TRANSFORMATION OF THE RURAL ECONOMY

IN THE PHILIPPINES, 1988-2006

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ABSTRACT *This research explores the changing structure of the rural economy in the Philippines from 1988 to 2006. We found that the expansion and upgrade of infrastructure such as electricity and roads and investment in secondary and tertiary education are important factors that induced the economic transformation of the rural economy. The importance of higher education as an entry requirement to the nonfarm labor market has declined over time, indicating that the rural nonfarm sector has been increasingly providing employment opportunities to the unskilled and the uneducated, which form the bulk of the rural poor.*

I. Introduction

The Philippine government recognizes that household income growth and poverty reduction are important national agenda as stipulated in the 2004-2010 Medium-Term Philippine Development Plan (MTPDP) (NEDA, 2004). In order to understand the dynamics of income growth and poverty reduction, many studies have explored the changing sources of household income particularly among rural households (Estudillo and Otsuka, 1999; Otsuka, Estudillo and Sawada, 2009). This is because a large majority of poor households live in the rural areas, possess few valuable resources, and have limited access to urban labor markets (World Bank, 1990, 2000).

Many studies show that the expansion of the rural nonfarm sector is the major driver of rural poverty reduction in the developing world as rural households increasingly derive their income from nonfarm sources (de Janvry and Sadoulet, 2001). Yet rural nonfarm earnings are not necessarily pro-poor. The poorly educated face entry barriers in the most lucrative nonfarm activities and thus gravitate towards low-productivity endeavor; the rich may prosper in high-returns activities. The development of nonfarm sector contributes to poverty reduction through the rise in agricultural wages because agricultural labor market tightens when the nonfarm sector siphons labor out of agriculture (Lanjouw, 2007).

Similarly, agricultural growth has an important role in poverty reduction. De Janvry and Sadoulet (2002) found that agricultural technology offers direct benefits to adopters and indirect benefits to others through lower food prices, employment creation, and growth linkage effects. Ironically, Bautista (1995) found that rapid agricultural growth in the Philippines during 1965-1980 did not provide a strong stimulus to the growth of broadly based nonagricultural income, which could have possibly created strong consumption linkages generating employment and raising rural wages. However, the shift of rural household income structure away from farm to nonfarm sources and subsequent income growth and poverty

reduction has been well documented in the Philippines (Hayami and Kikuchi, 2000; Estudillo, Sawada and Otsuka, 2008), Bangladesh (Hossain, Rahman and Estudillo, 2009), Thailand (Cherdchuchai and Otsuka, 2006), Tamil Nadu in India (Kajisa and Palanichamy, 2006) and sub-Saharan Africa (Matsumoto, Kijima and Yamano, 2006).

Considering the importance of the development of the rural nonfarm, it is important to investigate its evolutionary processes and locational dynamics. To date, there are three strands of thoughts that trace the development of the rural nonfarm sector. The first strand—geography of economic development—views that rural nonfarm activities tend to proliferate in areas near urban centers and in areas where infrastructure is well developed (Haggblade, Hazell, and Reardon, 2007; Renkow, 2007). The second strand—the role of human capital—asserts the importance of schooling in facilitating labor mobility away from low-productivity farm activities to high-productivity nonfarm activities so as to stimulate the development of the nonfarm sector (Kijima and Lanjouw, 2005; Takahashi and Otsuka, 2009). The third strand—agricultural growth linkages—asserts that agricultural development resulting from technological advancement could spur the development of the nonfarm sector through several forward and backward linkages (Haggblade, Hazell and Dorosh, 2007).

This study aims to test the validity of the aforementioned three strands of thoughts in the rural Philippines with a focus on the role of infrastructure in facilitating structural transformation from farm to nonfarm sector. Such research and analysis is largely missing from the literature, although development economists consider physical infrastructure to be an indispensable precondition of industrialization and economic development (Murphy, Shleifer, and Vishny, 1989). Many empirical studies demonstrate that the development of physical infrastructure improves an economy's long-term production and income levels (Lipton and Ravallion, 1995; Esfahani and Ramirez, 2003). Moreover, an increasing amount of micro

empirical literature has started to focus on the role of infrastructure in reducing poverty in a direct fashion (Gibson and Rozelle, 2003;; Lokshin and Yemtsov, 2005).

While these micro-econometric studies are insightful in uncovering the role of infrastructure in reducing poverty, an important issue remainsunexplored, that is, a proper identification of the causal impact of infrastructure on poverty reduction. This issue has not been explored deeply because randomized evaluation, which has been increasing rapidly (Duflo, Glennerster, and Kremer 2008), is difficult to implement in the context of large-scale infrastructure. This paper aims to close this gap in the literature by evaluating the role of infrastructure in facilitating the structural transformation of the rural Philippines. We use topographic information as our identifying instruments. By doing so, we believe that we will be able to uncover causal impacts of infrastructure on structural transformation.

We explore the structural transformation at the provincial and township levels covering an 18-year period from 1988 to 2006. The towns are located in Central Luzon, CALABARZON (acronym for the provinces of Cavite, Laguna, Batangas, Rizal and Quezon), Central Visayas and Western Visayas, which are the most progressive regions in the country where economic transformation away from farm to the nonfarm sector has been more rapid and changes in the composition of the nonfarm sector have been more dramatic than elsewhere in the country. We divided our analysis into two periods of time: (1) 1988-1997 (representing the period before the Asian currency crisis and a major drought) and (2) 2000-2006 (representing the period thereafter).

This paper has five remaining sections. Section II reviews the literature on the rural nonfarm sector and presents three testable hypotheses. Section III describes the evolution of the rural nonfarm sector in the Philippines. Section IV discusses the data and methodology. Section V presents the regression results on the determinants of the different income sources. Section VI concludes the paper and provides policy recommendations.

