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# The Philippine Review of Economics



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# The Philippine Review of Economics

A joint publication of the UP School of Economics (UPSE)
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# Is household income diversification welfare improving? The evidence from Philippine panel data

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Using panel data from the Annual Poverty Indicator Surveys for 2007, 2008, and 2010, I estimate two-stage pooled and fixed effects models to examine the income diversification behavior of Filipino households, with a special emphasis on rural areas. In order to evaluate the welfare implications, I test for a significant effect of diversification on income and consumption volatility in the presence of idiosyncratic and aggregate shocks. The results support both risk aversion and wealth accumulation as valid motives for diversification, although the former is more dominant among poor and rural households. Owing to asset build-up, diversification helps well-off families mitigate future income and consumption fluctuations. However, there is no evidence of a similar effect for rural households whose diversification strategy is primarily subsistence-driven. This implies a situation where income diversification may further worsen unequal access to resources and opportunities.

**JEL classification**: D10, D12, D13, R20
**Keywords**: permanent income hypothesis, risk aversion, income diversification, consumption smoothing

## 1. Introduction

As suggested by the permanent income hypothesis, economic agents are generally perceived to have a strong preference for a stable consumption pattern over time [Friedman 1957]. Hence, fluctuations and permanent declines in income due to negative shocks can cause considerable welfare losses among vulnerable households.[1] For instance, sudden unemployment, sickness, hostile weather

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[1] The terms "family" and "household" are used interchangeably in this study, although the equivalence is not necessarily true all the time (e.g., in the case of nuclear versus extended families).

conditions, and economic downturns pose restrictions on consumption through their adverse effect on family earnings. Welfare losses can further be aggravated by households' inability to augment income in the face of liquidity constraints, minimal savings, and limited access to credit [Deaton 1991].

In order to minimize these risks, households normally engage in income diversification strategies through involvement in different livelihood activities. In the literature, having multiple income sources is commonly referred to as "pluriactivity" [Reardon et al. 2007]. This may take the form of employment and entrepreneurship in both agricultural (e.g., farming and fishing) and non-agricultural (e.g., agro-processing, mining, manufacturing, construction, utilities, trading, and services) sectors. Participation in several economic activities and investing in assets with inversely related or totally uncorrelated returns allow families to manage income fluctuations and smooth consumption overtime. As noted by Barrett et al. [2001], diversification in this context becomes a form of self-insurance against economy-wide shocks and seasonal income swings. However, for families endowed with financial and human capital, branching out to more lucrative jobs and businesses may be a deliberate strategy to accumulate more wealth [Haggblade et al. 2010].

The importance of reducing dependence on few dominant income sources is even more pronounced among low-income households, especially those in rural agricultural areas. In the absence of supplemental livelihood activities, poor families are more vulnerable to earnings fluctuations and possible cutbacks in consumption following unfavorable events such as droughts and typhoons. This is particularly true for those living in developing countries where access to stable employment, entrepreneurial opportunities, formal credit lines, and social safety nets are constrained by their socioeconomic status, education, and limited social networks (Ellis [2000]; Haggblade, Hazell, and Reardon [2010]; Schwarze and Zeller [2005]). In addition, access to better opportunities in cities and urban centers is restricted in remote locations where hard and soft infrastructure (e.g., transport systems and internet connection) are largely underprovided (Davis, Di Giuseppe, and Zezza [2014]; Nakajima, Otsuka, and Yamano [2017]). In the literature, numerous studies have extensively explored the linkages between income diversification, risk management, and poverty reduction in rural agricultural areas. See for instance Ellis [2000] and the focused surveys of Barrett et al. [2001] for Africa, Reardon and Escobar [2001] for Latin America, and Reardon et al. [2007] and Davis, Di Giuseppe, and Zezza [2014] for Africa, Latin America, and Asia. The papers reviewed in these surveys generally agree that income diversification has the potential to improve welfare and reduce poor rural households' vulnerability to adverse shocks, particularly the seasonal uncertainty of agricultural employment. At the aggregate level, the transition to high-return nonfarm activities is a key driver of the rural economy's structural shift to a higher growth path [Haggblade et al. 2010].

In the Philippines, many of the poor can also be found in rural areas. As noted by Balisacan and Pernia [2002], poverty in the country is largely a "rural phenomenon" with 78 percent of the poor living in rural areas in 2012 [Briones 2016]. Reyes et al. [2012] also show that poverty is more prevalent in households that rely heavily on agricultural income. In particular, they estimate that poverty incidence among agricultural households in 2009 was three times higher compared to non-agricultural families. As a consequence, poverty reduction policy in the Philippines has traditionally revolved around programs (e.g., agrarian reform, farm-to-market roads, training and skills development, microcredit, and expansion of safety nets) aimed at improving the rural poor's access to productive resources, economic opportunities, and social services [Balisacan and Pernia 2002]. For instance, the current Philippine Development Plan targets to bring down rural poverty incidence to 20 percent by 2022 through holistic interventions that can stimulate agricultural productivity and on-farm diversification (e.g., to high-value crops and agro-processing), increase off-farm opportunities, and improve the spatial and inter-sectoral mobility of goods and labor [NEDA 2017].

Despite the relevance of income diversification in the welfare of many poor Filipinos, there is an apparent gap in terms of focused research on the subject. This paper contributes to the literature by analyzing the significant factors affecting the diversification strategies of Filipino households, particularly those in rural areas. In addition, this study investigates the welfare impact of income diversification which is not yet widely explored in previous researches. A better understanding of households' diversification behavior may guide policies that aim to reduce the vulnerability of poor families to income and consumption fluctuations and to correct market inefficiencies that constrain factor movements to higher productivity livelihood. I apply panel data techniques to identify the significant determinants of income diversification for the national and rural samples. To my knowledge, this is the first study on income diversification using panel household data from the Philippines. To check the robustness of the results, simple two-stage (2SLS) pooled regressions are also estimated as the baseline specification. In order to evaluate the welfare implications, fixed effects models are used to check any significant impact of diversification on income and consumption volatility in the presence of adverse aggregate and idiosyncratic shocks.

The results provide evidence for both risk aversion and wealth accumulation as valid motives for income diversification, although the former is expectedly more dominant among poor rural households. Based on the national sample, the estimates suggest that households' degree of income diversification helps moderate future income and consumption volatility. However, there is no evidence that diversification adequately reduces the vulnerability of the rural poor to welfare losses caused by negative income and consumption shocks.

The rest of the paper is organized as follows. The theoretical framework, methods, and data used are presented in the next two sections. This is succeeded by the discussion of the main empirical findings of the study. The last section summarizes the paper with the conclusion and some policy implications.

## 2. Theoretical framework

It is common among family members to jointly decide on the allocation of their time and capital endowments when maximizing the present value of household wealth or consumption level (Blank et al. [2007]; Mishra, El-Osta, and Sandretto [2002]). Further, the decision on how much to consume in the current period is simultaneously determined with the decision about how much will be saved for future consumption and provisions for some contingency [Deaton 1992]. Considering income uncertainty within a finite lifetime, the typical household's utility function can be represented as:

$$U_t = E_t\left[\sum_{t=0}^{T-1}\left(\frac{1}{1+\delta}\right)^t u\left(C_t\right)\right] \tag{1}$$

where $E_t$ is the expectations operator, $\delta$ is the subjective discount factor, and $C_t$ is the consumption level at time *t*. The household maximizes its utility subject to a budget constraint given by:

$$A_{t+1} = \left(1+r\right)\left(A_t + Y_t - C_t\right) \tag{2}$$

which can be expressed in the following form after integrating forward up to time *T* and discounting at time zero[2]:

$$\sum_{t=0}^{T-1}\left(\frac{1}{1+r}\right)^t C_t = \sum_{t=0}^{T-1}\left(\frac{1}{1+r}\right)^t Y_t + A_0 \tag{3}$$

where *r* is the interest rate, $Y_t$ is total income, and $A_t \geq 0$ is the stock of assets. Further, $Y_t$ and $A_t$ can be decomposed as $Y_t = \sum_{j=1}^{J} y_{jt}$ and $A_t = \sum_{j=J+1}^{K} a_{jt}$, where the *y*'s and *a*'s are component earnings from different activities and assets, respectively.

The standard consumption Euler equation obtained from maximizing the household's utility is combined with Equation 3 to derive an extreme case of consumption smoothing (i.e., $C_0 = E_0[C_t] \forall t \in [0, T-1]$ and $T \to \infty$) that is consistent with the permanent income hypothesis[3]:

$$C_0 = \left(\frac{r}{1+r}\right)\left[E_0\left[\sum_{j=1}^{J}\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^t y_{jt}\right] + \sum_{j=J+1}^{K} a_{j0}\right] \tag{4}$$

[2] This assumes $A_T = 0$ since there is no reason to accumulate assets at the end of a finite lifetime [Blanchard and Fisher 1989].

[3] The solution is detailed in Blanchard and Fisher [1989: chapter 6, section 2].

Finally, the change in consumption can be expressed as a function of a *change in expectation* about future income:

$$\Delta C_t = \left(\frac{r}{1+r}\right)\left[\sum_{p=0}^{\infty}\left(\frac{1}{1+r}\right)^p\left(\Delta E_t\left[\sum_{j=1}^{J} y_{j,t+p}\right]\right)\right] \tag{5}$$

Based on Equations 4 and 5, it can be inferred that household utility is a positive function of earnings from all sources [Reardon, Delgado, and Matlon 1992]. In addition, it is clear that higher uncertainty about future income flows can generate welfare losses. For instance, threats to job security in times of sickness and volatile entrepreneurial income during crises may distort consumption smoothing when households have to revise expectations more frequently.

