provides more efficient estimates (Greene, 2003).

Reducing Incidence of Hunger Through Government-Sponsored Programs

In addressing the third research objective of showing if the government's poverty reduction programs are effective in addressing incidence of hunger, we assessed the impact of existing programs to the probability that a household will experience hunger. Unfortunately, the 2007 APIS cannot

capture the incidence of the state of hunger—defined by the Community-Based Monitoring System (CBMS) as an indicator whether a household experienced insufficient food supplies for the past three months. We are arguing that having insufficient food supplies can be ascribed to food distribution inequality.

To determine whether the government's poverty reduction programs can reduce the probability of hunger incidence in a household, the CBMS survey data is used since it contains the variables for the constructs hunger and government programs. Specifically, we will look into the data of Pasay City (2005), Eastern Samar (2005), and Agusan del Sur (2006). For the profiles of these areas, refer to the official site of the City of Pasay (http://pasay.gov.ph), CBMS (2010a), and CBMS (2010b) for Eastern Samar and Agusan del Sur, respectively. These provinces were selected to approximate Philippine behavior with ample representatives from the major island groupings of Luzon, Visayas, and Mindanao. Equation 2 shows the logistic specification of the variables influencing the probability that the household experienced hunger. The marginal effects of Equation 2 will be estimated using MLE. For a complete discussion of the methodology, refer to Aliping, Pizarro, Reyes, and Rivera (2013).

$$\ln\left(\frac{p_i}{1-p_i}\right) = f(FSIZEi, HHINCOMEi, ESTATHHi, HEALTHi, FEEDINGi, SCHOLARi, SKILLSi, HOUSINGi, CREDITi) + \varepsilon i \quad (2)$$

where:

p_i is the probability that a household has experienced hunger. This is an indication of irregularities in a household's access to food;

$FSIZE_i$ is the number of members in household *i*. This is expected to have a positive effect on p_i because more members will have to share a finite amount of food a household was able to acquire. The significance of this variable will suggest the need for a population policy to combat food inequality;

$HHINCOME_i$ measures the total household income—the sum of all sources of household income from domestic and international sources. By a priori, the higher the income of the household is, the lower is the probability of hunger;

$ESTATHH_i$ is a vector of employment status of the household head whose categories include $PERMANENT_i$ and $SEASONAL_i$—dummy variables

indicating whether the household head is employed permanently or seasonally. The temporarily employed category was dropped to avoid the dummy variable trap. Categories assume a value of 1 if the household head is permanent or seasonal, 0 if otherwise. By a priori, having permanent employment reduces the probability of hunger due to the stable flow of income to finance food consumption. Meanwhile, having seasonal or temporary employment might increase the probability of hunger because of the impermanent flow of income resulting to ephemeral food consumption;

$HEALTH_i$ is a dummy variable indicating whether a household availed health assistance programs (e.g., free eye checkup, dental services) during the past 12 months. It assumes a value of 1 if the household availed this program, and 0 if otherwise;

$FEEDING_i$ is a dummy variable indicating whether a household availed supplemental feeding program for the past 12 months. It assumes a value of 1 if the household availed this program, and 0 if otherwise;

$SCHOLAR_i$ is a dummy variable indicating whether a household availed education and scholarship program for the past 12 months. It assumes a value of 1 if the household availed this program, and 0 otherwise;

$SKILLS_i$ is a dummy variable indicating whether a household availed of skills or livelihood programs for the past 12 months. It assumes a value of 1 if the household availed this program and 0 if otherwise;

$HOUSING_i$ is a dummy variable indicating whether a household availed of housing program for the past 12 months. It assumes a value of 1 if the household availed this program, and 0 if otherwise;

$CREDIT_i$ is a dummy variable indicating whether a household availed of credit program for the past 12 months. It assumes a value of 1 if the household availed this program, and 0 if otherwise. These variables represent the provision of government subsidies that will support poor households to acquire decent and sufficient amount of food. By a priori, these programs should reduce the probability of hunger because these provisions shift a portion of the burden of financing food consumption, effectively decreasing the perceived and actual costs of purchasing food. On the other hand, assuming food is a normal good, by Engel aggregation, as income increases (regardless of source), food consumption will also

increase; and

ε_i is the stochastic disturbance term that captures all other variables that were not included in the equation.

To address the endogeneity of $HHINCOME_i$, we also modeled the direct relationship of education to income represented by Equation 3. Those who are able to acquire higher educational attainment are individuals who have access to higher levels of income and thus can reduce the likelihood to experience hunger. Equation 3 will be estimated using OLS. Afterwards, the predicted values of $HHINCOME_i$ will be generated and then substituted to Equation 3 to represent the income variable. That is, income is the channel of education in affecting incidence of hunger.

$$HHINCOME_i = \alpha_0 + \alpha_1 ELEMGRAD_i + \alpha_2 HSUNDR_i + \alpha_3 HSGRAD_i + \alpha_4 PSUNDR_i + \alpha_5 PSGRAD_i + \alpha_6 COLUNDR_i + \alpha_7 COLGRAD_i + \alpha_8 WMSPHD_i + \nu_i \quad (3)$$

where

$ELEMGRAD_i$, $HSUNDR_i$, $HSGRAD_i$, $PSUNDR_i$, $PSGRAD_i$, $COLUNDR_i$, $COLGRAD_i$, and $WMSPHD_i$ are dummy variables indicating whether the household head is an elementary graduate, high school undergraduate, high school graduate, postsecondary undergraduate, postsecondary graduate, college undergraduate, college graduate, and with graduate studies, respectively. The category elementary undergraduate was dropped to avoid dummy variable trap. By a priori, the higher the educational attainment of the household head, the household head will have better chances in acquiring lucrative job opportunities that will provide for food consumption; and

ν_i is the stochastic disturbance term that captures all other variables that were not included in the equation.