II. Review of Literature and Testable Hypotheses

Definition and magnitude of the rural nonfarm economy

The nonfarm sector consists of a wide diversity of activities in manufacturing, commerce, finance, construction, community and personal services. Haggblade, Hazell and Reardon (2007) show that the rural nonfarm sector is substantial in terms of its share in the total employment and income. The share of the nonfarm sector in primary employment was 24 per cent in Asia, 31 per cent in Latin America and 9 per cent in Africa and its share of household income was 51 per cent in Asia, 47 per cent in Latin America, and 37 per cent in Africa. The magnitude of the rural nonfarm sector could be underestimated because a large number of rural nonfarm activities are undertaken as a secondary employment during slack agricultural season and some are not remunerated, especially those undertaken by women in family-owned enterprises (Lanjouw and Lanjouw, 2001).

Distance and infrastructure

Proximity to urban centers affects the sources of household income, specifically the composition of nonfarm income (Reardon et al., 2007) and household participation in nonfarm activities (Deichmann, Shilpi and Vakis, 2008). Distance from major cities is also found to be an important determinant of the location of industries and composition of rural nonfarm activity (Sonobe and Otsuka, 2006). In Nepal, for example, nonfarm employment is heavily concentrated in and around the cities while agricultural wage employment dominates in villages located further away (Fafchamps and Shilpi, 2003).

The development of infrastructure could mitigate the negative impact of distance in the transformation of the rural economy (the so-called 'death of distance' coined by Weiss, 2007: 51-67). Improved roads have facilitated the emergence of subcontracting arrangements between the urban traders and the rural firms (Kikuchi, 1998). The availability of electricity has induced an expansion of labor employment opportunities in export-oriented sectors in the Philippines (Fabella, 1985) and in a wide variety of nonfarm activities in Indonesia (Gibson and Olivia, 2010) and Nicaragua (Corral and Reardon, 2001).

Given the aforementioned, we propose Hypothesis 1:

Hypothesis 1 on the geography of economic development and the role of infrastructure*: The rural nonfarm sector tends to develop in areas near the urban and rural town centers. The development of the infrastructure system, however, integrates distant villages with urban areas and rural towns, leading to the development of the rural nonfarm sector in distant villages.*

Human capital

A few studies point out that education is important in enhancing farm productivity as it facilitates the smooth adoption of modern agricultural technology (Foster and Rosenweig, 1996). In the rural Philippines, it is found that the more educated household members are those who are more actively involved in nonfarm activities and have higher propensities to move out of the village to work in the cities and overseas (Kajisa, 2007; Takahashi and Otsuka, 2009). Jolliffe (2004) found that in rural Ghana, returns to education are higher in nonfarm activities. Corral and Reardon (2001) found in Nicaragua that secondary and tertiary schooling increase income in formal wage employment and in other lucrative nonfarm jobs, but does not have a significant impact on self-employment income. Interestingly, the impact of secondary and tertiary education on the probability of engaging in nonfarm work is found to be more

pronounced among the females, than among the males, in the Philippines (Takahashi and Otsuka, 2009) and China (Glauben, Herzfeld and Wang, 2008). Indeed, the availability of an educated labor force could facilitate the transformation of the rural economy away from the farm to nonfarm sector by inducing a movement of labor away from the farm to nonfarm sector (de Janvry and Sadoulet, 2001).

Given the aforementioned, we postulate:

Hypothesis 2 on the role of human capital*: The availability of an educated labor force serves as an important factor promoting the development of the rural nonfarm economy.*

It is important to explore whether the process of economic transformation that integrates the rural and urban markets is able to provide employment and income earning opportunities even to the less skilled and less educated workers. This will lead to the decline in the relative importance of formal schooling as an important entry requirement in the rural nonfarm labor market. This is crucial for poverty reduction insofar as unskilled labor is the main asset of the rural poor. This issue, which has never been fully examined in the existing literature, will be the main subject of our investigation.

Modern agricultural technology

Studies on the determinants of different sources of rural household income show that adoption of modern technology (that is, modern varieties [MVs] of rice and irrigation) significantly increases farm income (Estudillo and Otsuka, 1999; Estudillo, Sawada and Otsuka, 2008; Hossain, Rahman and Estudillo, 2009) through increases in yield and cropping intensity (Otsuka, Asano and Gascon, 1994). Yet, Jayasuriya and Shand (1986) show evidence on the acceleration in the use of labor-saving technologies because of the increasing wages in Asia.

The agricultural growth linkage hypothesis postulates that modern agricultural technology propels the development of the nonfarm economy through several production and consumption linkages (Haggblade, Hazell and Dorosh, 2007). On the production side, improved agricultural technologies may spur the birth and development of industries engaged in the provision of agricultural inputs (for example, fertilizer) and service-related support to the agricultural sector (for example, repair shops for agricultural machinery). Also, a dynamic agriculture breeds industries that have strong linkages with agriculture such as food processing and agro-based manufacturing industries. On the consumption side, increase in farm income brought about by increased agricultural productivity stimulates consumer demand for locally produced nonfarm goods and services (Haggblade, Hazell and Reardon, 2007).

Given the aforementioned, we postulate that:

Hypothesis 3 on agricultural growth linkage: *The adoption of modern agricultural technology is critically important in stimulating the development of the rural nonfarm sector through various production and consumption linkages.*

Overall, our literature review emphasizes that infrastructure systems, human capital and modern agricultural technology could propel the development of the rural nonfarm economy, which could lead to poverty reduction and equitable income distribution.

III. The Evolution of the Rural Nonfarm Economy in the Philippines[1]

The economic importance of the rural nonfarm sector

Table 1 gives an overview of the structural transformation of the Philippine economy from 1970 to 2006. The data show the diminishing importance of agriculture as shown by the declining share of agriculture in the per capita gross domestic product (GDP). The share of

industry had remained fairly stable during the same period, while the share of the services sector had gone up substantially.