However, it is possible to reduce fluctuations in total income if the component earnings are negatively correlated with each other [Robison and Barry 1987]. In other words, the returns from different economic activities and assets should have offsetting effects especially during bad times. Stable income flows reduce downward revisions in earnings expectations, which in turn prevents drastic cutbacks in consumption. Denoting by Ω the $K \times K$ variance-covariance matrix of income and asset earnings from different sources, it is obvious that having positive off-diagonal elements $\sigma\left(y_j, y_{\sim j}\right)$ implies a possible decline in consumption in the presence of negative income shocks since $\partial^2 C / \partial y_j \partial y_{\sim j} > 0$. Conversely, when $\sigma\left(y_j, y_{\sim j}\right) \leq 0$, the total effect on consumption is ambiguous, but the risk of automatic decline during bad times is somehow minimized. As noted by Reardon et al. [2007], households manage risks *ex ante* by diversifying into activities that have low positive covariance with the main income source. This implies that the source of risks for one livelihood or employment is different and weakly correlated with the factors that create risks for other activities [Ellis 2000]. Furthermore, households may practice income skewing by engaging in low-risk activities even if returns are possibly also low. Alternatively, Olale and Henson [2012] suggest that high income variability should encourage greater diversification. Hence, the preceding utility maximization problem may be expounded to reflect income volatility, household labor allocation, and explicit constraints on the production technologies of different income-generating activities. (See for instance Mishra et al. [2010], Olale and Henson [2012], and Wouterse and Taylor [2008].) Ultimately, the diversification strategy should reflect a balancing act between earning the highest possible income and managing total risk exposure.

As suggested by Keynes [1936], the preference for liquidity is rooted in three major purposes: transactional, precautionary, and speculative motives. The first two are broadly in line with consumption smoothing since households want to be adequately liquid to satisfy both planned and unexpected expenditures in the current period and in the immediate future. Friedman [1957] and Modigliani [1975] add that in the presence of uncertainty, the propensity to spend out of permanent income would normally decline such that precautionary saving increases.

However, Zeldes [1989] highlights that households with low earnings and very little accumulated assets are precisely the least protected from uncertainty. With limited access to credit and minimal transfers, an alternative way of managing the risks associated with income fluctuations is through diversifying the family's income portfolio (Mishra and Goodwin [1997]; Morduch [1995]; Robison and Barry [1987]).

Reardon et al. [2007] suggests that the decision to diversify has several dimensions. In particular, the diversification strategy should determine the sectors of choice (i.e., agricultural versus manufacturing versus services), the mode of income generation (i.e., entrepreneurship versus wage employment), and the location (e.g., home-based versus migration). Ultimately, the decision to diversify depends on the household's incentives and its capacity to pursue multiple livelihood activities. The set of incentives includes the relative net benefits from the range of alternative activities and the volatility of those gains in the face of risks (e.g., supply and demand shocks). The capacity variables pertain to human, financial, and network resources that enable households to overcome the entry barriers of various activities.

The incentives (or motives) to diversify may be broadly categorized into push and pull factors. Push factors include *ex ante* risk management in anticipation of seasonal unemployment, potential shocks (e.g., economic crisis, war, and bad weather), and resource constraints (e.g., diminishing returns to factors of production due to population pressure) (Balisacan [1991]; Barrett et al. [2001]; Ersado [2006]; Reardon et al. [2007]). This implies that distress-pushed families with limited liquid assets are more likely to use diversification as a form of self-insurance [Martin and Lorenzen 2016]. Families may also adopt risk-coping strategies that involve precautionary savings, asset management, and *ex post* income diversification following a drop in permanent income (Morduch [1995]; Reardon et al. [2007]).

Locational features may likewise affect a household's desire and ability to broaden its livelihood activities. For instance, a study using spatial analysis reveals that there are inter-household spillovers of diversification practices in Nigeria, suggesting that households learn from the strategy of their neighbors through market-based and social interactions [Corral and Radchenko 2017]. In addition, Davis, Di Giuseppe, and Zezza [2014] show that distance from market centers affects the nonfarm diversification of households in low-potential areas in sub-Saharan Africa. In particular, Djido and Shiferaw [2018] find that income is more diversified in areas closer to urban districts in Nigeria. This echoes the conclusions in previous studies that remote communities with limited natural endowments, poor road networks, and market inefficiencies (e.g., high transaction costs in formal credit, insurance, and factor markets) are expected to have risk aversion as the primary motive for income diversification (Balisacan [1991]; Schwarze and Zeller [2005]).

On the other hand, pull factors are normally associated with diversification for wealth accumulation purposes [Reardon et al. 2006]. Barrett et al. [2001] identify productivity-enhancing resource reallocation, exploitation of economies of scale and scope, better access to technology, and improved production efficiency as examples of pull factors. In general, higher pay-offs and tolerable risks encourage households to increase capital investments that stimulate further diversification; hence an upward spiral of income and wealth. However, Schwarze and Zeller [2005] add that households' ability to engage in additional productive endeavors is constrained by access to physical, financial, and social assets. This means that success-pulled diversification is more likely among non-poor families that possess the resource and experience to deal with the costs of pursuing high-return but risky activities [Martin and Lorenzen 2016]. For instance, Zhao and Barry [2014] find that production assets (e.g., equipment, orchards, and livestock) are more relevant in the diversification strategy of richer households in rural China.

In terms of capacity, access to public goods such as roads, electricity, and town centers increase the probability of non-agricultural participation of households [Barrett et al. 2001]. For instance, Gibson and Olivia [2010] show that lack of access to quality infrastructure limits the nonfarm activities of rural-based families in Indonesia. Socioeconomic characteristics such as educational attainment and social networks may also influence the way households manage their income portfolios [Schwarze and Zeller 2005]. Abdulai and Delgado [1999] and Corral and Reardon [2001] find that less educated households are mainly dependent on low-wage employment or low-productivity activities, while families with more education have higher earnings from nonfarm livelihood. A number of studies also point out that landholdings are associated with diversification although the evidence is mixed (Abdulai and Delgado [1999]; Reardon et al. [2007]). For example, Imai, Gaiha, and Thapa [2015] find that Vietnamese households that own small lots tend to concentrate on farming only while those who are either landless or hold large parcels are more likely to branch out to nonfarm employment.

Balisacan [1991] and Barrett and Reardon [2000] add that demographic characteristics may also influence the diversification of income sources. In particular, family composition will have an impact on the division of labor in line with intra-household specialization. In other words, diversification can be a direct manifestation of the household's effort to maximize the allocation of the talents and skills of different members [Davis, Di Giuseppe, and Zezza 2014]. In rural areas, low-quality labor is expected to work in farms, while more skilled and more educated family members will be delegated to non-agricultural activities [Lanjouw and Murgai 2009]. Based on gender, male members of rural households are expected to perform farm-based tasks [Balisacan 1991]. Hence, the nonfarm sector can act as the residual employer of women given their limited employability in agriculture [Bezu, Barrett, and Holden 2012].

In the literature, there are also extensive empirical studies that support the positive relationship between income diversification and welfare. Based on

a survey by Barrett et al. [2001], diversification towards nonfarm livelihood is usually associated with higher purchasing power and increased food expenditures in several African countries. A study by Islam et al. [2018] also shows that higher nonfarm income increases the dietary diversity of households in Bangladesh. However, Bezu, Barrett, and Holden [2012] find that participation in off-farm activities has a bigger impact on the consumption of wealthier households in Ethiopia. In Vietnam, a big proportion of farmers surveyed in 1994 claimed that their living standards improved partly due to additional earnings from livestock and new crops [Minot et al. 2006]. Ersado [2006] also finds that households with relatively broad-based income are more resilient to the adverse impacts of weather shocks and policy shifts in Zimbabwe. In terms of contingency funds, Reardon et al. [1992] show that poor agricultural households derive their main savings from nonfarm income, which in turn are used to satisfy food consumption during bad times. Mishra and Chang's [2012] evidence from US households also suggests that retirement savings increase with the decision to work off-farm. There are also studies that show a positive contribution of diversification to poverty reduction. For instance, Martin and Lorenzen [2012] find that livelihood diversification can potentially reduce poverty in Laos through its positive effects on wealth and asset ownership. Himanshu et al. [2013] also document similar results in a village case study in India, noting that accelerated diversification can help upgrade the economic and social status of the poor. However, the quality of income diversification also matters. Using household data from Vietnam and India, Imai, Gaiha, and Thapa [2015] find that the risk of falling back to poverty is lower for those who diversified to more skilled employment instead of unskilled manual jobs.

## 3. Data and methodology

Based on the determinants identified above, I model household-level income diversification as:

$$d_{it} = f\left(v_{it}, x_{it}, z_{it}, u_i, \varepsilon_{it}\right) \tag{6}$$

where $d_i$ is a measure of income diversification for household $i$, $i = 1,\ldots, n$; $\boldsymbol{v_i}$ is the vector of demographic profile; $\boldsymbol{x_i}$ is the vector of socioeconomic characteristics such as asset holdings and per capita income level; $\boldsymbol{z_i}$ is the vector of accessibility indicators, i.e., access to public goods and formal financial markets; $u_i$ is the unobserved time-invariant effect; and $\varepsilon_{it} \sim N\left(0, \sigma^2\right)$ is the stochastic error term. Observations across time are indexed by $t$, $t = 1, 2, 3$. More explicitly, income diversification is modeled as a linear function of the said variables:

$$D_t = \alpha + V_t\beta + X_t\theta + Z_t\phi + U\gamma + \varepsilon_t \tag{7}$$

where $\boldsymbol{D}$, $\boldsymbol{\alpha}$, and $\varepsilon$ are $n \times 1$ vectors of household income diversification indicator, constants, and error terms, respectively; $\boldsymbol{V}$, $\boldsymbol{X}$, and $\boldsymbol{Z}$ contain the values of the hypothesized determinants across observations; $\boldsymbol{U}$ is the matrix of latent heterogeneity at the household and aggregate levels; and $\boldsymbol{\beta}$, $\boldsymbol{\theta}$, $\boldsymbol{\phi}$, and $\boldsymbol{\gamma}$ are vectors of coefficients.

Following Dimova and Sen [2010] and Martin and Lorenzen [2016], I use the indicators in $\boldsymbol{X}$ to test the validity of the diversification for risk management and accumulation hypotheses. One indication of the risk aversion view is that diversification should be negatively related with income since poor households are more likely to engage in multiple income-generating activities. In other words, low-income families are "pushed" by low and volatile earnings to diversify their portfolio. On the other hand, the accumulation view suggests a positive relationship between diversification and asset holdings since richer households tend to diversify to further increase wealth [Babatunde and Qaim 2009].