Results and Discussion

Lorenz Curves

Figure 4 illustrates the Lorenz curve for the Philippines. It can be construed from Figure 4 that there is an apparent food inequality in the country. However, not much can be said unless the Lorenz curve is compared

with another. Distinct ranking is possible only if the curves do not intersect but it is not impossible for curves to intersect because there are cases wherein the upper percentage of the population might dominate whilst there are also cases wherein the lower distribution of the population are worse off than the rest. Hence, there is selectivity in terms of ranking and no certainty of complete ranking. Meaning, it should be noted at which point in the graph is being considered (Jao et al., 2000). To identify the complete ranking of the different regions, numerical measures then should be utilized. For an in-depth discussion on interpreting Lorenz curves, refer to Todaro and Smith (2006).

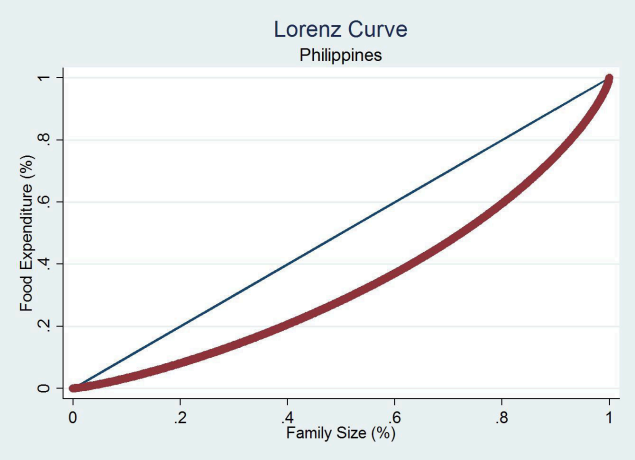


Figure 4. The Lorenz curve of the Philippines.

Figure 5 illustrates the Lorenz curves for each region and for the Philippines. It is evident that there are no significant distances among the curves. Region II and Region XV dominated all other regions. Region X lies farthest from the egalitarian line and does not intersect any of the regional curves including the national-level Lorenz curve. Hence, Region X has the most inequality in food distribution compared to all other regions.

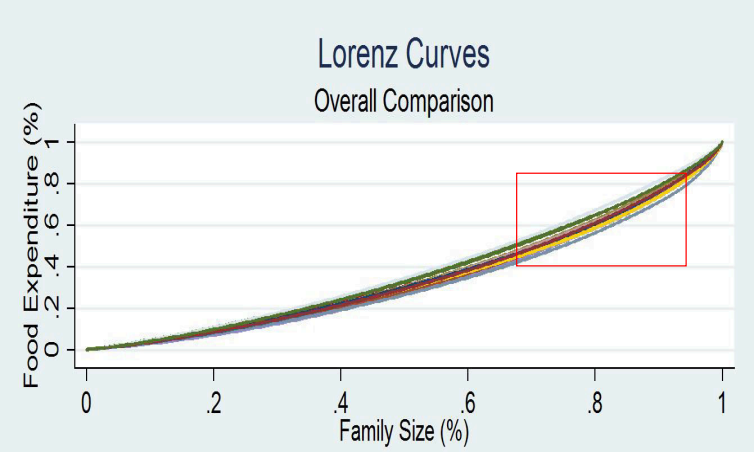
In Figure 6, the Lorenz curve for Region II dominates all regions in Luzon (same observation in Figure 5). Furthermore, majority of the Lorenz curves for the regions in Luzon dominate the national-level Lorenz curve. That is, there is less food inequality at the regional level. For the Cordillera Administrative Region (CAR), it dominates the national-level curve at first, but at 65% of the population, it intersects the Philippine curve making it the

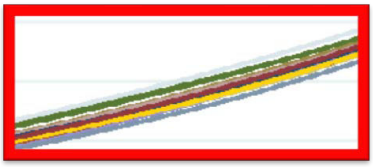
worse-off region in Luzon. As the cumulative percentage of household size increases, at 85% and beyond, there is a convergence in the curves making it hard to determine which curve dominates. Here, we must be careful in making assumptions of complete ranking.

In Figure 7, Region VI is seen to be the dominant curve—indicating egalitarianism in food distribution. For the other curves, ranking is not applicable. We should be mindful of what point in the graph is being observed due to intersections at certain points. For instance, the curve of Region VII reveals that the proportion of the family size below 75% is the worst off compared to Region VIII and the national level, but beyond that cumulative percentage, it dominates both curves. For Region VIII, it shows that in the 15% to 75% of the population, it dominates the curve of the Philippines and Region VII, but beyond 75%, it becomes the worse-off region.

In Figure 8, ARMM displayed consistent dominance as compared to the Lorenz curves of other regions in Mindanao. At 25% cumulative population, Region X deviated from the rest of the curves positioning it as the worst-off region (similar to Fig. 5). Furthermore, the complete ranking of the other regions using the Lorenz curve cannot be done due to the several intersections. Hence, there is an obvious disparity observed in Mindanao.

We also compare the Lorenz curves of the major metropolitan regions in the country (see Fig. 9). We plot the Lorenz curves of NCR (Metro Manila), Region VII (Metro Cebu), and Region XI (Metro Davao). From Figure 9, NCR is seen as the most egalitarian (since it is the center of commercial activities and exchange). However, the Lorenz curve of NCR is very close to Region XI, while Region VII is located outside the national-level Lorenz curve. Consistent with Figure 7, Region VII is also the worse-off region.