Table 2 reports the changes in the sources of rural household income from 1988 to 2006. Households in rural Philippines have been increasingly deriving their income from nonfarm sources—the share of nonfarm income, including nonfarm activities and remittances as a whole rose during the 18-year period; correspondingly, the share of farm income decreased.

The increase in the share of remittance incomes in the Philippines could be explained by the increasing number of deployed overseas Filipino workers (OFWs), which more than doubled from 1989 to 2006. [2] The most popular destinations of OFWs are United Arab Emirates, Saudi Arabia and Hong Kong.[3] Parallel to the increase in the number of OFWs is the huge increase in the amount of remittances from about US$1 billion to about US$13 billion in the same period, placing the Philippines in the top four recipients of foreign remittances next to India, China and Mexico.[4] Bulk of the emigrants still consists of the highly educated although the percentage of emigrant with less than high school of schooling increased over time.[5]

The development of the infrastructure systems has been an important stimulus behind the increasing economic importance of the rural nonfarm sector. Electrification coverage in the Philippines has expanded starting with only 60 per cent of the households with access to electricity in 1988 and reaching to as high as 82 per cent in 2006 (Table 3). The progressive towns have displayed an even higher electrification coverage for the same period. Accomplishments in terms of increasing the quantity of roads and improving its quality, however, have been modest. The Philippine national government's spending on infrastructure is below the World Bank's five per cent recommendation to enable the Philippines meet its infrastructure needs in the coming decade (Llanto, 2007).

The transformation of the economy towards the nonfarm sector is also facilitated by the increase in the proportion of labor force with higher educational attainment. Table 4 reports that the proportion of labor force without schooling is very small (less than 6%) and this has even declined in recent years. Furthermore, while bulk of the rural labor force only attained primary education level, the share of rural labor force with secondary and tertiary education has substantially increased from 1988 to 2006. The National Statistics Office (NSO) reports that the female labor force participation rate in the Philippines increased from 48 per cent in 1990 to 50 per cent in 2005.[6] This is consistent with the egalitarian tradition in rural Philippines of bequeathing farmlands to males, who have the comparative advantage in farm work, while investing in the education of females, thereby providing them with opportunities to participate in the nonfarm sectors (Quisumbing, Estudillo and Otsuka, 2004). As a result, the Filipino female labor force generally has a higher level of education compared with their female counterparts in Asia (Esguerra and Manning, 2007). This gives Filipino women a clear edge in participating in the international labor market.

There has been a decline in the average farm size in the Philippines as a whole and in its progressive towns (Table 5). The average farm area in the progressive towns is relatively smaller than the average for the Philippines, and the drop in average farm area is greater in the former than in the latter. Interestingly, irrigation and MV adoption are higher in the progressive towns than in the country as a whole.

Overall, the changes in the composition of the GDP, household income, and labor force allocation away from the farm to nonfarm sector serve as clear indications of the structural transformation of the rural economy in the Philippines.

IV. Data and Methodology[7]

We explored the determinants of rural per capita income at the provincial and township levels. Income data were derived from the Family Income and Expenditure Surveys (FIES), which is a nationwide survey of households undertaken by the NSO every three years.[8] In our analysis, we included seven rounds of FIES data from 1988 to 2006. For the town-level analysis, we included towns and large cities belonging to Central Luzon, CALABARZON, Western Visayas and Central Visayas. We selected Central Luzon and CALABARZON because these regions are in close proximity to Metro Manila and Western Visayas and Central Visayas because they are close to Metro Cebu, which are the two major cities and the main hub of economic growth in the country. Accordingly, we call the towns in these four regions the 'progressive towns'.[9]

We estimated the determinants of income consisting of: (1) farm, (2) nonfarm, which is further subdivided into, (3) formal salary work, (4) informal manufacturing and (5) informal trade, transportation and communication or TTC[10]) and remittance (further subdivided into (6) foreign and (7) domestic remittance).[11] We represented the provincial (town) per capita rural income as the average of the real per capita income of all rural households belonging to each province (town). We deflated the per capita income using the PPP based on GDP with 2000 as base year taken from the World Development Indicators (WDI) (2008). Specifically, the functional form is

$$\log(y_{ijt}) = b + \Sigma_n \omega_n X_{nit} + u_{it} \quad , \qquad (1)$$

where $log(y_{ijt})$ is the natural logarithm of real per capita income in province (town) *i*, sector *j* at time *t*; and *X* refers to the vector of explanatory variables. We used the logarithm of average real per capita income to reduce heteroskedasticity of the error term, which is inherently large in nationwide survey data (Wooldridge, 2000).

We divided our explanatory variables into five major categories as follows: (1) infrastructure, (2) human capital, (3) agricultural technology indicators, (4) geography, and (5) time.

Following the idea of Duflo and Pande (2007), we exploit the unique spatial characteristic of the Philippines by using geographic characteristics as instrumental variables (IVs) to address possible endogeneity of the infrastructure variables. A possibly good IV for electricity access and roads specific for the Philippines is the number of islands per province. Since the Philippines is an archipelago, expanding infrastructure coverage to the remote islands is an expensive endeavor. Note there could be habitable and uninhabitable islands within the same province.[12] We deleted the uninhabitable islands in each province because the infrastructure system will only be set up in islands where there are communities. One of the biggest constraints in expanding and improving the quality of infrastructure in the country is the scarcity of public funds. The local governments are largely dependent on the Internal Revenue Allotment (IRA) from the national government for financing infrastructure investments. The amount received by the provinces from the IRA is stipulated under the Local Government Code (LGC) of 1991 and is primarily based on the size of population and land area regardless of provincial income. We, therefore, included population density, population, and land area as additional instruments for electricity and roads, considering that the local government share of the IRA is exogenously determined as stipulated in the LGC.[13] To mitigate the endogeneity of population, we used data from the population survey prior to the rounds of FIES (for example, population census in 1990 was used for the FIES 1994).[14]

To test the validity of our instruments, we performed various diagnostic tests for under and weak identification. We verified the validity of the instruments, and thus, the IV regression was used in our estimation. Results of the diagnostic tests and the first-stage regressions are available on-line.The first-stage regressions show that electricity coverage is lower in

provinces and progressive towns with a higher number of habitable islands, which substantiates the difficulty and high cost of connecting the small islands to the main electricity grid in areas with a high number of widely disperse islands. The number of habited islands is also negatively related with the paved local roads in the progressive towns. While population and population density are generally positively related with electricity and paved local roads, opposite sign is observed for the land area, possibly reflecting the constraint of expanding infrastructure in large areas.

