Growth, Convergence and Spending Efficiency among Filipino Households

Erniel B. Barrios
BSP Sterling Professor of Statistics
School of Statistics
University of the Philippines Diliman
Correspondence: ernielb@yahoo.com, ebbarrios@up.edu.ph

Abstract

A growth model is used in the context of Sala-i-Martin's definition of conditional convergence to assess the household income dynamics in segmented groups at the provincial level in the Philippines. There is a direct relationship between spending efficiency and income growth convergence across income groups. The lower income convergence rate among low income households can be attributed to their relatively less efficient access to the factors of production.

The study provides tools in identifying targeted intervention strategies that will facilitate poverty alleviation among the households at the provincial level. The viability of poverty alleviation strategy can be assessed in terms of convergence of the different income groups. Low income groups converging slower than the high income groups support the recent data on measures of inequality in the Philippines (very minimal movement among the indicators). In order to alleviate inequality, the low-income group should be targeted for poverty-alleviating interventions like the conditional cash transfer.

1. Introduction

There was a slow movement among the inequality indicators in the Philippines in the recent past. (NSCB, 2007) reported that the income gap defined to be the shortfall of per capita income to poverty threshold barely changed from 29.8% in 1997 to 29.6% in 2000. The poverty gap remained practically the same level (8.4% both in 1997 and 2000). Severity of poverty is reported at 3.5% in 1997 to 3.4% in 2000. Finally, the GINI coefficient is from 0.4881 in 1997 to 0.4814 in 2000. While income and expenditure levels may have changed between the reference years, inequality measures had been stable. It can be deduced easily that the poverty alleviation measures that the government emphasized in several development plans may have produced tremendous leakage towards the non-target beneficiaries. This can result to the failure of the low-income households to catch up with the high-income household causing the minimal movement of the inequality indicators.

It is imperative whether the practice of assessing the aggregate of households in analyzing poverty conditions will be beneficial both in analyzing the conditions of the poor and in development of policies that can be used as instruments towards eventual alleviation.

Convergence and efficiency among households analyzed in the framework of poverty alleviation is not new. (Balisacan and Fuwa, 2004): analyses growth and poverty reduction simultaneously in a neoclassical growth model framework using provincial data from the Philippines. Using the Family Income and Expenditure Surveys, they noted the high rate of provincial income

convergence among the households. In addition, they also realized a trade-off between equity and growth, explaining why growth in income is not necessarily translated into narrowing of the gap between the low- and the high-income households. They further reported other determinants of development including: lack of political competition inhibits growth; land reform is positively associated with growth and poverty reduction; and higher agricultural terms of trade facilitating poverty reduction.

Poverty incidence in rural Philippines is about double those in urban areas. This implies that a clear understanding of rural development dynamics is an essential tool is developing policies geared towards poverty alleviation. Due to the often isolation of rural areas, one common prescription towards rural development (that will also stimulate poverty alleviation) is rural infrastructure. (Barrios, 2007a and 2007b) argued from an empirical model that accessibility infrastructure like roads and bridges can be the crucial backbone of rural development.

Rural areas are often interchangeably considered agricultural areas. (Kikuchi and Hayami, 1978) postulated that the pattern of agricultural growth is shifting from the extension of cultivation frontier towards technological innovations. Improvements in land infrastructure, such as irrigation and drainage, are identified as preconditions for development of land-saving farming technology. They further indicated that public investments in land infrastructure were induced by the higher rates of return to irrigation construction and improvements than to new land opening.

The goal of this paper is to assess convergence and efficiency in income and expenditures among Filipino households. Aggregation level will be at the provincial level, and by income group. Income grouping is expected to mitigate the potential effect of heterogeneity of the households towards convergence and efficiency analysis.

2. Efficiency and Inequality

For many types of analysis units (e.g., firms, households, or communities), efficiency and inequality always correlate positively. As efficiency is achieved, there is a tendency for inequality to widen. Inequality and efficiency treated separately or as a package has been included in many debates concerning development issues.

In terms of inequality, the poverty lines had been very crucial instrument in measurement of the magnitude. Because of the extent of the subjective influence, it is often the subject of criticisms among stakeholders. (Foster, 1998) assessed the new “hybrid” approach to measuring poverty that is sensitive to changes in the general living standards, but less sensitive than a purely relative approach. The issue however remains the same, regardless of the way a poverty line is rationalized, it cannot be imposed homogenously across all segments of the population and still be able to characterize the magnitude of inequality.