Legend:

Philippines and Caraga Region

Region I: Ilocos Region

Region IVA: CALABARZON

Region II: Cagayan Valley

Region IVB: MIMAROPA

Region III: Central Luzon

Region V: Bicol Region

Region VI: Western Visayas

Region VII: Central Visayas

Region VIII: Eastern Visayas

Region IX: Western Mindanao

Region X: Northern Mindanao

Region XI: Southern Mindanao

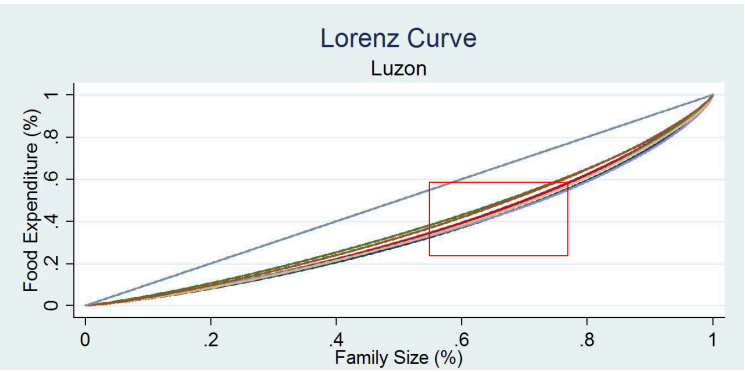
Region XII: SOCCSKSARGEN

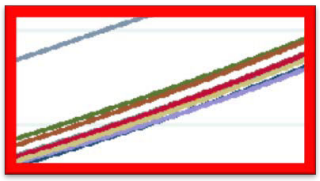
National Capital Region (NCR)

Cordillera Administrative Region (CAR)

ARMM

Figure 5. The Lorenz curve of the Philippines and its regions.





Legend:

Philippines

Region I: Ilocos

Region II: Cagayan Valley

Region III: Central Luzon

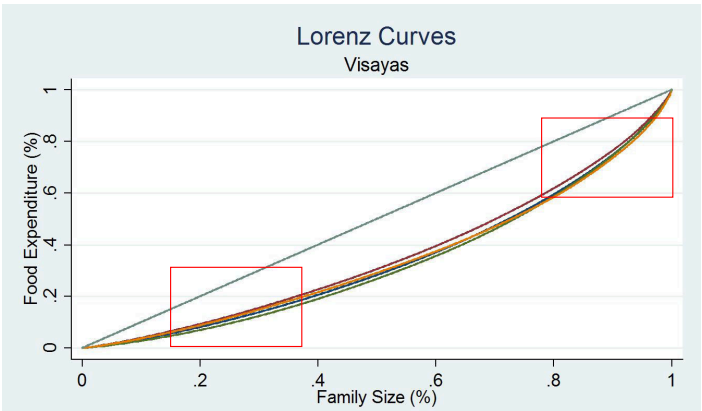
Region IV A: CALABARZON

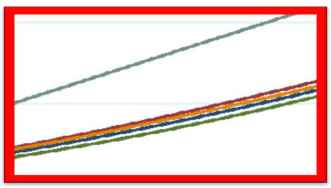
Region IV B: MIMAROPA

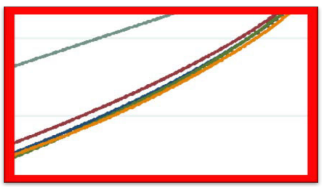
National Capital Region (NCR)

Cordillera Administrative Region (CAR)

Figure 6. The Lorenz curve of the Philippines and Luzon.







Legend:

Philippines

Region VI: Western Visayas

Region VII: Central Visayas

Region VIII: Eastern Visayas

Figure 7. The Lorenz curve of the Philippines and Visayas.

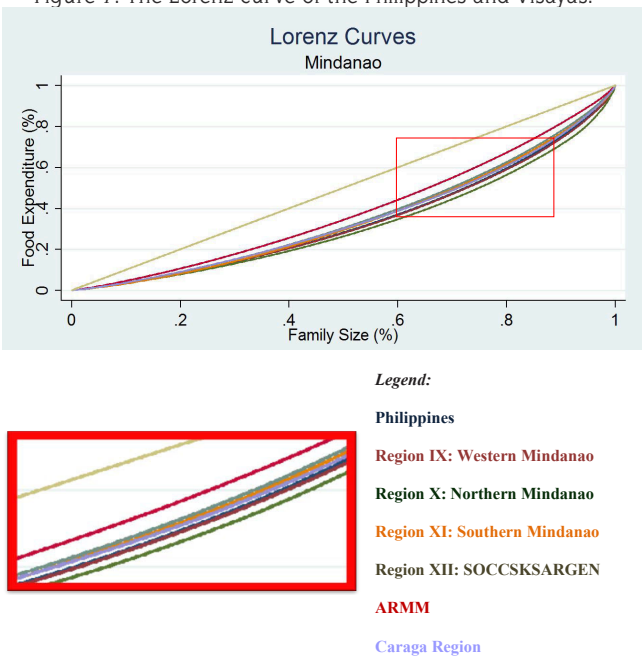


Figure 8. The Lorenz curve of the Philippines and Mindanao.