V. Determinants of Income

Determinants of income at the provincial level

Table 6 shows the results of the IV regression runs on the determinants of the provincial real per capita rural income.

Infrastructure

Electricity does not significantly affect farm income, but has a positive impact on increasing nonfarm income as a whole, most importantly, incomes from formal salary work; TTC and foreign and domestic remittances in 2000-2006. Foreign and domestic remittances tend to be higher in areas where a larger proportion of households has access to electricity, which could have facilitated the flows of money from overseas and major cites to the provinces. The more pronounced impact of electricity in 2000-2006 is reflective of the efforts of the government to encourage players in the provision of electricity through the deregulation of the electric industry. It can be recalled that during the 1990s, the Philippines experienced massive power shortages because of the abolition of the Department of Energy and the discontinuation of the Bataan Nuclear Power Plant during the regime of Corazon Aquino. Much of demand for electricity was met in areas with high demand, mainly urban areas and wealthier towns. In the

year 2001, the Philippine government enacted Republic Act 9136 (Electric Power Industry Reform Act), which aimed at encouraging entry of several power providers . The results are lower electricity rates expansion in power coverage in the country. We found a significant impact of electricity in increasing nonfarm income in 2000-2006 both in the provinces and progressive towns, but not in 1988-97 (Tables 6 and 7). Important lesson is that electricity could effectively increase nonfarm income only when there is an extensive nation-wide coverage.

Road densities do not affect any of the provincial income components possibly because there has been minimal increase in road densities. Paved national road has exerted a positive impact on increasing income from manufacturing, while paved local road has a positive impact on nonfarm and on formal salary work incomes especially in 1988-1997. Paved local road has exerted a positive impact on nonfarm income as a whole in 1988-1997, but not in 2000-2006, probably because the expansion of local paved road has been minimal during 2000-06 as evident in Table 3. Overall, these findings largely support Hypothesis 1 on the role of infrastructure on the development of the rural nonfarm sector.

Human capital

The higher proportion of female labor force increases nonfarm income as a whole, and, more importantly, income from formal salary work, manufacturing, and domestic remittances. Age compositions of the labor force have largely insignificant coefficients, indicating that the development of the rural nonfarm sector opens up labor employment opportunities to all workers, regardless of age. Tertiary schooling remains to be important in the nonfarm income as a whole, formal salary work, TTC and domestic remittance income, especially in 1988-1997, but not in 2000-2006, implying that even the less educated and less skilled workers were employed in these sectors in later years. The positive relationship of tertiary education with domestic remittance income is consistent with the general observation that the more educated

workers have the higher tendency to migrate to cities or nearby provinces. The more significant impact of education in the earlier period probably reflects that a relatively smaller number of labor force has attained higher levels of education thereby creating a larger marginal impact of schooling.

Agricultural Technology and Farm Size

Irrigation does not seem to have a positive impact on farm income partly because of two reasons: (1) irrigation data refer to coverage of the national irrigation systems, which are mainly gravity (or dam) irrigation (that is, covered by the National Irrigation Administration) with the exclusion of privately owned pump or ground water irrigation system, on which data are largely not available, and (2) pump irrigation is used for high-value crops while dams are used for rice, which is less profitable than high-value crops . Also, our farm income consists of income not only from crop production, but also from fishing, forestry, and hunting and high-value crops, whilethe impact of irrigation may be more pronounced in rice production, which has become less important as a source of agricultural income with the shift to high-value crops.

Irrigation is largely not significant in the nonfarm income sources, indicating that production linkages are weak (Foster and Rosenweig, 2004; Haggblade, Hazell, and Reardon, 2007). Yet, irrigation significantly increases nonfarm income in composite and formal salary work in 1988-1997, presumably because irrigation increases the collateral value of farmland and pawning revenues that could be used to finance the fixed cost of moving from farm to formal salary employment. It has been a common practice in the Philippines to pawn irrigated farmland to finance education of the children, which facilitates their participation in the nonfarm sector (Estudillo, Sawada and Otsuka, 2006). Our results on the impact of irrigation on rural income could indicate that agricultural growth linkages on the production side have weakened especially in the recent years in the Philippines. On the whole, the implementation of land reform (variable LAD) does not show any significant impact in increasing provincial

income possibly because of insufficient support services in agrarian communities (e.g., extension services and credit). Provinces with larger per capita farmland endowment (farmland to labor ratio) (where land reform was presumably not effectively implemented) tend to have larger income from nonfarm sources, which may imply that farmland may be an important source of funds for participation in the nonfarm sector especially for self-employment in manufacturing and TTC. The impact of farmland endowment, however, has diminished, suggesting that different nonfarm activities have increasingly become accessible across rural households regardless of access to farmland.