We apply panel data techniques to identify the significant determinants of income diversification for the national and rural samples. In particular, I apply fixed effects estimation to eliminate time invariant but unobservable household characteristics that may be related to their income diversification behavior. Consequently, the estimation procedure transforms Equation 7 into:

$$\left(D_t - \bar{D}\right) = \left(V_t - \bar{V}\right)\beta + \left(X_t - \bar{X}\right)\theta + \left(Z_t - \bar{Z}\right)\phi + \left(\varepsilon_t - \bar{\varepsilon}\right) \qquad (8)$$

where the *mean* vector and matrices contain averages of specific household-level characteristics across time. For instance, $\bar{\boldsymbol{D}}$ is a vector containing $\bar{d}_i = \frac{1}{T}\sum_{t=1}^{T} d_{it}$. In the current context, $T = 3$.

However, it is very likely that contemporaneous per capita earnings are also determined by the diversification strategy of households, especially for families driven by wealth accumulation. Hence, using current income as an explanatory variable poses a possible endogeneity problem. Following Ersado [2006] and Dimova and Sen [2010], I augment the fixed effects models with an instrumental variable to address potential reverse causality. I use the lag values of per capita income and total household expenditures as instruments. To check the robustness of the results across different specifications, pooled 2SLS models are also estimated as the baseline.

To evaluate the welfare effects, I model the impact of diversification on income and consumption volatility while controlling for socioeconomic household characteristics and negative idiosyncratic (i.e., getting ill) and aggregate (i.e., oil price) shocks. In particular, I apply fixed effects estimations using $\left(\sigma_{Y_{it}} - \bar{\sigma}_{Y_i}\right)$ and $\left(\sigma_{C_{it}} - \bar{\sigma}_{C_i}\right)$ as the dependent variables, where $\sigma_{Y_{it}} = \sigma\left(Y_{it}, Y_{i,t-1}\right)$ and $\sigma_{C_{it}} = \sigma\left(C_{it}, C_{i,t-1}\right)$ are proxies for the volatilities of income and consumption, respectively. The set of controls are derived from previous studies such as Deaton [1991] which argues that prudent households exhibit a precautionary motive for saving in the presence of both income uncertainty and credit constraint. In addition, Haughton and Khander [2009] note that factors such as productivity, employment decisions, and

asset holdings (e.g., land, durable goods, and financial investments) determine income flows and households' inventory of wealth. In this light, Morduch [1995] suggests that households can smooth consumption not only by borrowing and saving but also by liquidating non-financial assets and reallocating labor supply to additional income-generating activities. The last two options are particularly important when credit and insurance markets are practically nonexistent [Bezu, Barrett, and Holden 2012]. As shown by Rosenweig and Stark [1989] and Kochar [1999], farm-based households in India respond to shocks by assigning some labor resources to non-agricultural activities, particularly stable wage employment, thus diversifying their income sources and effectively insulating consumption from income volatility. Corral and Radchenko [2017] likewise find that lower rainfall increases off-farm diversification in Nigeria.

The analyses in this paper are based on an original panel of 6,652 households from the Annual Poverty Indicator Surveys of the former National Statistics Office (now Philippine Statistics Authority) for the years 2007, 2008, and 2010. Out of this sample, 4,070 are identified as rural households based on the 2010 classification. Only demographic features of the household head are considered in the model, while socioeconomic variables take into account the characteristics of the entire household. Other variables derived from the Annual Poverty Indicator Surveys include the ratio of male family members to family size, household-level working age ratio, years of education, and several dummies for socioeconomic indicators, asset holdings, and access to markets. In calculating the diversification index, only major income categories are used namely, wages, transfers, returns from assets and investments, family sustenance activities[4], and agricultural, industrial, and services-related entrepreneurial activities. However, the components of these sub-groups (as reported in the Annual Poverty Indicator Surveys) are considered in counting the number of income sources per family. For completeness purposes, unclassified items are grouped as a separate category of income source. Refer to Table A1 in the Appendix for the summary statistics of the variables used in this study.

Several measures of income diversification are used in the literature. The simplest approach involves counting the number of economic activities where a household generates positive earnings. However, this measure may not accurately gauge the degree of diversification due to the unaccounted contribution of each income source to total family receipts. Based on Schwarze and Zeller's [2005] approach, I constructed a Shannon diversity index for income diversification based on the following formula:

$$d_{it} = \sum_{l=1}^{L} s_{lit} \ln\left(\frac{1}{s_{lit}}\right) \tag{9}$$

[4] According to the official definition, the output coming from family sustenance activity (e.g., backyard farming) is mainly used for home consumption, although occasional sale is done when there is surplus [NSCB 2003].

where $d_i$ is the index for a particular household $i$ in time $t$, and $s_{lit}$ is the share of income source $l$ in total family receipts in time $t$.[5] The Shannon diversity index has a lower limit of zero and an upper limit of ln($L$). In contrast to simply counting pluriactivity, this measure does not assume that a higher degree of diversification necessarily follows from engagement in more economic activities. Similar to the more popular Herfindahl concentration index, this measure also takes into account both the number of income sources and their respective weights in total earnings. However, unlike the Herfindahl index that is decreasing with diversity, a higher value of $d$ intuitively means a more diversified income portfolio.

In order to provide an indicator of the quality of infrastructure and local accessibility, road density index for each province is also used in this study. The data are obtained from the 2007, 2008, and 2010 annual reports of the Department of Public Works and Highways. Unfortunately, there are no available data for provinces in the Autonomous Region in Muslim Mindanao. Hence, the households in the region are only included in stylized facts but not in econometric estimations.

Lastly, the international oil price shocks are derived from the World Bank commodity price database.

## 4. Results and discussion

Initial inspection of the data shows that wage income is the main source of household earnings during the period studied, as shown in Table 1. This observation is true for both poor and non-poor households and for the national and rural samples. It is also worth noting that wage earnings dominate by a wide margin, indicating a potentially unbalanced diversification due to high dependence on a single income source. For poor families, total receipts from agriculture-related activities (e.g., crop farming and gardening, livestock and poultry raising, and fishing) are also a major income source, especially when compared to the relatively small role of agriculture in non-poor households' earnings. Conversely, transfers (e.g., foreign remittances) and non-agricultural enterprises (e.g., wholesale and retail trade, manufacturing, mining, and construction) are more important for non-poor families. As expected, high-return activities are less relevant to poor households since they lack the resources to overcome the barriers to entry. For instance, Estudillo, Ramos, and Otsuka [2009] document that credit access and land ownership are important factors in Filipino families' decision to pursue overseas work. Likewise, more productive nonfarm businesses and permanent jobs have higher skills, education, and capital requirements that are often not available to low-income households.

[5] The Shannon diversity index is more popularly used in biology as a measure of ecological diversity [Schwarze and Zeller 2005].

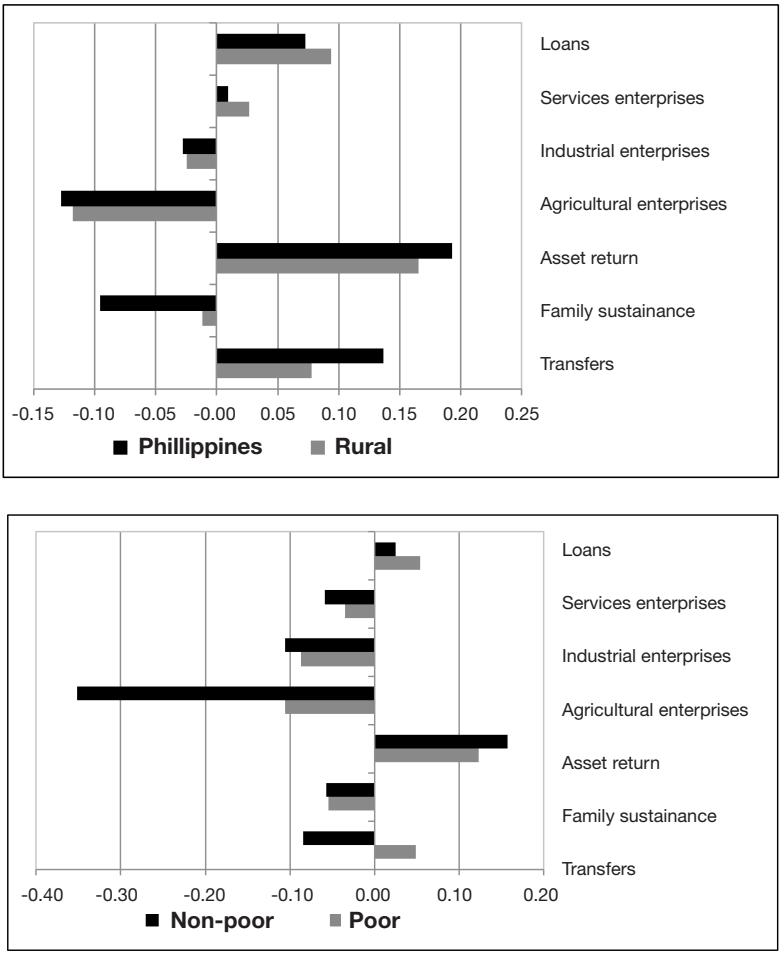
**TABLE 1. Composition of total family receipts**

| Component | Philippines | | Rural | |
|---|---|---|---|---|
| | Poor | Non-poor | Poor | Non-poor |
| Wages | 34.3 | 36.7 | 29.8 | 30.9 |
| Entrepreneurial activity | 33.4 | 24.0 | 37.3 | 30.2 |
| of which: Agriculture | 21.9 | 8.4 | 27.7 | 16.0 |
| Industries | 7.6 | 10.2 | 6.5 | 10.2 |
| Services | 3.9 | 5.4 | 3.1 | 4.0 |
| Transfers | 14.4 | 22.6 | 14.9 | 23.8 |
| of which: Foreign | 2.7 | 11.3 | 2.5 | 11.4 |
| Asset return | 9.7 | 12.5 | 8.8 | 9.7 |
| Family sustenance activities | 4.3 | 1.0 | 5.2 | 1.8 |
| Loans | 3.1 | 2.2 | 3.2 | 2.8 |
| Others | 0.9 | 1.1 | 0.8 | 0.8 |