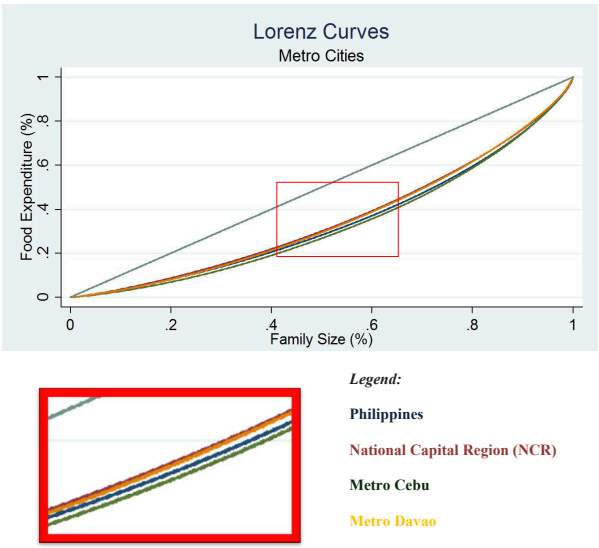


Figure 9. The Lorenz curve of the Philippines and metropolitan regions.

Epanechnikov Kernel Density

The kernel density serves as an alternative visual tool to do a comparative analysis of the food inequality among regions in the Philippines. This graphical representation depicts the distribution of the data allowing us to locate the poverty line, illustrate the incidence of food poverty, and provide an insight about the proportion of the poor in food in various areas. As a matter of caution, according to Jao et al. (2000), poverty line determination is a complex issue. We do not highlight the pros and cons of the various methods of poverty line identification; instead, the identified poverty line is used as the basis of comparison across regions.

From Figure 10, it can be seen from the kernel density (using the natural logarithm of food consumption) that the Philippine food poverty line is approximately at 10 (indicated by the tip of the distribution). To make sense of the graph, densities that are more to the right of the food poverty line indicate less food poverty. It can be seen from Figure 10 that the density is centered at 10 showing that majority of households in the sample are in close proximity to the national food poverty line.

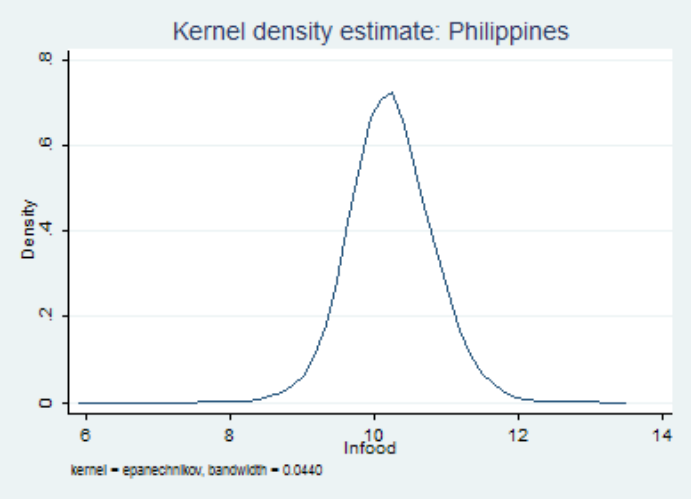


Figure 10. The Epanechnikov kernel distribution for the Philippines.

Figure 11 illustrates the food density estimates per region in Luzon. It can be seen that majority of the region's food poverty line is close to the national food poverty line (i.e., Bicol, Cagayan Valley, and Ilocos). However,

MIMAROPA's (Mindoro, Marinduque, Romblon, and Palawan) food poverty line is to the left of the national average. This is the case because the main source of food production in Luzon lies on the main island where all of the regions are located except MIMAROPA. Alternatively, MIMAROPA is frequently hit by typhoons, which disrupt region-specific industrial food processes. Meanwhile, NCR, Central Luzon, and CALABARZON demonstrated food poverty lines greater than the national level because there is ease in the flow of goods distribution. These regions are also highly urban indicating a higher standard of living. Also, NCR, as the main commercial district of the country, is also the hub of overall production and distribution. Meanwhile, Central Luzon, also known as the rice granary of the country, supplies the majority of the demand for rice—a staple food in the country. Likewise, there exists special economic zones (SEZs) in the region that significantly contribute to their regional output. Lastly, CALABARZON has also evolved into an industrialized region as evidenced by the establishment of commercial districts due to its close proximity with NCR.

Figure 12 illustrates the various food density estimates in Visayas. It can be seen that Eastern Visayas's food poverty line is below the national level. However, regions in Visayas illustrated similar states of food inequality with central tendencies around the national average (but at varying kurtosis due to differences in food production and distribution). With regards to the kurtosis, from the three regions, only Central Visayas exhibited a wide span compared to the other two regions. Figure 12 shows that there are households who would just need a marginal amount of income to finance food consumption to exceed the food poverty line. This is manageable because of the nature of food production dependent on their rich marine resources.

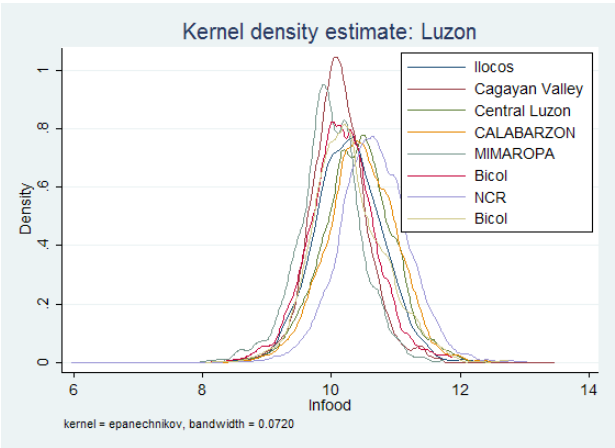


Figure 11. The Epanechnikov kernel distribution for Luzon.