Distance

The distance variable shows that farm income tends to be higher in areas far away from the major cities. Nonfarm income, in general, formal salary work and TTC services, in particular, tend to be concentrated in areas near the cities in 1988-1997 (negative sign of the distance variable), but appears to have spread out to the remote rural areas in 2000-2006. Infrastructure development could bring about the 'death of distance' (Weiss, 2007: 51-67) by inducing the growth of nonfarm sectors even in the peripheries. This is indicated by the positive sign of the interaction between distance and proportion of paved roads. Specifically, for every 10-kilometer increase in the length of paved roads connecting the provincial capital to the major city, nonfarm (Column C) and formal salary work (Column E) incomes increase by 5 per cent and income from TTC increases by 9 per cent (Column I). In contrast, manufacturing income is negatively affected by the interaction term between distance and paved road (Column H) possibly supporting the argument of Renkow (2007) that infrastructure development can be a "double-edged sword," bringing growth of some sectors while causing the demise of others. This may also imply that the manufacturing sector in rural Philippines may be producing inferior products that cannot compete with urban-manufactured goods and imports. Aside from the IV regression, we also tried various model specifications for robustness check. Results

generally highlight the importance of infrastructure and human capital and weak agricultural growth linkages on the production side. Overall, our findings on the role of infrastructure, human capital, agriculture and physical distance are robust regardless of model specification.

Determinants of income at the town level

The results of the IV regressions in the progressive towns are shown in Table 7. Our instruments in the IV regression include population density, land area and total population of the towns and the number of habitable islands of the province where the towns belong.

Infrastructure

Electricity has exerted a positive impact on the total nonfarm, formal salary work and domestic remittance, with its impact more pronounced in the progressive towns compared to the provinces. National road density positively and significantly affects nonfarm income in both 1988-1997 and 2000-2006, but surprisingly local road density negatively affects nonfarm income in the progressive towns in those 2 periods. This contradicting result is possibly because the national government has devolved in 1992 a number of its functions to local government units (LGUs) including service provision. Thus, in 2000-2006, the LGUs took full responsibility in the expansion and maintenance of local roads while the national government continued to make decisions on national roads. Expansion of local roads under the LGUs could have been done in a "piece meal" fashion concentrated only in a few favored localities where the local official could maximize her/his votes. This implies that for a road project to be effective in increasing nonfarm income, it is necessary to have a massive and well orchestrated effort on road projects even in only a few adjacent localities where the economies of scale in road projects could be attained.

Human capital

Similar to the provinces, the coefficient of the female labor force is positive in the nonfarm income as a whole, as well as formal salary work and informal manufacturing and TTC. Farm income is lower and nonfarm and formal salary work incomes are higher in towns with a larger proportion of labor force belonging to the younger age group. While a higher level of education is important in enhancing nonfarm income in the provinces, the education variables are generally not significant in the progressive towns. There could be three reasons for this. First, a relatively larger number of labor force in the progressive towns have attained higher levels of education creating a lower incremental impact of schooling on household income. Second, it might reflect the fact a large proportion of migrants to the cities or urban areas and even abroad are those who obtained tertiary schooling. Finally, the presence of a more vibrant nonfarm sector in progressive towns could have increased the demand for unskilled labor increasing the rates of returns to lower levels of schooling. In the provincial analysis, we have shown that the less educated are employed in the informal TTC sector, which could be large in magnitude in progressive towns where consumer demand for services are higher.

Agricultural technology and farm size

Irrigation has positively affected farm income in the progressive towns, but not in the provinces, which probably reflects the greater access to irrigation by the progressive towns a (Table 5). Irrigation does not significantly affect the nonfarm income as a whole, even at a lower level of disaggregation, where goods and services could be easily traded. The per capita farmland endowment and the proportion of land under full ownership are also less important in increasing farm income, especially in 2000-2006. Similar to the provinces, the proportion of land under full ownership, which is used as a proxy for land reform implementation at the town level, does not seem to have a positive impact on the different nonfarm income componentss. While this result is rather surprising, we speculate that this is because farming has become less

popular among younger generation while the older generation, who is the principal beneficiary of the land reform program, retrieves from farming because of advancing age and income effect brought about by the land reform. The beneficiary of the land reform oftentimes hires a landless worker to become a 'permanent worker' ('porcientuhan') doing all the farm tasks and receiving 10 per cent of the output at the end of the season. Since family labor is more efficient than hired labor, labor efficiency in farming has declined among the beneficiaries of land reform program.

Distance

The distance variable shows that nonfarm income as a whole and income from formal salary work tend to increase with the development of paved roads connecting the town capital to the major city. Similar to the provinces, manufacturing income tends to decrease with increased integration as indicated by the negative sign of the road and distance interactions.

Overall, for both the provinces and the towns, the magnitude of the negative impact of distance has declined in recent years, implying that the dispersion of rural nonfarm activities to the remote rural areas has proceeded over time, along with improvements in infrastructure. This is consistent with Hypothesis 1 on the "death of distance" that is brought about by infrastructure development.

Additional robustness checks for the town level regressions likewise provide the same conclusions on the role of infrastructure and human capital in the development of the nonfarm sector and weak agricultural growth linkages.

VI. Conclusions and Policy Implications

This study explores the evolutionary processes in the structural transformation of the rural economy with a focus on the changing importance of infrastructure, human capital, modern agricultural technology, farmland, and physical distance on various income sources in the rural

Philippines using household-level survey data spanning 18 years from 1988 to 2006.. Structural transformation refers to the shift in the 'center of gravity' of economic activity away from the farm to the industry and services sectors (Hayami and Godo, 2005: 36). In the Philippines, the structural transformation is evident in the increasing share of the value added of the nonfarm sector as a percentage of the GDP and the increasing share of the labor force employed in the nonfarm sector. In the rural Philippines, we found that TTC is the most dominant and vibrant sector.

Our regression results show that the development of the rural nonfarm sector has been largely stimulated by the improvement in the "quality" (represented by electricity and paved roads) and "quantity" of infrastructure. Improvement in the quality of roads enhances income and addresses the constraints of distance in the development of the nonfarm sector as a whole, especially the TTC sector in the provinces. Overall, our results support Hypothesis 1 on the decisive role of infrastructure in the development of the rural nonfarm sector.