Sources of data: Philippine Statistics Authority Annual Poverty Indicator Surveys for 2007, 2008, and 2010

Figure 1 illustrates that households not only diversify their income sources, they also choose activities that do not necessarily move together. For instance, it can be observed that the covariance of entrepreneurial income with wages is generally negative. Based on the risk aversion view, this suggests that family members tend to engage in alternative livelihood activities as a source of supplemental income in case of unexpected fall in wages. As noted by Reardon et al. [2007], households choose negatively related flows so that total earnings do not automatically decline when hit by adverse income shocks. In turn, this strategy may minimize the volatility of total earnings and consumption. However, based on the wealth accumulation motive, the negative relationship between entrepreneurial income and wages may reflect the fact that a household's choices are influenced by its human and financial resources. Expectedly, lower-income families with limited capital and business experience end up in wage employment or low-return livelihood where barriers to entry are not very high. Figure 1 also shows that wages are positively related with asset returns, suggesting that some earnings are used to purchase productive investments. Consistent with the wealth accumulation view, the co-movement is generally weaker among rural and poor households since they are more likely driven by survival rather than asset buildup. Lastly, the observed positive covariance of loans with wages and asset returns suggests that resorting to credit markets during bad times may be an option limited to those with known capacity to repay.

**FIGURE 1. Covariance of different income sources with wage income**

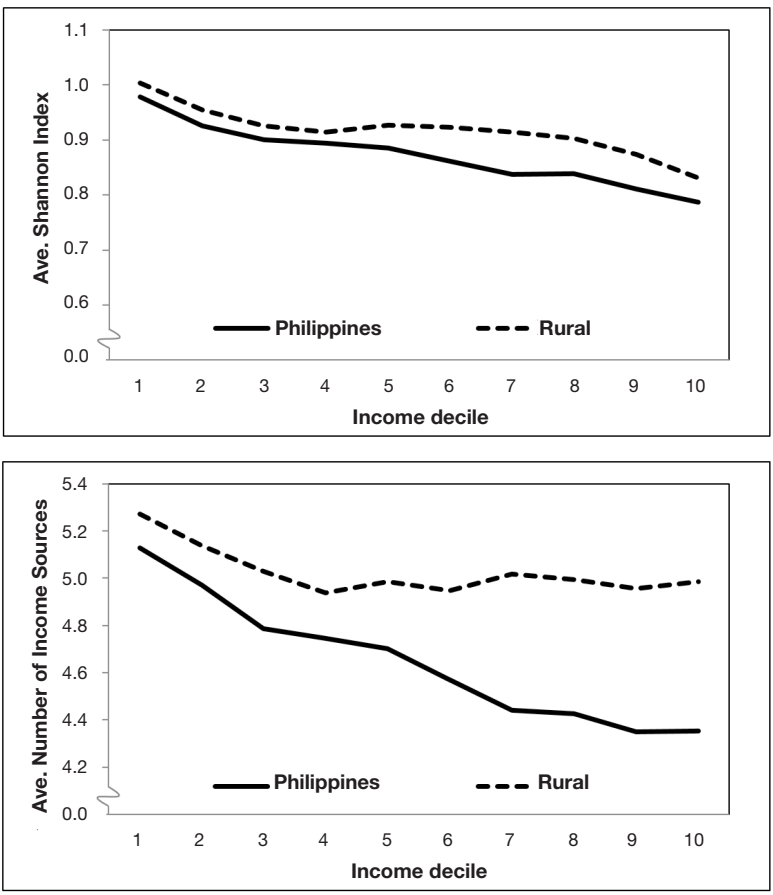



Sources of data: Philippine Statistics Authority Annual Poverty Indicator Surveys of 2007, 2008, and 2010

The Shannon diversity index shows a negative relationship between income diversification and the level of per capita earnings, as shown in Figure 2. This is consistent with the widely held belief that risk aversion declines as income rises, implying that poorer households will have higher preference for diversification as a form of *ex ante* risk management due to their low stock of wealth and liquid assets (Balisacan [1991]; Barrett et al. [2001]). According to Reardon et al. [2007], lower-income households will try to compensate for their small asset base and volatile earnings by doing a variety of activities, albeit not performing all efficiently. Since there is a tradeoff between risk and return, poor households have to pay the implicit price of avoiding specialized but risk-prone jobs by

engaging in multiple low-risk but low-paying activities [Martin and Lorenzen 2016]. Other than the risk motive, it is also possible that the type of livelihood activities available to poor families are simply low-skilled and low-return. Since more productive activities have higher entry barriers, families with low wealth and human capital stock end up in low-paying precarious jobs [Nakajima, Otsuka, and Yamano 2017]. As a result, family members are forced to seek additional sources of income just to meet a subsistence level of consumption. In contrast, richer households are commonly specialized in non-agricultural activities and wage employment that provide high and stable income flows. This renders diversification due to risk aversion less urgent for well-off families.

**FIGURE 2. Average Shannon diversity index and number of income sources by income decile**




Sources of data: Philippine Statistics Authority Annual Poverty Indicator Surveys of 2007, 2008, 2010

In addition, the income portfolio of households in rural areas are more diversified relative to the national average. As shown in Figure 2, the mean Shannon values and average number of income sources across income deciles are consistently higher for the rural sample. An obvious explanation for this pattern is the well-known fact that rural areas are coincidentally poorer (Balisacan and Pernia [2002]; Briones [2016]). Based on the data from the Annual Poverty Indicator Surveys, my estimates in Table 2 shows that the share of poor households is more than two times higher in rural than in urban areas. Consistent with the preceding discussion, the risk aversion view predicts a relatively high diversification among rural households since the majority of their earnings is linked to farming, fishing, and low-wage and seasonal employment. As noted by Dimova and Sen [2010], income in rural agricultural areas, especially in developing countries, is usually characterized by excessive volatility due to weather variations, pests, limited road networks, and international price shocks. Given the seasonal fluctuations in farm-based production, households are normally motivated to seek additional employment, albeit low-skilled and contractual, to ensure a steady flow of income especially during idle post-harvest months [Martin and Lorenzen 2016]. Barrett and Reardon [2000] add that high transaction costs, increasing population pressures, and weak credit markets create strong incentives for rural residents to engage in self-provision and self-insurance by maintaining a diversified portfolio of activities. In this context, households can be viewed as diversifying to survive.

**TABLE 2. Distribution of poor and non-poor households across rural and urban areas (percent)**

| | 2007 | | | 2008 | | | 2010 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Non-poor | Poor | Total | Non-poor | Poor | Total | Non-poor | Poor | Total |
| Rural | 15.3 | 41.6 | 56.9 | 18.9 | 38.2 | 57.2 | 16.2 | 41.3 | 57.6 |
| Urban | 25.1 | 18.0 | 43.1 | 27.5 | 15.4 | 42.8 | 25.0 | 17.4 | 42.4 |
| Total | 40.4 | 59.6 | 100.0 | 46.4 | 53.6 | 100.0 | 41.2 | 58.8 | 100.0 |

Source: Author's calculation based on data from NSCB and Annual Poverty Indicator Surveys of 2007, 2008, 2010

Based on Figure 2, the average number of income sources also generally decreases with income.[6] In other words, the poor more commonly practice pluriactivity, although the pattern is more apparent for the national than the rural sample. In addition, the curves for the average number of income sources and the average Shannon diversity index for rural households are consistently higher

[6] This pattern does not conform with the earlier hypothesis of a non-linear "J-curve" relationship between diversification of livelihood activities and income level as suggested by Balisacan [1991].

than for the national sample. This provides further support to my claim that risk aversion could be a major reason for diversification among low-income rural families. Davis, Di Giuseppe, and Zezza [2014] note that rural households may engage in risk-spreading activities as a response to market failures and lack of lucrative opportunities. For instance, without crop insurance, farmers are inclined to diversify to non-agricultural jobs that are less prone to seasonal volatility. Figure 2 also implies that poorer households have lower average receipts per activity compared to higher income families. Given a subsistence level of consumption, it is intuitive that lower-income households will try to have multiple income sources especially when each activity can only generate limited earnings.

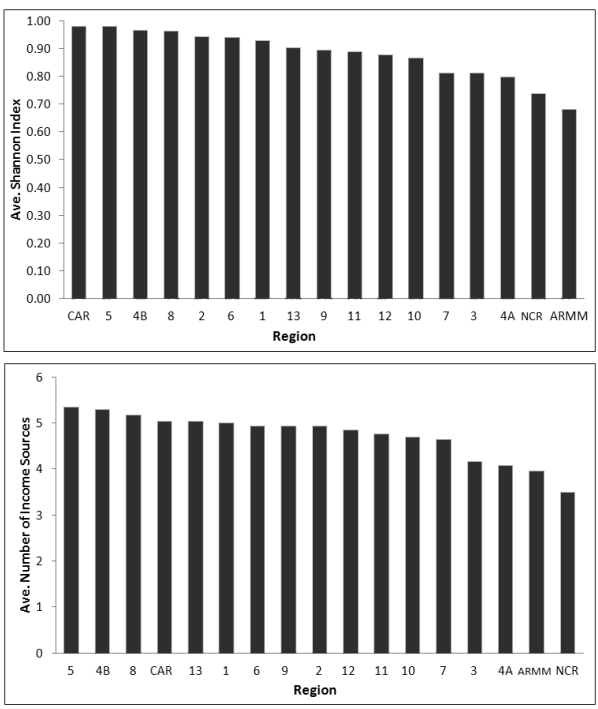
**TABLE 3. Income diversification in other countries**

| Location | Year | Average Shannon diversity index | Source |
|---|---|---|---|
| Australia | 2006 | 0.76 | Worthington [2009] |
| First quartile | | 1.04 | |
| Second quartile | | 0.79 | |
| Third quartile | | 0.50 | |
| Bhutan | 2012 | 1.54* | Rahut, Mottaleb, and Ali [2017] |
| First quintile | | 1.66* | |
| Third quintile | | 1.62* | |
| Fifth quintile | | 1.46 | |
| Rural Colombia | 2001 (?) | 1.27* | Deininger and Olinto [2001] |
| First quintile | | 1.15* | |
| Third quintile | | 1.00* | |
| Fifth quintile | | 1.02* | |
| Rural Nigeria | 2006 | 1.48* | Babatunde and Qaim [2009] |
| First quartile | | 1.34* | |
| Second quartile | | 1.35* | |
| Third quartile | | 1.43* | |
| Fourth quartile | | 1.46* | |
| Vietnam | 2002 | 1.04 | Minot et al. [2006] |
| Rural | | 1.04 | |
| Urban | | 0.90 | |
| First quintile | | 1.08 | |
| Third quintile | | 1.04 | |
| Fifth quintile | | 0.93 | |