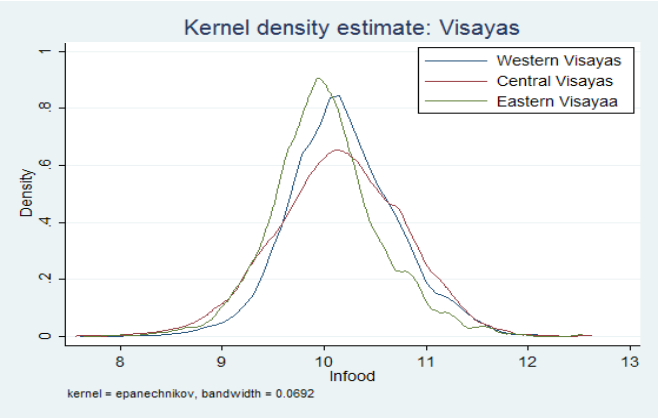


Figure 12. The Epanechnikov kernel distribution for Visayas.

Figure 13 illustrates the various food density estimates in Mindanao. It can be seen that all regions, expect Western Mindanao, have food poverty lines approximately equal with the national average. The rest of the region is experiencing similar state of food inequality vis-à-vis the national average because of the presence of food manufacturing multinational companies (MNCs) such as *Del Monte* and *DOLE*. As such, it warrants that agricultural production be designed to meet the demands of these MNCs. Moreover, the industrial and tourism sector in Mindanao is lucratively contributing to their regional output. In Southern Mindanao, majority of its people are above the national food poverty line because the region encompasses a highly urban capital, that is, Davao City, but it is also predominantly agri-based evolving into an agro-industrial region. In addition, its competitive advantage is in agri-industry, in exporting its agricultural and marine products.

Lastly, Figure 14 compares the major metropolitan areas in the country—NCR, Central Visayas, and Southern Mindanao. It can be observed that the national food poverty line of NCR exceeds Central Visayas and Southern Mindanao. Such is the case because NCR houses the main commercial and financial center indicating a high level of urbanity and standard of living. However, it can also be observed that Central Visayas and Southern Mindanao's food poverty line is relatively the same as the national level. One may infer that the inhabitants of metropolitan areas in Luzon, Visayas, and Mindanao have access to food. Looking at the kurtosis, it can be seen that metropolitan regions exhibit high concentration levels wherein residents of NCR have higher food consumption compared to the national average. Meanwhile, Central Visayas and Southern Mindanao residents' food

consumption is in proximity with that of the national average. Lastly, Central Visayas has the worst state of food inequality among metropolitan regions. This may be due to the mismatch in food supplies and high population density. This increases the probability of having more people suffering from food poverty.

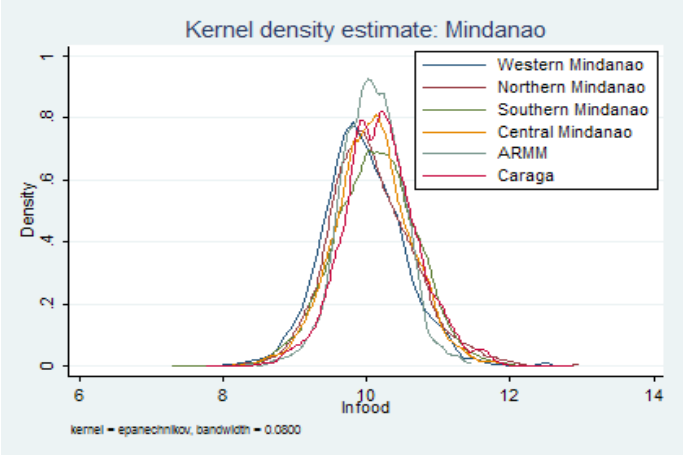


Figure 13. The Epanechnikov kernel distribution for Mindanao.

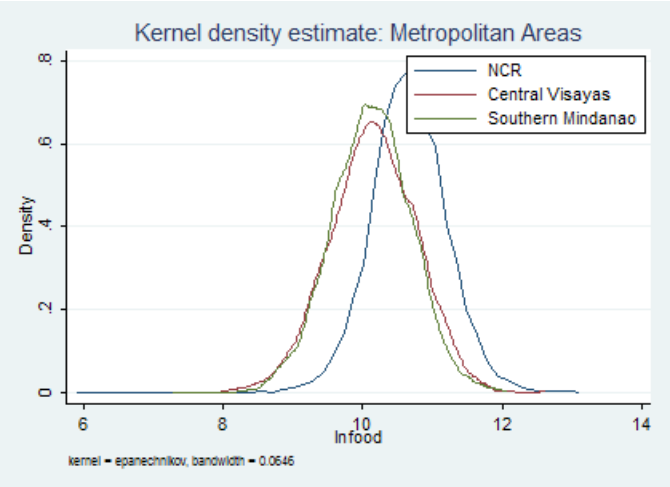


Figure 14. The Epanechnikov kernel distribution for metropolitan regions.

Engel Curves

Table 5 shows the Engel curve estimates for the Philippines using GMM. Results show that an increase in income, regardless of source, increases food expenditure. It also shows that food is a normal good, that is, by income effect, food expenditures increase given an increase in purchasing power. Among the three major business activities households engage in, an additional income from engaging in industrial activities has the largest positive marginal effect to food expenditure. An extra income from engaging in agricultural activities also has greater effect than an extra income from service activities. Households that have rental income spend more on food. Income from dividends and net winnings from gambling do not have any effect on food consumption. This can be ascribed to the few households that engage in such activities. They do not rely on these to spend for food expenditure. It is also interesting to note that from Table 6, as with any other normal good, food consumption is income inelastic.