Our empirical findings show that a higher level of education (that is, tertiary level) remains to be a binding constraint in the formal salary work income while its impact becomes modest or not statistically significant in rural manufacturing and TTCespecially in recent years. The age and sex composition of the labor force likewise provides evidence that the nonfarm sector opens up employment opportunities to all workers alike, regardless of age and gender. This is important in reducing poverty and attaining a more egalitarian income distribution insofar as the poor are characterized by a lower level of education.

The strength of agricultural growth linkages depends largely on income growth (which drives consumption linkages) and input use and mechanization (which drives production linkages). Our empirical findings point to the weakened production linkages given a large number of statistically insignificant coefficients of the irrigation variable in various nonfarm income sources. This implies that agricultural growth linkages on the production side have

become weak in the Philippines at least during 1988-2006, which does give full support to Hypothesis 3.

This study suggests a two-fold strategy to enhance the development of the rural nonfarm sector. First, is investment in electricity and paved road. The benefits of these investments will likely trickle down to the poor because of its positive impact on the development of the TTC sector, a large informal sector employing a large number of poor people. Second, continuous investments in education remain mandatory. Since the labor market has been expanding and increasingly accommodating the lowly educated, it is important to improve the quality of education at all levels, most especially in primary and secondary levels. The focus should be on public schools since a large number of poor families send their children to public schools. Overall, with the strong commitment of President Benigno Aquino on the advancement of human capital, the Philippines is on the way forward but to produce a better quality labor force.

Notes:

[1]Detailed discussion of the Evolution of Rural Nonfarm Economy in the Philippines can be accessed on-line.

[2] Visit www.bsp.gov.ph

[3] Visit www.pcw.gov.ph.

[4] Visit www.worldbank.org

[5]Visit www.cfo.gov.ph.

[6]Figures are derived from the Philippine Yearbook of the NSO.

[7]Detailed discussion of the Data Sources and Methodology can be accessed on-line.

[8]The NSO defines household as a group of individuals who are currently living together and sharing the same pot.

[9] Progressive regions and towns are defined mainly based on geography and has little to do with the structure and growth of agriculture.

[10] We included in the TTC sector the income from hotels and restaurants, financial intermediation, business and some income from mining and quarrying and construction.

[11]Total income also includes income from community and personal services and other income not elsewhere classified, but we did not undertake a separate regression analysis for these income sources as they comprise a small portion of the total income.

[12]The Census of the Philippine Islands summarizes the islands in the Philippine archipelago. We define as habitable islands those islands with an area of more than 0.1 square miles, are named and are not rocks/rock formations.

[13]Data on population and land area are generated from NSO Census of Population and Housing.

[14]Population surveys were conducted in 1980, 1990, 1995, 2000, and 2007.

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Table 1
Indicators of economic transformation in the Philippines, 1970-2006

Description	1970	1990	2006
Gross Domestic Product per capita (US$ PPP)[1]	733	918	1,155
Agriculture (%)	30	22	14
Industry (%)	31	34	32
Service (%)	39	44	54
Total (%)	100	100	100

[1]The base year is 2000.
Source: World Bank (2008).

Table 2
Sources of real per capita income of rural households in the Philippines and its progressive towns, 1988-2006

Source: Authors' calculations from the FIES, selected years.
[1]CALABARZON includes provinces of Cavite, Laguna, Batangas and Quezon.

Income source	1988	1997	2000	2006
Philippines (US$ PPP)	578	857	826	943
Farm (%)	45	39	35	32
Nonfarm (%)	41	46	48	46
Formal salary work (%)	28	33	35	32
Informal work (%)	13	13	13	14
Manufacturing (%)	2	2	2	1
Trade, transportation and communication (%)	10	10	10	11
Others (%)	1	1	1	1
Remittances (%)	14	15	17	22
Domestic (%)	8	9	9	12
International (%)	6	6	8	10
Total (%)	100	100	100	100
Central Luzon, CALABARZON[1], Western Visayas and Central Visayas (US$ PPP)	586	974	941	1,026
Farm (%)	38	32	26	26
Nonfarm (%)	45	50	54	50
Formal salary work (%)	32	39	40	35
Informal work (%)	13	11	14	14
Manufacturing (%)	2	1	2	1
Trade, transport and communication (%)	9	9	10	12
Others (%)	2	1	1	1
Remittances (%)	17	18	20	24
Domestic (%)	9	10	10	12
International (%)	8	8	9	12
Total (%)	100	100	100	100

Table 3
Infrastructure development indicators, the Philippines and its progressive towns, 1988-2006

Indicator	1988	1997	2000	2006
Philippines				
Electricity (% of households)	60	70	76	82
Total road density (km/sq.km)	0.61	0.63	0.75	0.75
National	0.11	0.11	0.12	0.12
Local	0.50	0.52	0.63	0.63
Paved road (%)				
National	44	57	59	69
Local	7	10	14	14
Central Luzon, CALABARZON[1], Western Visayas and Central Visayas				
Electricity (% of households)	63	76	82	87
Total road density (km/sq.km)	0.69	0.72	0.83	0.83
National	0.12	0.13	0.14	0.13
Local	0.63	0.62	0.77	0.77
Paved road (%)				
National	60	71	73	82
Local	12	12	19	19

Sources: Authors' calculations from the FIES, selected years; and the Department of Public Works and Highways.
[1]CALABARZON includes provinces of Cavite, Laguna, Batangas and Quezon.

Table 4

Schooling characteristics of the rural labor force, the Philippines and its progressive towns, 1988-2006

Category	1988	1997	2000	2006
Philippines				
No schooling (%)	6	5	4	3
Primary (%)	56	51	47	44
Secondary (%)	26	31	34	37
Tertiary (%)[4]	12	13	15	16
Total (%)	100	100	100	100
Central Luzon, CALABARZON[1], Western Visayas and Central Visayas				
No Schooling (%)	4	3	3	2
Primary (%)	58	50	47	41
Secondary (%)	27	32	34	40
Tertiary (%)	11	15	16	17
Total (%)	100	100	100	100

Source: Authors' calculations from *Labor force Surveys*, selected years.
[1]CALABARZON includes provinces of Cavite, Laguna, Batangas and Quezon.