*Author's estimates based on the breakdown of average household income provided in the original papers

The observed downward trend in Figure 2 is broadly similar to the documented diversification patterns in other countries. Table 3 summarizes the estimated Shannon diversity index in several illustrative cases. Except for Nigeria[7], diversification in all listed countries is consistently higher in lower income categories. This indicates that pluriactivity among poorer households, whether in a developed country like Australia or in a remote territory like Bhutan, is mainly motivated by risk aversion. Although it must be cautioned that direct cross-country comparisons may not be completely accurate due to definitional variations, it is still interesting to note that the overall degree of diversification is relatively lower in more advanced states. In particular, Australia, the richest in the group, has a relatively small Shannon value compared to the other countries. Further, my own estimate for the Philippines is comparable to the diversification index for another emerging Asian economy (i.e., Vietnam) but relatively lower than the computed values for lower income countries (i.e., Bhutan, Colombia, and Nigeria). Lastly, the findings from Vietnam mirror my earlier observation that rural households have more diversified income.

**FIGURE 3. Average Shannon diversity index and number of income sources by region**




Sources of data: Philippine Statistics Authority Annual Poverty Indicator Surveys of 2007, 2008, and 2010

[7] This implies that the wealth accumulation motive is more dominant in Nigeria. Similar patterns have been documented in other African countries like Ghana [Senadza 2012], Tanzania [Dimova and Sen 2010], and Zambia [Bigsten and Tengstam 2011]. Further investigation may be required to explain why this pattern seems common among African countries.

In terms of location, the patterns of both the Shannon diversity index and the average number of activities summarized in Figure 3 indicate that income diversification is highest in poor regions, such as the land-locked mountains of Cordillera, the typhoon-prone provinces in Bicol and Western Visayas, and the scattered islands of Mimaropa. In contrast, rich industrial centers such as the National Capital Region, Central Visayas, and Central and Southern Luzon have expectedly less diversified income. A peculiar result, however, is the low degree of income diversification in the Autonomous Region in Muslim Mindanao, which hosts some of the poorest provinces in the Philippines. One possible explanation for this is what Reardon et al. [2007] call the "meso paradox", wherein resource-rich areas have high incentive but low capacity to diversify due to market and institutional failures. That is, missing markets and weak institutions result in a dearth of economic opportunities that limits any meaningful and productive income diversification. In other words, there are limited options to begin with. Reardon et al. [2007] suggest that addressing this paradox requires introduction of local growth engines such as modernized agriculture, mining, and tourism. Improving physical and virtual connectivity can also stimulate the movements of productive resources to and from the region.

### *4.1. Econometric results*

The findings presented so far show that poor and rural households have more diversified income. This pattern is broadly consistent both on a micro (i.e., across households) and aggregate (i.e., across regions) levels. In this section, I explore the underlying factors explaining this pattern. Table 4 presents the estimates of the econometric models I used to assess the determinants of households' income diversification strategies. The first and fourth columns show the baseline 2SLS results for the national and rural samples, respectively.[8] In these regressions, having bank deposits is used as the indicator for access to financial markets since I lack balanced panel data on access to credit. Nevertheless, to test the significance of credit access, I re-estimated the baseline 2SLS model in the second and fifth columns but with bank access replaced by an indicator for having obtained a loan. In general, the results of the 2SLS models are similar for both samples in terms of signs and statistical significance. To check for robustness, I also present the fixed effects-instrumental variable estimates in the third and sixth columns.[9] It should be noted that the demographic variables are excluded in the panel regressions as the lack of variability made the estimates insignificant after the fixed effects transformation using Equation 8.

[8] The instruments used, i.e., lag values of per capita income and total household expenditures passed the Stock and Yogo relevance criterion and the Sargan exogeneity condition.

[9] Fixed effects are used instead of random effects based on the rejection of the Hausman test for the appropriateness of the random effects model.

**TABLE 4. Determinants of income diversification**

| Variables | National | | | | | | Rural | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instrumental variable | | Instrumental variable (2) | | Fixed effects-instrumental variable | | Instrumental variable | | Instrumental variable (2) | | Fixed effects-instrumental variable | |
| Demographic characteristics | | | | | | | | | | | | |
| Age of household head | 0.001 | *** | 0.003 | *** | | | 0.000 | | 0.003 | *** | | |
| | (4.83) | | (6.92) | | | | (1.17) | | (4.62) | | | |
| Dummy: 1 = household head is male | 0.002 | | -0.005 | | | | 0.004 | | -0.013 | | | |
| | (0.25) | | (-0.34) | | | | (0.34) | | (-0.68) | | | |
| Ratio of male to total household size | 0.009 | | -0.036 | | | | 0.033 | | -0.005 | | | |
| | (0.53) | | (-1.50) | | | | (1.53) | | (-0.14) | | | |
| Ratio of household members aged ≥ 15 | 0.114 | *** | 0.120 | *** | | | 0.169 | *** | 0.153 | *** | | |
| | (5.45) | | (4.16) | | | | (6.01) | | (3.98) | | | |
| Years of education | 0.005 | *** | 0.005 | *** | | | 0.005 | *** | 0.006 | ** | | |
| | (4.43) | | (2.84) | | | | (3.26) | | (2.51) | | | |
| Assets | | | | | | | | | | | | |
| Dummy: 1 = owns house | 0.174 | *** | 0.194 | *** | 0.099 | *** | 0.059 | ** | 0.100 | *** | 0.070 | ** |
| | (11.16) | | (8.38) | | (5.14) | | (2.43) | | (2.91) | | (2.54) | |
| Dummy:1 = owns agricultural land | 0.127 | *** | 0.105 | *** | 0.046 | *** | 0.101 | *** | 0.078 | *** | 0.025 | * |
| | (17.46) | | (9.99) | | (3.97) | | (11.66) | | (5.97) | | (1.78) | |
| Number of vehicles owned | 0.036 | *** | 0.039 | *** | 0.018 | ** | 0.032 | *** | 0.039 | *** | 0.029 | ** |
| | (5.33) | | (4.67) | | (2.27) | | (3.11) | | (3.09) | | (2.30) | |
| Number of appliances owned | 0.014 | *** | 0.016 | *** | 0.006 | * | 0.012 | *** | 0.014 | *** | 0.003 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (5.65) | | (5.01) | | (1.98) | | (3.30) | | (2.82) | | (0.67) | |
| Accessibility | | | | | | | | | | | | |
| Number of mobile phones owned | 0.003 | | 0.008 | * | 0.009 | ** | 0.004 | | 0.005 | | 0.003 | |
| | (0.92) | | (1.70) | | (2.14) | | (0.91) | | (0.70) | | (0.54) | |
| Dummy: 1 = has electricity at home | 0.042 | *** | 0.047 | *** | 0.020 | | 0.061 | *** | 0.067 | *** | 0.038 | * |
| | (3.98) | | (3.04) | | (1.04) | | (5.00) | | (3.76) | | (1.79) | |
| Road per hectare | -0.015 | ** | 0.017 | | -0.378 | ** | 0.298 | *** | 0.293 | ** | 3.629 | *** |
| | (-2.07) | | (1.50) | | (-1.97) | | (3.42) | | (2.23) | | (2.78) | |
| Dummy: 1 = has bank deposits | 0.022 | * | | | 0.000 | | 0.018 | | | | -0.002 | |
| | (1.65) | | | | (0.01) | | (0.90) | | | | (-0.11) | |
| Dummy: 1 = availed loan within last 6 months | | | 0.242 | *** | | | | | 0.241 | *** | | |
| | | | (23.82) | | | | | | (18.08) | | | |
| Income | | | | | | | | | | | | |
| Per capita income (ln) | -0.156 | *** | -0.167 | *** | -0.113 | *** | -0.160 | *** | -0.179 | *** | -0.116 | *** |
| | (-11.88) | | (-9.27) | | (-4.56) | | (-8.32) | | (-6.91) | | (-4.13) | |
| Constant | 1.880 | *** | 1.850 | *** | | | 2.008 | *** | 2.013 | *** | | |
| | (17.54) | | (12.39) | | | | (12.9) | | (9.43) | | | |
| N | 12,774 | | 4,868 | | 12,774 | | 7,674 | | 2,921 | | 7674 | |
| Adj. R-squared | 0.094 | | 0.188 | | | | 0.063 | | 0.154 | | | |

The numbers in the parentheses are z-statistics.
In the instrumental variable regressions, income is instrumented by lagged per capita income and lagged household expenditures. Instrumental variable estimates are based on robust standard errors.
* p<0.10, ** p<0.05, *** p<0.01

For the baseline 2SLS model, the demographic coefficients for the national sample are broadly consistent with the estimates for rural households, except for the insignificant coefficient of age in the latter. For the entire sample, the age of the household head has a significant and positive impact on income diversification based on the 2SLS results. This suggests that families with older heads tend to have better access to a wider range of productive resources. In addition, households headed by older people are more likely to have less dependents and more adult members who are either productively employed, employable, or engaged in other livelihood activities. In particular, the most senior members probably have accumulated useful skills and experience from their past employment. Consequently, the 2SLS results also indicate that the number of family members who are of working age has a significant and positive impact on income diversification. As suggested by Babatunde and Qaim [2009], it is intuitive that families with more economically-active members will be more likely to have multiple income sources. In terms of education, the household head's years of schooling is also significant and positively related with income diversification. Not only are educated family members qualified to a wider range of jobs, they also have better networks that can provide information about new opportunities [Minot et al. 2006]. This is broadly consistent with the conclusions in previous studies (e.g., Babatunde and Qaim [2009], Barrett et al. [2001], Nakajima, Otsuka, and Yamano [2017], and Schwarze and Zeller [2005]) that highly educated household members have more access to different employment and entrepreneurial activities. In a related Philippine study, Estudillo, Ramos, and Otsuka [2009] also find that college education is the most important factor that contributes to the movement of rural households to nonfarm activities.