Among the three major industries, households' food expenditure is the most sensitive to changes in income from agricultural activities. This confirms the importance of the agricultural sector in the Philippines wherein 51% of the sample engages in agricultural activities and most poor households' major source of food are from agriculture. Even though households that have rental income allocate more of their income on food expenditure, food expenditure is less sensitive to changes in rental income. This is because more than 90% of households engage in other entrepreneurial activities. Also, the additional support from abroad contributes to an increase in food expenditures although less sensitive. This is plausible because cash support from abroad is usually spent on other basic commodities—education and utilities.

Table 5. Results of the Generalized Method of Moments Regression

(Dependent Variable: Food Consumption)			
Variables	Coefficient	Standard Error	Probability Value
$RENT_i$	1.3561	0.0146	0.000
$WAGES_i$	0.4422	0.0018	0.000
$AGRI_i$	0.4886	0.0022	0.000
$INDSTRY_i$	0.6967	0.0049	0.000
$SRVCS_i$	0.2872	0.0028	0.000
$OTHR_i$	0.2415	0.0028	0.000
$INTRST_i$	0.9141	0.2609	0.000
$CONAB_i$	0.0159	0.0038	0.000

Table 5 continued...

DIV_i	0.4066	0.2136	0.057
$GAMB_i$	0.0446	0.0467	0.906
Constant	7803.8540	60.7578	0.000

Table 6. Estimated Marginal Effects

Dependent Variable: Food Consumption			
Variables	ey/ex	Standard Error	Probability Value
$RENT_i$	0.0137	0.0001	0.000
$WAGES_i$	0.2918	0.0011	0.000
$AGRI_i$	0.1760	0.0008	0.000
$INDSTRY_i$	0.0107	0.0001	0.000
$SRVCS_i$	0.0304	0.0002	0.000
$OTHR_i$	0.1026	0.0011	0.000
$INTRST_i$	0.0001	0.0000	0.000
$CONAB_i$	0.0008	0.0002	0.000
DIV_i	0.0000	0.0000	0.023
$GAMB_i$	0.0004	0.0005	0.325

Reducing Incidence of Hunger Through Government-Sponsored Programs

Table 7 reports selected descriptive statistics for Pasay, Eastern Samar, and Agusan del Sur. It shows that income at level has an abnormally high mean, standard deviation, and skewness. This can lead to poor estimates. We opted to transform income to its natural logarithmic form to contain the high variability.

Table 7. Selected Descriptive Statistics

Variables	Pasay			Eastern Samar			Agusan Del Sur		
	Mean	Standard Deviation	Skewness	Mean	Standard Deviation	Skewness	Mean	Standard Deviation	Skewness
HSIZEi	4.1980	2.0689	1.7265	4.5129	2.2613	0.6619	6.0776	2.3704	0.7116
INCOMEi	220,963	2,373,431	181.32	68,230	90,669	3.21	79,901	379,458	204.722
LNINCOMEi	11.9394	0.7743	(0.3112)	10.4874	1.1758	(0.1367)	10.7236	1.0253	(0.2522)

Table 8 shows the results of OLS regression for household income. There is a high positive and significant relationship between education and income. Furthermore, as seen in Pasay and Agusan del Sur, as educational attainment increases, its marginal effect on income also increases. Compared to Eastern Samar, college undergraduates and college graduates are the only estimates that have a significant contribution to income. This may be due to the rural status of the region wherein college attainment is deemed as the only beneficial factor in acquiring the most lucrative jobs in the locality. In addition, graduate studies in Eastern Samar does not contribute a significant increase in income since, yet again, Eastern Samar is a rural area and jobs requiring such credentials are not found in the locality and/or if ever there is a position, the compensation cannot suffice for the bargained salary. As compared to the marginal contribution of those who possess graduate studies in Pasay and Agusan del Sur, these coefficients are highly significant, therefore giving incentives to those who have graduate degrees in getting higher income.

Table 8. Ordinary Least Squares (OLS) Regression

Dependent Variable: Log of Total Income									
Variables	Pasay			Eastern Samar			Agusan del Sur		
	Coefficient	Standard Error	*p*-Value	Coefficient	Standard Error	*p*-Value	Coefficient	Standard Error	*p*-Value
ELEMGRADi	0.0884	0.0184	0.000	0.3130	0.1837	0.089	0.0380	0.0081	0.000
HSUNDRi	0.0408	0.0177	0.210	0.0236	0.0954	0.805	0.3468	0.0034	0.000
HSGRADi	0.2089	0.0153	0.000	0.3123	0.1488	0.036	0.3853	0.0067	0.000
PSUNDRi	0.3239	0.0422	0.000	—	—	—	0.7242	0.0238	0.000
PSGRADi	0.3678	0.0202	0.000	0.1823	0.8205	0.824	0.8517	0.0341	0.000
COLUNDRi	0.3999	0.0163	0.000	0.4106	0.1113	0.000	0.9219	0.0057	0.000
COLGRADi	0.6952	0.0162	0.000	0.6435	0.1307	0.000	1.4293	0.0077	0.000
WMSPHDi	0.8535	0.1625	0.000	—0.7614	0.6708	0.257	1.3659	0.1099	0.000
Constant	11.638	0.0142	0.000	10.3257	0.0572	0.000	10.5369	0.0016	0.000

Table 9 shows the marginal effects after logit. It can be seen that household size, household income, permanent employment, and seasonal employment have significant effect on the incidence of hunger in Pasay. It is also apparent that none of the government programs in Pasay have significant marginal effect on state of hunger.