Table 5
Agriculture development indicators in Central Luzon, CALABARZON, Western Visayas and Central Visayas,1988-2006

Indicator	1988	1997	2000	2006
Philippines				
Average farm area (ha.)[1]	2.16[5]	na[6]	2.00[7]	na[6]
% area irrigated [2]	47	43	44	46
% area under MV [3,4]	93	94	98	95
Central Luzon, CALABARZON, Western Visayas and Central Visayas				
Average farm area (ha.)[1]	1.75[5]	na[6]	1.37[7]	na[6]
% area irrigated [2]	56	47	49	50
% area under MV [3,4]	96	98	98	99

[1]Source: National Statistics Office
[2]National Irrigation Administration.
[3]MV = modern variety.
[4]Philippine Rice Statistics.
[5]Represents the average farm size in 1991.
[6]na = not available.
[7]Represents the average farm size in 2002.

Table 6
Determinants of real rural per capita income at the provincial level in the Philippines, 1988-2006 (IV regression)

Variable	Farm		Nonfarm	
	1988-1997	2000-2006	1988-1997	2000-2006
	[A]	[B]	[C]	[D]
Access to electricity	-0.17	-1.70	0.58	1.45**
Proportion of paved national road	0.37*	-0.04	-0.15	0.004
National road density	2.03	0.81	-1.25	-0.11
Proportion of paved local road	-4.38***	-0.75	2.79**	0.76
Local road density	-0.12	0.07	-0.05	-0.13
Proportion of labor force:				
Female	-0.50	0.30	1.84***	1.21**
Between 15 and25 years old	2.54***	1.80**	1.18*	1.21*
26-35 years old	3.17***	3.12***	0.85	0.79
36- 45 years old	1.75**	0.70	-0.46	0.77
46-59 years old	2.91***	-1.86	-0.35	1.14
With primary schooling	-0.35	1.49	-0.01	-0.79
With secondary schooling	-0.05	1.32	-0.49	-1.17
With tertiary schooling	-0.76	3.16	3.99***	1.34
Proportion of irrigated area	0.04	0.05	0.15*	0.05
Land Acquisition and Distribution (LAD)	0.27	0.45	0.08	-0.20
Farmland to labor ratio	0.12***	0.04	0.11**	0.03
Distance	0.004***	0.000	-0.004***	0.000
Road*distance	-0.003	0.003*	0.005***	-0.001
Number of observations	248	186	248	186
R-squared	0.20	0.45	0.78	0.78

Table 6 (continued)

Variable	Formal Salary Work		Manufacturing		TTC	
	1988-1997	2000-2006	1988-1997	2000-2006	1988-1997	2000-2006
	[E]	[F]	[G]	[H]	[I]	[J]
Access to electricity	0.08	1.32*	2.85	-2.63	-1.33	2.73**
Proportion of paved national road	-0.40	-0.10	0.71	1.34**	0.467	0.17
National road density	-3.53**	-0.52	4.38	-0.12	0.49	1.13
Proportion of paved local road	5.39***	1.07	-4.55	2.03	0.63	-0.62
Local road density	0.19	-0.13	-0.96	0.10	0.28	-0.24*
Proportion of labor force:						
Female	2.29***	1.09*	0.64	3.81*	1.26	0.76
15-25 years	0.68	1.28	-1.49	0.04	1.91	0.94
26-35 years old	-0.05	0.73	-0.84	-0.87	0.97	0.72
36-45 years old	-0.80	0.88	-1.90	-0.53	-0.42	-0.29
46-59 years old	-1.08	1.27	-2.65	-0.29	-0.37	1.01
Primary schooling	-0.26	-0.03	2.11	5.60	2.25**	-3.15*
Secondary schooling	-0.17	-0.22	-1.73	4.27	2.20	-3.74*
Tertiary schooling	5.36***	2.66	2.92	10.11	7.66***	-2.94
Proportion of irrigated area	0.23**	0.08	-0.08	0.36	0.17	-0.14
Land Acquisition and Distribution (LAD)	0.13	-0.27	0.35	-0.04	-0.06	-0.31
Farmland to labor ratio	0.004	-0.004	0.72***	0.25	0.31***	0.06
Distance	-0.004**	0.000	0.004	0.008*	-0.005**	-0.001
Road*distance	0.005**	-0.001	-0.009	-0.011*	0.009***	0.002
Number of observations	248	186	235	184	248	186
R-squared	0.66	0.75	0.11	0.17	0.37	0.49

Table 6 (continued)

Variable	Foreign Remittance		Domestic Remittance	
	1988-1997	2000-2006	1988-1997	2000-2006
	[K]	[L]	[M]	[N]
Access to electricity	1.02	6.02***	-0.13	2.49*
Proportion of paved national road	0.55	-0.15	-0.14	-0.13
National road density	0.71	-1.08	0.50	1.64
Proportion of paved local road	-2.24	-2.30	0.47	-1.50
Local road density	1.02	0.09	0.47	0.06
Proportion of labor force:				
Female	0.24	2.30	2.05***	0.99
15-25 years	-2.83	1.80	-0.44	-2.04**
26-35 years old	-3.01	0.57	-1.25	-2.04
36-45 years old	-3.57	0.05	-0.62	-1.62
46-59 years old	-1.24	3.23	0.51	-0.89
Primary schooling	-1.89	-3.52	2.21**	3.78**
Secondary schooling	2.68	-1.32	3.85***	2.78*
Tertiary schooling	0.27	-5.83	3.77**	2.71
Proportion of irrigated area	0.20	-0.22	0.12	-0.26
Land Acquisition and Distribution (LAD)	0.11	-0.52	0.05	-0.07
Farmland to labor ratio	-0.016	-0.30*	0.003	-0.14
Distance	0.005	-0.001	-0.001	0.000
Road*distance	-0.003	0.002	0.002	0.000
Number of observations	244	186	248	186
R-squared	0.56	0.57	0.59	0.62

*****=**significant at 1% level, **=significant at 5% level, *=significant at 10% level.
Note: The coefficients for the location and year dummies, interaction term between distance and location dummies and the constant term, which are not shown in the table, are available from the authors upon request.
To save space, t-statistics are omitted from the statistical tables. They are available upon request.