The estimated negative effect of per capita income on diversification is highly significant across all specifications. This confirms the trend in Figure 2 which shows a downward pattern of the Shannon diversity index as income rises. The negative relationship between income diversification and income level justifies the risk management motive or what Dimova and Sen [2010] call "diversification for survival", i.e., lower income households tend to have more diversified portfolio due to risk aversion and the fear of sudden decline in consumption during bad times. As expected, the estimated negative impact of income on diversification in rural areas is bigger than in the national sample, reflecting a more serious risk aversion due to volatile wage and agricultural earnings of the rural poor.

In addition to the risk management motive, the results of the 2SLS and fixed effects-instrumental variable regressions also show that asset indicators have a positive impact on households' ability to diversify income. For the entire sample, ownership of residential house, land, and durable goods have significant positive effects on diversification. The results are consistent across specifications. This lends support to the hypothesis that income diversification also serves as a form of wealth accumulation since households seem to acquire assets that are not very liquid (e.g., house and lot) and therefore may not be readily converted to cash

during unexpected declines in income [Dimova and Sen 2010]. Babatunde and Qaim [2009] find a similar evidence in Nigeria where asset endowments are directly used to branch out to more productive activities. In Laos, Martin and Lorenzin [2016] also document a positive relationship between their measures of wealth and diversification, indicating a more dominant progress-pull motive. These finding suggest that households acquire some assets as a store of value and source of additional earnings. However, my own results show that only house, land, and vehicle ownership remain significant in the rural fixed effects-instrumental variable regressions. In addition, the effect of these variables is smaller than the estimated coefficients for the entire sample. This further indicates that asset accumulation may not be the dominant diversification motive for rural residents since they are more concerned with subsistence given that their wealth is not large enough to support capital investments. To the extent that the rural population is predominantly poor, this result is also consistent with Haggblade, Hazell, and Reardon's [2010] observation that assetless agricultural households depend on nonfarm income diversification for survival.

In terms of connectivity, access to electricity increases income diversification. At the community level, this is intuitive since electrical power stimulates a wider range of off-farm activities such as mechanized food processing and other small-scale manufacturing. Further, access to road networks has a consistently significant effect on diversification. However, the negative effect for the entire sample is reversed for the rural sample. In rural places, physical accessibility supports income and livelihood diversification since good road networks encourage the mobility of productive labor and promotes pluriactivity. This is consistent with Estudillo, Ramos, and Otsuka's [2009] previous result that improvement in infrastructure and electricity supports the reallocation of rural labor to non-agricultural activities. Lanjouw, Quizon, and Sparrow [2001] and Babatunde and Qaim [2009] explain that good infrastructure lowers transportation and transaction costs, and ultimately increases the probability of moving into nonfarm activities. Hence, the positive impact of road improvements on rural households' diversification behavior supports the risk management motive since the rural poor are usually constrained by bad quality infrastructure. With the availability of farm to market roads, some family members can move to nearby city centers where there are more employment prospects, albeit still precarious and low-paying.

The 2SLS and fixed effects-instrumental variable results show that access to banks (proxied by having deposits) is generally insignificant, especially in rural areas. This outcome further validates that risk management may be more relevant than wealth accumulation in rural areas where formal financial markets are weaker and a large portion of households are poor and probably have no bank accounts. However, in the modified model that used credit access, the estimates are positive and highly significant. According to Dimova and Sen [2010], a positive relationship between credit access and income diversification supports the asset accumulation motive since formal credit is usually more accessible to

non-poor households whose loans are often used to fund business startups. For instance, Schwarze and Zeller's [2005] results from Tanzania show that access to formal credit institutions enabled households to change the composition of their physical capital stock, which ultimately increased the contribution of non-agricultural activities to family income.

To summarize, the results of my 2SLS and fixed effects-instrumental variable regressions for the determinants of income diversification among Filipino households are broadly consistent with the existing evidence from other countries. In particular, household-level working age ratio, years of education, per capita income, asset holdings, and physical connectivity are significant across different specifications. The results also lend empirical support to both the risk aversion and wealth accumulation motives for diversification although the former is more important for rural households.

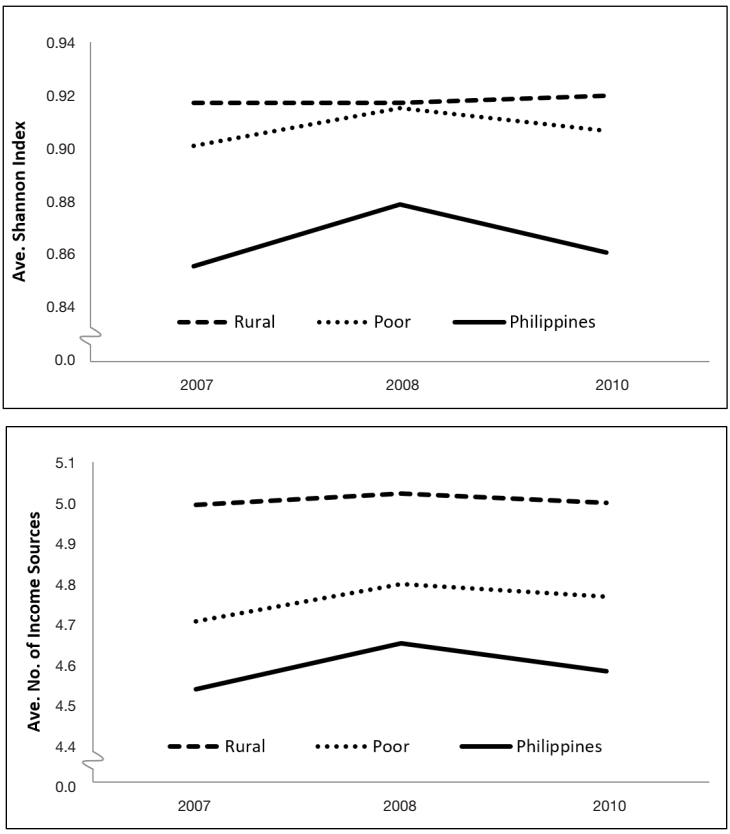
### *4.2. Welfare implications*

In this subsection, I analyze the impact of diversification on income and consumption volatility. Historically, the years 2007 to 2010 provides a perfect period to evaluate the impact of shocks on income and consumption since those years capture a complete boom-bust episode in the global business cycle. Following stable growth patterns through 2007, the Philippines was not spared from the effects of the commodity price crisis in 2007 and 2008 and the global recession in 2008 and 2009. The succeeding years were characterized by better growth performance following the recovery of the world economy.

The trend of income diversification from 2007 to 2010 lends further support to the claim that households diversify as a risk coping mechanism. As shown in Figure 4, both the Shannon diversity index and the average number of income sources increased in 2008 then decreased in 2010.[10] This implies that households tried to deal with negative income shocks during the economic downturn through pluriactivity. As the economy normalized after 2008, risk aversion eased and the degree of income diversification consequently decreased. Ersado [2006] documents a similar finding in rural Zimbabwe, where households diversify to nonfarm activities to weather negative shocks caused by past macroeconomic and rainfall volatilities. In rural Indonesia, Schwarze and Zeller [2006] also find that the occurrence of crop failures in the past reinforced overall diversification.

[10] Except for the rural sample, the increase from 2007 to 2008 and decline from 2008 to 2010 are both statistically significant based on the results of the t-tests.

**FIGURE 4. Average Shannon diversity index and number of income sources by year**




Sources of data: Philippine Statistics Authority Annual Poverty Indicator Surveys of 2007, 2008, and 2010

Table 5 presents the estimates of the fixed effects models for income and consumption volatility. Among the asset indicators, only house ownership is relevant in reducing income variability. Although houses *per se* are relatively illiquid, the significant negative effect partly reflects the fact that those who own this type of property are most likely non-poor families that depend on stable income sources. On the other hand, the positive and significant estimates for more liquid physical assets, such as appliances, indicate that part of asset accumulation is still driven by risk aversion. This is particularly relevant in areas where financial markets are incomplete such that formal institutions may not be present to store wealth and extend loans during episodes of liquidity constraints [Barrett et al. 2001]. In areas with limited credit access, a large transitory decline in income means unavoidable welfare losses for households unable to avail loans. As a safety net, more liquid assets such as jewelry, electronic gadgets, and appliances may be sold or pawned to avert cutbacks in consumption. The fixed effects regressions also indicate

that higher savings in the previous period is significant in reducing consumption fluctuations for the entire sample but not for rural households since they probably have low savings to start with. However, having access to bank services may significantly minimize the consumption fluctuation experienced by the rural poor. These results provide direct support to the precautionary motive for saving.