Table 9. Marginal Effects After Logit

Variables	Pasay			Eastern Samar			Agusan del Sur		
	Coefficient	Standard Error	*p*-Value	Coefficient	Standard Error	*p*-Value	Coefficient	Standard Error	*p*-Value
HSIZEi	0.0015	0.0002	0.0000	0.0094	0.0049	0.0560	0.0713	0.0003	0.0000
LNINCOMEi	-0.0243	0.0024	0.0000	-0.0780	0.0530	0.1410	-1.7387	0.0026	0.0000
PERMANENTi	-0.0328	0.0053	0.0000	-0.1778	0.0349	0.0000	-0.0303	0.0025	0.0000
SEASONALi	-0.0061	0.0011	0.0000	-0.0730	0.0215	0.0010	-0.0197	0.0024	0.0000
WOMENi	0.0075	0.0035	0.0340	—	—	—	—	—	—
FEEDINGi	—	—	—	0.1693	0.1077	0.1160	0.0020	0.0033	0.5470
HEALTHi	0.0013	0.0010	0.1980	0.0228	0.0250	0.3610	0.0132	0.0016	0.0000
SCHOLARi	0.0068	0.0042	0.1020	—	—	—	0.0509	0.0075	0.0000
TRAININGi	0.0112	0.0067	0.0950	-0.0259	0.0866	0.7650	0.0167	0.0049	0.0010
HOUSINGi	0.0072	0.0069	0.2950	—	—	—	-0.0392	0.0082	0.0000
CREDITi	0.0055	0.0049	0.2610	0.0097	0.0454	0.8300	-0.0265	0.0024	0.0000

For Eastern Samar, job status is the only significant factor that affects state of hunger (see Table 9). Permanent employment has the greatest marginal effect since permanency in job assures a steady flow of income and assures accessibility to food. Again, just like in Pasay, government programs have insignificant effect on addressing hunger. This implies that program implementation may not be as effective as in urban areas. This can be due to the topography of the area, difficulty of transportation, and lack of facilities. Hence, as reported in the CBMS Status Report on MDGs for Eastern Samar in 2010, the province is still under poverty and most households are under the food threshold. Moreover, the results suggest that there is a need for sustainable living programs, provision of basic necessities, better and quality educational facilities, and technology expansion.

The results from Agusan del Sur (see Table 9) reported high significance in all variables except for the provision of feeding programs—representation of food-related programs of the government. This may be due to the strong agricultural upbringing of the region making feeding programs irrelevant because households have easy access to food supply from farming and other agricultural activities. Likewise, household size, household income, permanent employment, seasonal employment, housing programs, and credit programs are significant and consistent in reducing the probability of hunger. On the other hand, access to health programs, scholarships, and training are counter intuitive but highly significant. In this context,

government provisions transfer the financial burden from the household to the state, thus freeing resources that would have been spent on basic necessities (Rivera & See, 2012). This encourages higher family size; thus, household members would get a smaller share of the food.

Conclusions

Poverty has been prevalent throughout history. Its eradication has been one of the priorities of past and present administrations. Using the APIS, we have generated the following conclusions. In addressing our first research objective, the estimated Lorenz curves for the Philippines and its regions show evidence of food inequality at varying depths. These Lorenz curves were compared with the national level and with other regions. We have seen Lorenz curves for some regions that are clustered with each other leaving no significant disparities amongst them. That is, it can be construed that food distribution in the Philippines does not favor any region. While it is evident that there are leading regions (regions that are closer to the egalitarian line), it is indicative that there are regions that have less food inequality compared to the national food distribution. Specifically, it was seen that NCR is one of the most egalitarian regions while Central Visayas has one of the worst food distribution in Visayas. Such results call for the need to help regions lagging behind in terms of food distribution.

These results have been reinforced by the estimated kernel density models. We have seen that almost all regions have approximately similar food poverty incidence, evidenced by the tightly clustered distributions. However, we have also observed differences in the peaks of the distributions indicating heterogeneity in food production and consumption among regions. Consistent with our conclusions with the Lorenz curves, it was also seen that NCR is the region with the lowest incidence of food poverty as evidenced by its kernel density whose concentration is way beyond the national average. Likewise, Central Visayas has the worst state of food inequality relative to the other two metropolitan areas in the country ascribed to its high population density. Lastly, Southern Mindanao is experiencing the least state of food poverty in Mindanao because of its rapidly expanding agri-business, which augments food production and distribution to all households.

Overall, the food poverty gap between regions in the Philippines and with respect to the national average is narrow. To augment food distribution and consumption of those under the food poverty line, the state must strengthen its food and nonfood distribution projects such as food and cash grants (see Conchada & Rivera, 2013). However, there is a need to precisely identify

intended recipients to address the distribution inefficiency. Also, the state must invest in technology to enhance food production in the regions that have the potential to supply food to the entire country such as Central Luzon, Southern Mindanao, and Western Visayas. The country needs to shift from subsistence farming to commercialized farming. Engaging in research and development on how to improve the quality and quantity of rice production is also necessary. Furthermore, the state must invest in facilities that will cultivate a sustainable source of marine products through technologically advanced fish pens, factories, and marine farms.