Table 7
Determinants of real rural per capita income in the progressive towns, 1988-2006
(IV regression)

Variable	Farm		Nonfarm	
	1988-1997	2000-2006	1988-1997	2000-2006
	[A]	[B]	[C]	[D]
Access to electricity	-0.65	-2.10***	3.39***	2.74***
Proportion of paved national road	0.01	-0.62	0.36	0.46
National road density	-2.70***	-2.30**	2.97*	1.99**
Proportion of paved local road	1.05	0.82	-2.31	0.69
Local road density	0.18	0.58**	-0.57**	-0.90**
Proportion of the labor force:				
Female	-0.35**	-0.40	1.11***	0.89***
15-25 years old	-0.69***	-0.91**	1.37***	0.83*
26-35 years old	-0.33	-0.67*	0.91*	0.74*
36-45 years old	-0.47*	-0.50	0.94*	-0.06
46-59 years old	0.03	-0.17	0.97*	0.44
Primary schooling	0.70*	1.39*	-1.08	-0.96
Secondary schooling	0.35	1.69	-1.50	-0.82
Tertiary schooling	0.49	1.94	0.29	0.28
Proportion of irrigated area	0.44***	0.34**	-0.66**	-0.07
Proportion of fully owned farmland	0.24	-0.73***	-0.79***	0.23
Farmland-labor ratio	-0.14***	-0.15***	0.04	0.04***
Distance	0.001	-0.006	-0.006**	0.003
Road*distance	-0.004	0.008	0.013**	-0.006
Number of observations	933	763	923	760
R-squared	0.32	0.02	0.32	0.54

Table 7 (continued)

Variable	Formal Salary Work		Manufacturing		TTC	
	1988-1997	**2000-2006**	**1988-1997**	**2000-2006**	**1988-1997**	**2000-2006**
	[E]	**[F]**	**[G]**	**[H]**	**[I]**	**[J]**
Access to electricity	3.21***	2.83***	-0.21	1.84	2.16**	1.13
Proportion of paved national road	0.56	-0.04	-1.76*	1.90*	-0.75	0.85
National road density	3.79**	2.15**	-3.26	1.90	-0.07	1.34
Proportion of paved local road	-2.49	1.01	9.93*	1.38	1.56	-0.31
Local road density	-0.51*	-0.92***	1.02*	-0.50	-0.53	-0.30
Proportion of the labor force:						
Female	0.87***	0.80**	2.03***	2.82***	1.12***	1.07**
15-25 years old	1.37**	1.03**	0.34	-1.26	0.90	-0.42
26-35 years old	0.67	0.54	-1.06	-0.73	1.65**	0.55
36- 45 years old	0.52	0.12	0.91	-0.74	1.38*	0.16
46-59 years old	0.67	0.63	0.97	-1.15	1.32**	0.02
Primary schooling	-1.62*	-1.97*	2.84	-4.03	-0.14	0.40
Secondary schooling	-2.01	-1.78	3.36	-3.96	-0.25	1.00
Tertiary schooling	0.30	-0.35	3.37	-4.16	0.34	1.10
Proportion of irrigated area	-0.66**	-0.15	0.08	-0.07	-0.10	-0.06
Proportion of fully owned farmland	-0.69***	0.24	-0.86*	-0.18	-0.53	0.14
Farmland-labor ratio	0.03	0.05***	0.17**	-0.09	0.10**	0.03
Distance	-0.007**	-0.004	0.012**	0.013	0.000	0.005
Road*distance	0.014**	0.005	-0.016*	-0.018	0.003	-0.009
Number of observations	900	753	374	383	797	714
R-squared	0.34	0.49	0.26	0.14	0.20	0.28

Table 7 (continued)

Variable	Foreign Remittance		Domestic Remittance	
	1988-1997	2000-2006	1988-1997	2000-2006
	[K]	[L]	[M]	[N]
Access to electricity	0.46	1.84	1.51*	1.35*
Proportion of paved national road	0.38	1.61**	0.01	0.36
National road density	2.39	3.03*	1.08	-0.01
Proportion of paved local road	1.81	-3.73**	2.06	-0.76
Local road density	0.74	0.74	-0.71***	-0.18
Proportion of the labor force:				
Female	-0.12	0.14	0.71***	0.49
15-25 years old	-3.53***	-1.72**	-2.80***	-2.32***
26-35 years old	-3.36***	-1.23	-2.75***	-1.68***
36- 45 years old	-2.82***	-1.38	-2.56***	-0.95**
46-59 years old	-1.56*	0.73	-2.22***	0.03
Primary schooling	4.33***	-0.89	-1.63**	-0.75
Secondary schooling	5.62***	0.32	-1.25	-0.26
Tertiary schooling	6.70***	1.53	-0.76	0.22
Proportion of irrigated area	0.05	0.06	-0.52**	-0.15
Proportion of fully owned farmland	-0.30	0.47	-0.40	0.30
Farmland-labor ratio	0.06	0.06**	0.01	0.06***
Distance	0.003	0.001	-0.001	0.004
Road*distance	-0.003	-0.003	0.002	-0.007
Number of observations	624	629	930	763
R-squared	0.237	0.298	0.195	0.335

*****=**significant at 1% level, **=significant at 5% level, *=significant at 10% level.
Note: The coefficients for the location and year dummies, interaction term between distance and the location dummies and the constant term, which are not shown in the table, are available from the authors upon request.
To save space, t-statistics are omitted from the statistical tables. They are available upon request.