**TABLE 5. Effect of income diversification on income and consumption volatility (dependent variable: year-on-year standard deviations of household income and consumption)**

| | Philippines | | Rural | |
|---|---|---|---|---|
| | **Income** | **Consumption** | **Income** | **Consumption** |
| Asset holdings | | | | |
| Dummy: 1 = owns house | -8,782.7 ** | -1,189.9 | -4,186.7 ** | -2,007.5 |
| | (-2.26) | (-0.53) | (-2.15) | (-1.40) |
| Dummy:1 = owns agricultural land | 2,572.0 | -1,012.4 | 1,899.3 | 403.2 |
| | (1.30) | (-0.58) | (1.46) | (0.22) |
| Number of vehicles owned | -33.86 | 1,393.7 | -3,189.0 | -31.63 |
| | (-0.01) | (0.79) | (-1.34) | (-0.02) |
| Number of appliances owned | 1,759.1 * | 221.9 | 1,244.1 * | 125.9 |
| | (1.80) | (0.29) | (1.89) | (0.20) |
| Dummy: 1 = has bank deposits | 3,559.2 | -4,146.1 | 3,909.2 | -7,401.8 * |
| | (0.62) | (-0.84) | (0.84) | (-1.84) |
| Saving rate (lagged) | | -12,537.6 *** | | -1,642.6 |
| | | (-2.84) | | (-0.63) |
| Shocks | | | | |
| Dummy: 1 = got ill or injured | -1,100.6 | 2,501.8 ** | -1,022.6 | 793.3 |
| | (-0.78) | (-2.47) | (-0.92) | (-1.01) |
| International oil price change | -7.082.0 | 72.4 *** | 13.4 | 51.7 ** |
| | (-0.24) | (2.82) | (0.56) | (2.22) |
| SD of household income | | 0.59 *** | | 0.42 *** |
| | | (3.77) | | (6.44) |
| Shannon diversity index (lagged) | -5,856.2 ** | -2,982.0 * | 615.7 | -1,698.2 |
| | (-2.22) | (-1.75) | (0.38) | (-1.48) |
| N | 7,962 | 7,962 | 4,932 | 4,932 |

The numbers in the parentheses are t-statistics.
The estimates are based on robust standard errors.
* p<0.10, **p<0.05, *** p<0.01

For the entire sample, the effect of the idiosyncratic income shock (i.e., having an illness) increases the volatility of consumption. Likewise, the aggregate price shock in the form of abnormal spikes in international oil price intensifies consumption volatility. Based on recent experience, an accelerated increase in oil prices can be welfare reducing since its effects are propagated in different sectors of the economy. Given high forward linkages of petroleum products, a positive price shock is expected to have a negative effect on consumption.

Finally, the results show that higher income instability expectedly distorts consumption smoothing. Likewise, the estimates suggest that households' degree of income diversification will help mitigate future income and consumption volatility. This supports the hypothesis that *ex ante* income diversification is used as a risk-minimizing strategy. However, a striking result is that this effect is insignificant for rural households. This indicates that while a high degree of diversification is observed among the rural poor, it doesn't seem to adequately moderate income and consumption fluctuations. The implication of this result is profound in terms of reducing the vulnerability of poor households to welfare-reducing shocks. While diversification driven by wealth accumulation results in an upward spiral of earnings and assets, the diversification due to push factors can be merely immiserising as a household augment its risky, often agricultural, income base with other subsistence-level activities that yield low and volatile returns [Reardon et al. 2007]. Hence, I can call the latter "bad-quality" diversification. Although poor households in rural areas may have diversified their income sources well, their lack of better options typically limit them to unstable, low-paying, and low productivity options that offer no escape out of poverty but only a means of survival. In this context, Dimova and Sen [2010] describe diversification among the poor as a "desperate" measure to smooth consumption in the face of income uncertainty.

In general, the preceding discussions confirm that diversification into higher productivity income sources apparently requires entry costs such as investments in human and physical capital. In this case, success will only be likely for households with adequate assets, capabilities, and market access. Barrett [1997] and Reardon et al. [2000] previously showed that initial wealth conditions determine future income patterns, indicating that the poor will face enormous difficulty in breaking out of bad-quality diversification. Given minimal income and asset holdings, the poor will only be able to diversify into low-return activities where the costs of entry and exit are small [Barrett and Reardon 2000]. What this implies is the possibility of good and bad equilibria that can potentially worsen the already unequal access to resources and opportunities of rich and poor households. Himanshu et al. [2013] observe a similar pattern in rural India, where diversification away from farm-based activities was accompanied by a rising income inequality at the village level.

## 5. Conclusions and policy implications

The empirical results using Philippine household data confirm many of the existing evidence in the literature regarding the factors affecting household income diversification. In particular, the estimates show significant positive effects of demographic factors such as age and years of education on income diversification. In addition, the number of family members who are of working age encourages pluriactivity. Further, the quality of infrastructure as proxied by roads and access to electricity also facilitates diversification since connectivity supports the mobility of productive labor and increases the available livelihood options.

The findings also suggest that diversification is decreasing in income level, with poor families having more diversified economic activities. This confirms the view that households diversify earnings portfolios as a risk management strategy. Nevertheless, there is also evidence that diversification is used by rich households to accumulate wealth. In particular, ownership of assets such as houses, agricultural lands, and durable goods positively contributes to income diversification. However, the results suggest that risk aversion may be more important than asset buildup in the diversification behavior of rural households.

In terms of welfare impacts, the results support the hypothesis that income diversification is used *ex ante* to mitigate income and consumption volatility. However, there is no evidence for a significant effect among rural households since they usually diversify into unstable, low-paying, and low productivity jobs. This indicates that although the rural poor have the highest degree of diversification, it doesn't seem adequate to protect their families from the welfare losses caused by income and consumption fluctuations. On the other hand, well-off families are able to weather the effects of negative shocks using their portfolio of high-return assets and livelihood activities. This implies a situation where income diversification can potentially worsen the already unequal access to resources and opportunities between rich and poor households.

The findings summarized above provide some important insights to guide policy. In light of the wealth accumulation motive, the evidence suggests that engaging in this type of diversification is constrained by high entry costs that confine low-income families to subsistence-driven pluriactivity. Therefore, policies should be designed to facilitate "good-quality" income diversification, i.e., movement from high risk and low return activities into more stable employment and livelihood. Evidence from cross-country studies, including my own, consistently identify education, infrastructure, and access to credit as the most important contributors to good-quality diversification. This means that programs that directly improve productivity through skills upgrading and widened access to local markets, public goods, and government services are potentially welfare-improving especially when well-targeted for the poor. Public investments that increase the returns to rural agricultural activities (e.g., roads to access bigger markets, electricity to venture into cottage industries, and agricultural R&D

that promotes high value-added crops and livestock) offer a possible path out of income volatility and into investment-driven diversification. More importantly, given that labor is the most valuable asset of the poor, higher investment in basic education, technical schools, and training centers will allow younger family members to acquire skills that ultimately improve their employment options.

Removing severe information asymmetries in rural areas and complementing the deficiencies of missing markets may help rural households diversify beyond subsistence. Better telecommunication technology broadens the knowledge of households about available opportunities. In addition, government policies that support a stronger insurance system (e.g., unemployment, disability, and crop) will reduce poor households' risk aversion. Lastly, fast-tracking financial deepening and expanding credit to support micro, small, and medium enterprises will enhance good-quality income diversification.

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## References

Abdulai, A. and C. Delgado [1999] "Determinants of nonfarm earnings of farm-based husbands and wives in northern Ghana", *American Journal of Agricultural Economics* 81(1): 117-130.

Babatunde, R. and M. Qaim [2009] "Patterns of income diversification in rural Nigeria: determinants and impacts", *Quarterly Journal of International Agriculture* 48(4): 305-320.

Balisacan, A. [1991] "Dynamics of rural development: linkages, poverty, and income distribution", PIDS Working Paper Series No. 1991-15, Philippine Institute of Development Studies, Makati City, Philippines.

Balisacan, A. and E. Pernia [2002] "What else besides growth matters to poverty reduction? Philippines*",* ERD Policy Brief Series No. 5, Asian Development Bank, Mandaluyong City, Philippines.

Barrett, C. [1997] "Food marketing liberalization and trader entry: evidence from Madagascar", *World Development* 25(5): 763-777.

Barrett, C. and T. Reardon [2000] "Asset, activity, and income diversification among African agriculturalists: some practical issues*",* Working Papers 14734, Department of Applied Economics and Management, Cornell University.

Barrett, C., T. Reardon, and P. Webb [2001] "Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications", *Food Policy* 26(4): 315-331.

Bezu, S., C. Barrett, and S. Holden [2012] "Does the nonfarm economy offer

pathways for upward mobility? Evidence from a panel data study in Ethiopia", *World Development* 40(8): 1634-1646.

Bigsten, A. and S. Tengstam [2011] "Smallholder diversification and income growth in Zambia", *Journal of African Economies* 20(5): 781-822.

Blanchard, O. and S. Fischer [1989] *Lectures on macroeconomics*. Cambridge, Mass.: MIT Press.

Blank, S., K. Erickson, R. Nehring, and C. Hallahan [2007] "Agricultural profits and farm household wealth: a farm-level analysis using repeated cross-sections", *Journal of Agricultural and Applied Economics* 41(1): 207-225.

Briones, R. [2016] "Growing inclusive businesses in the Philippines: the role of government policies and programs", Discussion Paper Series No. 2016-06, Philippine Institute of Development Studies, Quezon City, Philippines.

Corral, L. and T. Reardon [2001] "Rural nonfarm incomes in Nicaragua", *World Development* 29(3): 427-442.

Corral, P. and N. Radchenko [2017] "What's so spatial about diversification in Nigeria?", *World Development* 95(July): 231-253.

Davis, B., S. Di Giuseppe, and A. Zezza [2014] "Income diversification patterns in rural sub-Saharan Africa: reassessing the evidence", Policy Research Working Paper No. WPS 7108, World Bank, Washington, D.C., USA.

Deaton, A. [1991] "Saving and liquidity constraints", *Econometrica* 59(5): 1221-1248.

Deaton, A. [1992] *Understanding consumption*. Oxford: Oxford University Press.

Deinger, K. and P. Olinto [2001] Rural nonfarm employment and income diversification in Colombia", *World Development* 29(3): 455-465.

Department of Public Works and Highways (DPWH) [2008] *Annual report 2007*. Manila: DPWH.

Department of Public Works and Highways (DPWH) [2009] *Annual report 2008*. Manila: DPWH.

Department of Public Works and Highways (DPWH) [2011] *Annual report 2010*. Manila: DPWH.

Dimova, R. and K. Sen [2010] "Is household income diversification a means of survival or a means of accumulation? Panel data evidence from Tanzania", Working Paper Series 12210, Brooks World Poverty Institute, University of Manchester.