When these technologies are in place, the country can slowly start reducing the importation of rice from Thailand and Vietnam. The country must harness again its potential in producing its own rice for national consumption and export the surplus (just like in the 1970s). Funds that are supposedly used to import rice can be reallocated for research development to further enhance food production in the country. It is essential that the country achieve sustainability in food production.

In addressing our second research objective, our estimated Engel curve for the Philippines showed that households demonstrate variation in food consumption. This heterogeneity in food consumption can be ascribed to the different levels and sources of income each household has. Moreover, the differing elasticities of various significant sources of household income against food expenditure show the sensitivity of food consumption to various sources of income. We have also seen that food consumption is most responsive to changes in salaries and wages relative to any other sources of income. Beyond this finding, it reveals the importance of addressing unemployment in the Philippines since households rely more on their salaries and wages. It has also been observed that, among the three major industrial activities, food consumption is most sensitive to income from agricultural activities, proving the significance of the agricultural sector. It can be understood that many households' food consumption may be affected if there were sudden shocks that will reduce income from agriculture. On the other hand, households' level of food consumption is least responsive to changes in (1) income from interest and (2) income from abroad. It denotes that although food consumption increases, given increases in these income channels, these incomes are usually spent on other nonfood commodities.

In addressing our third research objective, we estimated a logistic regression that will show whether government-sponsored programs in alleviating state of hunger in selected provinces are effective. Results have shown that government programs are ineffective in Pasay and Eastern Samar while only feeding program is statistically significant in Agusan del Sur. This may indicate that program implementation is not effective and does not target

the intended population. This is worsened by regional topology that hinders implementation because it deters authorities in reaching those in isolated areas, who are requiring most of the assistance. For Agusan del Sur, some of the government programs positively influence hunger. This may be due to the consequence of such programs that cushion household expenditures providing them with financial flexibility to accommodate larger family size affecting food distribution within the household (see Rivera & See, 2012).

However, we do not suggest that the state stop implementing antipoverty programs. Programs addressing food shortages should be reinforced especially in areas where help from the government are very limited or close to none. However, committed programs are needed so that it reaches the most isolated households. The government can efficiently delegate tasks at the *barangay* level so that programs effectively reach small and far-flung communities. Although feeding programs are needed to instantaneously address hunger, there is a need to call for a sustainable food production and distribution in the country. It will not only change the landscape of food supply but it will also enhance work supply in the country considering the Philippines is an agricultural economy.

Another alternative undertaking is to reduce food inequality through the implementation of an enhanced food distribution projects such as conditional food and cash grants (see Conchada & Rivera, 2013). Correspondingly, a more sustainable solution to alleviate state of hunger is to provide employment. Providing a stable and meaningful employment will relieve the government the burden of continuously providing food and other transfers for the poor. Instead, resources can be devoted to other avenues of development such as agrarian reform and infrastructure development.

Addressing food poverty is a tedious task for the state. It requires political will to mitigate dependence of poor households on government transfers. The poor must harness government transfers by using them to fund household activities that will uplift them from poverty (i.e., education, entrepreneurship). Poor households should make conscious effort to climb the social ladder.

It is the obligation of the state to initiate functional frameworks aimed to address poverty at a faster pace. However, implementation is slow due to weak targeting and highly politicized intentions—programs are often designed to secure votes for the next elections. Given the political environment, legislation is required to ensure that ongoing poverty alleviation programs that are functional should be pursued regardless of who is the responsible party. Another issue to settle is financing these programs. An integrated approach will require a large sum of money since these programs will cover several issues simultaneously. Initially, programs are implemented on a national

level, which requires not only financial resources but also infrastructures and manpower. This warrants serious budgetary planning and, to some extent, philanthropic actions. Microfinance for entrepreneurial ventures can also be an alternative. It has already been proven to be a scalable and sustainable tool in addressing poverty through the income channel. The increase in income will give poor households a head start to finance recurring expenditures.

In addition, microfinance institutions (MFIs) should heighten their responsibility in dealing with their clients—mostly poor and uneducated households. Educating them on how to handle the funds borrowed is complimentary. Transparency and information will give way for the efficient use of borrowed funds reducing the great deal of risks MFIs face when lending.

Once budgets are recognized and properly allocated, the state can seek help from NGOs and private groups because they are knowledgeable in addressing specific problems and are able to help advance the goals of poverty reduction. Furthermore, they can focus on smaller groups allowing them to reach out to households beyond the geographical scope of programs since they might have access to remote areas, which require most attention and help.

Health, gender, and education are equally crucial in terms of its role in poverty-reduction programs since these are mediums to enable manpower to be productive. Healthy and skilled manpower will not only make the labor market self-sufficient but also knowledgeable on handling their respective livelihoods—advancing households' respective socioeconomic status. Similarly, provisions of jobs will cater to the influx of skilled workers, facilitated by increased education. As such, those who are given scholarships and education programs will be able to use the skills imparted and reduce the incidence of free-riding.

We would like to emphasize that the government can only do so much in alleviating the hunger among impoverished households. A more sustainable way of relieving the poor from poverty must be designed instead of employing "band-aid" solutions to address hunger. If the intent of antipoverty programs is to win the votes of poor households, then they will repeatedy free-ride on government initiatives. Hence, our long-run solution is the redistribution of wealth through the provision of conditional livelihood programs. It must be implemented in such a way that the recipient must sustain the livelihood; otherwise, they will be held accountable.

It is also the obligation of poor households to strategize and to manage their resources responsibly. They should learn to be self-sufficient and should not rely solely on government support. They should complement government efforts by taking resources given to them a step further—they

have a role too in poverty reduction. They should help themselves to strive independently for them to climb the social ladder.

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