Djido, A. and B. Shiferaw [2018] "Patterns of labor productivity and income diversification - empirical evidence from Uganda and Nigeria", *World Development* 105(May): 416-427.

Ellis, F. [2000] "The determinants of rural livelihood diversification in developing countries", *Journal of Agricultural Economics* 51(2): 289-302.

Ersado, L. [2006] "Income diversification in Zimbabwe: welfare implications from urban and rural areas", World Bank Policy Research Working Paper 3964, World Bank, Washington, D.C., USA.

Estudillo, J., C. G. Ramos, and K. Otsuka [2009] "Geography and the evolution

of rural nonfarm sector in the Philippines, 1988-2006", *Philippine Review of Economics* 46(2): 183-219.

Friedman, M. [1957] *A theory of the consumption function.* New Jersey: Princeton University Press.

Gibson, J. and S. Olivia [2010] "The effect of infrastructure access and quality on non-farm enterprises in rural Indonesia", *World Development* 38(5): 717-219.

Haggblade, S., P. Hazell, and T. Reardon [2010] "The rural non-farm economy: prospects for growth and poverty reduction", *World Development* 38(10): 1429-1441.

Haughton, J. and S. Khander [2009] *Handbook on poverty and inequality.* Washington, D.C.: World Bank.

Himanshu, P. Lanjouw, R. Murgai, and N. Stern [2013] "Nonfarm diversification, poverty, economic mobility, and income inequality: a case study in village India", *Agricultural Economics* 44: 461-473.

Imai, K., R. Gaiha, and G. Thapa [2015] "Does non-farm sector employment reduce rural poverty and vulnerability? Evidence from Vietnam and India", *Journal of Asian Economics* 36: 47-61.

Islam, AHMS, J. von Braun, A. Thorne-Lyman, and A. Ahmed [2018] "Farm diversification and food and nutrition security in Bangladesh: empirical evidence from nationally representative household panel data", *Food Security* 10: 701-720.

Keynes, J. M. [1936] *The general theory of employment, interest and money*. London: Macmillan.

Kochar, A. [1999] Smoothing consumption by smoothing income: hours-of-work responses to idiosyncratic agricultural shocks in rural India", *Review of Economics and Statistics* 81(1): 50-61.

Lanjouw, P., J. Quizon, and R. Sparrow [2001] "Non-agricultural earnings in peri-urban areas of Tanzania: evidence from household survey data", *Food Policy* 26: 385-403.

Lanjouw, P. and R. Murgai [2009] "Poverty decline, agricultural wages, and nonfarm employment in rural India: 1983-2004", *Agricultural Economics* 40(2): 243-263.

Martin, S. and K. Lorenzen [2016] "Livelihood diversification in rural Laos", *World Development* 83(July): 231-243.

Minot, N., M. Epprecht, T. T. T. Anh, and L. Q. Trung [2006] "Income diversification and poverty in the northern uplands of Vietnam", Research Report 145, International Food Policy Research Institute, Washington, D.C., USA.

Mishra, A. and B. Goodwin [1997] "Farm income variability and the supply of off-farm labor", *American Journal of Agricultural Economics* 79(4): 880-887.

Mishra, A., H. El-Osta, and C. Sandretto [2002] "Factors affecting farm enterprise diversification", *Agricultural Finance Review* 64(2): 156-166.

Mishra, A. and H-H Chang [2012] "Can off farm employment affect the

privatization of social safety net? the case of self-employed farm households", *Food Policy* 37: 94-101.

Mishra, A., K. Erickson, M. Harris, C. Hallahan, and H. Uematsu [2010] "Determinants of farm household income diversification in the United States: evidence from farm-level data", Selected Paper No. 11394, Agricultural and Applied Economics Association Annual Meeting 2010.

Modigliani, F. [1975] "The life-cycle hypothesis of saving twenty years later", in M. Parkin, ed., *Contemporary issues in economics*. Manchester: Manchester University Press. 2-35.

Morduch, J. [1995] "Income smoothing and consumption smoothing", *Journal of Economic Perspectives* 9(3): 103-114.

Nakajima, M., K. Otsuka, and T. Yamano [2018] "Jobs off the farm: wealth, human capital, and social group in rural eastern India", *The Journal of Development Studies* 54(1): 111-132.

National Economic and Development Authority (NEDA) [2017] *Philippine development plan 2017-2022*. Pasig City: NEDA.

National Statistical Coordination Board (NSCB) [2003] "Notes on the official poverty statistics in the Philippines", http://www.nscb.gov.ph/technotes/poverty/concept.asp Accessed 1 April 2014

Olale, E. and S. Henson [2012] "Determinants of income diversification among fishing communities in western Kenya", *Fisheries Research* 125-126(August): 235-242.

Rahut, D. B., K. A. Mottaleb, and A. Ali [2018] "Rural livelihood diversification strategies and household welfare in Bhutan", *The European Journal of Development Research* 30(3): 718-748.

Reardon, T., C. Delgado, and P. Matlon [1992] "Determinants and effects of income diversification amongst farm households in Burkina Faso", *Journal of Development Studies* 28(January): 264-296.

Reardon, T., J. Berdegué, C. Barrett, and K. Stamoulis [2007] "Household income diversification into rural nonfarm activities", in S. Haggblade, P. Hazell, and T. Reardon, eds., *Transforming the rural nonfarm economy.* Baltimore: Johns Hopkins University Press.

Reardon, T., J. E. Taylor, K. Stamoulis, P. Lanjouw, and A. Balisacan [2000], "Effects of nonfarm employment on rural income inequality in developing countries: an investment perspective", *Journal of Agricultural Economics* 51(2): 266-288.

Reyes, C., A. Tabuga, R. Asis, and M. B. Datu [2012] "Poverty and agriculture in the Philippines: trends in income poverty and distribution", Discussion Paper Series No. 2012-09, Philippine Institute of Development Studies, Makati City, Philippines.

Robison, L. and P. Barry [1987] *The competitive firm's response to risk.* New

York: Macmillan Publishing Company.

Rosenzweig, M. and O. Stark [1989] "Consumption smoothing, migration, and marriage: evidence from rural India", *Journal of Political Economy* 94(4): 905- 926.

Schwarze, S. and M. Zeller [2005] "Income diversification of rural households in central Sulawesi, Indonesia", *Quarterly Journal of International Agricultur*e 44(1): 61-73.

Senadza, B. [2012] "Non-farm income diversification in rural Ghana: patterns and determinants", *African Development Review* 24(3): 233-244.

World Bank. "Commodity markets", http://www.worldbank.org/en/research/commodity-markets Accessed 4 April 2014.

Worthington, A. [2009] "Household asset portfolio diversification: evidence from the household, income and labour dynamics in Australia (HILDA) survey", Discussion Papers in Finance No. 2009-08, Department of Accounting, Finance and Economics, Griffith University, Australia.

Wouterse, F. and J. E. Taylor [2008] "Migration and income diversification: evidence from Burkina Faso", *World Development* 36(4): 625-640.

Zeldes, S. [1989] "Consumption and liquidity constraints: an empirical investigation", *Journal of Political Economy* 97: 305-346.

Zhao, J. and P. Barry [2014] "Income diversification of rural households in China", *Canadian Journal of Agricultural Economics* 62: 307-324.

## Appendix

**TABLE A1. Summary statistics**

| Variable | N | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|---|
| Income diversification | | | | | |
| Shannon diversity index | 12,774 | 0.9 | 0.3 | 0.0 | 1.9 |
| Number of income sources | 12,774 | 4.7 | 1.6 | 1.0 | 12.0 |
| Demographic characteristics | | | | | |
| Age of household head | 12,774 | 52.1 | 13.4 | 15.0 | 98.0 |
| Dummy: 1= household head is male | 12,774 | 0.8 | 0.4 | 0.0 | 1.0 |
| Ratio of male to total household size | 12,774 | 0.5 | 0.2 | 0.0 | 1.0 |
| Ratio of household members with age ≥ 15 | 12,774 | 0.7 | 0.2 | 0.1 | 1.0 |
| Years of education | 12,774 | 8.8 | 3.8 | 1.0 | 16.0 |
| Asset holdings | | | | | |
| Dummy: 1= owns house | 12,774 | 0.9 | 0.2 | 0.0 | 1.0 |
| Dummy:1= owns agricultural land | 12,774 | 0.3 | 0.4 | 0.0 | 1.0 |
| Number of vehicles owned | 12,774 | 0.2 | 0.5 | 0.0 | 14.0 |
| Number of appliances owned | 12,774 | 2.8 | 2.7 | 0.0 | 28.0 |
| Accessibility | | | | | |
| Number of mobile phones owned | 12,774 | 1.4 | 1.4 | 0.0 | 12.0 |
| Dummy: 1 = has electricity at home | 12,774 | 0.9 | 0.3 | 0.0 | 1.0 |
| Road per hectare | 12,774 | 0.3 | 0.5 | 0.0 | 1.8 |
| Dummy: 1 = has bank deposits | 12,774 | 0.1 | 0.3 | 0.0 | 1.0 |
| Dummy: 1 = availed loan within last 6 months | 4,868 | 0.3 | 0.5 | 0.0 | 1.1 |
| Income and consumption | | | | | |
| Per capita income (ln) | 12,774 | 9.6 | 0.8 | 6.7 | 13.1 |
| Total family expenditure (ln) | 12,774 | 11.0 | 0.7 | 8.2 | 14.3 |
| Year-on-Year SD of real household income (‘000) | 7,962 | 22.2 | 43.6 | 0.0001 | 1,411.9 |
| Year-on-Year SD of real household consumption (‘000) | 7,962 | 17.7 | 31.7 | 0.0015 | 887.9 |
| Shocks | | | | | |
| Dummy: 1 = got ill or injured | 7,962 | 0.2 | 0.4 | 0.0 | 1.0 |
| % change in international oil price | 7,962 | 54.8 | 12.9 | 25.9 | 60.6 |

Sources of data: Philippine Statistics Authority Annual Poverty Indicator Surveys for 2007, 2008, 2010; Department of Public Works and Highways; World Bank