Inequality is also associated with the process of globalization. (Walby, 2000) emphasized that globalization is led by new information and communication technologies that are reshaping not only financial and capital markets but political and cultural processes. The different social institutions are taking up new forms as well as different patterns of interrelationships that surely lead towards varying degree and forms of social inequality. One mechanism supporting the argument is described by (Krugman and Venables, 1995), who emphasized the role of accessibility infrastructure. They pointed out that at high transport costs, all countries are forced to engage into manufacturing. However, as transport costs fall below a critical value, a core-periphery production area spontaneously forms. Nations that find themselves in the periphery suffer a decline in real incomes, in which peripheral nations gain and core nations may lose. International trade behavior as characterized by inflation movement (Albanes, 2007) can further illustrate the effect of globalization towards inequality. Cross-country evidence on inflation and income inequality suggests that they are positively related. Using a political economy model, it was concluded that equilibrium inflation is positively related to the degree of inequality in income due to the relative vulnerability to inflation of low income households.

While China these recent years experienced massive growth, widening income disparities between the east and west, urban and rural, rich and poor was observed (Zhou and Wan, 2003).

They argued the need to balance efficiency and equity to maintain sustainable growth in the process of reforms continuously implemented in China.

3. Growth and Convergence

There is a massive literature on the interplay of growth and convergence in the framework of varying growth theories. The interest on the issue is growing at a tremendous rate recently because of the formation of bilateral or multilateral trade agreements and regional cooperation globally. Some of the literatures that will be used as the basis of some concepts used in this paper are presented.

(Scheve and Slaughter, 2004) argued that one big question in globalization is whether economic integration increases worker insecurity in advanced economies. They claimed that the literature focuses on the role of international trade, but failed to produce convincing evidence that such a link exists. It is possible that foreign direct investment (FDI) by multinational enterprises (MNE) is the key aspect of the integration that generates the risk of worker insecurity among the advanced countries. Along the flow of investments where labor is expected to be lower, the workers from the countries of origin of such investments can be exposed to so much vulnerability in their tenure,

While public policy provides the backbone of the possible convergence among cooperating countries, the role of public expenditures and other forms of public investments cannot be discounted. (Farmer and Lahiri, 2006) used the Solow-Swan growth model and discussed why growth should be uncorrelated with the ratio of national investment to GDP and that there is instantaneous convergence of GDP per capita across countries. A slowdown in the convergence process can be observed whenever there is a capital market imperfection. They further noted that savings and investment ratios are strongly correlated with growth across countries and investment ratios are closely correlated with savings ratios within countries.

In a cross-country analysis, (Kumar and Russell, 2002) decomposed labor productivity growth into components attributable to technological change, technological catch-up, and capital accumulation. Technological change is decidedly non-neutral and that both growth and bipolar international divergence are driven primarily by capital deepening.

The linkage between policy, efficiency and inequality has been pursued by (Binswanger and Deininger, 1997). They hypothesized that special characteristics of the farm economy also influence a country's social and political environment and possibly generate a feedback mechanism in policy-making. The properly identified and implemented policies provide a strong justification for focusing specifically on agricultural and agrarian policies. They concluded that policy distortions coupled with imperfect and missing markets, and the unequal distribution of wealth jointly contribute into efficiency reduction.

Different growth theories used as a framework in the study of convergence can yield different perspectives on convergence. Using a neoclassical growth model, the 48 contiguous US states were analyzed by (Barro and Sala-i-Martin, 1992). Convergence was defined terms of poor countries/states growing faster than the rich ones. The "small" economies catching up with the "large" economies will result to equality in the long-run, and such a state of equilibrium is called convergence. Since the early work of convergence provide negative result in a variety of cross-county and within-country analysis, (Sala-i-Martin, 1996) expanded the notion of convergence. Absolute convergence was defined as growth of smaller economies faster than those of the larger economies. In this case, the annualized growth rates are regress negatively to the logarithm of per capita income. Conditional convergence however, is defined to be present when other exogenous variables are added in the regression before negative regression of growth on per capita income is exhibited.

Following (Barro and Sala-i-Martin, 1992) and (Sala-i-Martin, 1996), given the annual growth rate of GDP $\gamma_{i,t,t+T}$ of country i between period t and t+T, $\log(y_{i,t})$, the logarithm of economy GDP per capita at time t, (Sala-i-Martin, 1996) proposed to verify the convergence hypothesis

from the model $\gamma_{i,t,t+T} = \alpha - \beta \log(y_{i,t}) + \varepsilon_{i,t}$, where β>0 means that there is β-convergence (absolute). Small economies will grow faster while large economies will stabilize, until the small will catch up with the large economies towards the steady-state level. If σ_t is the dispersion of per capita GDP of economies at time t, $\sigma_{t+T} < \sigma_t$ implies σ-convergence, where convergence viewed in terms of more predictable differentiation of economies. Conditional convergence is defined by fitting $\gamma_{i,t,t+T} = a - b \log(y_{i,t}) + \psi X_{i,t} + \varepsilon_{i,t}$ where $X_{i,t}$ is a vector of variables that hold constant the steady state of economy i, $b = \frac{(1 - e^{-\beta T})}{T}$, if the estimate of β is positive once $X_{i,t}$ is hold constant, then there is conditional convergence and value of β estimates the rate of convergence, say per year if data is annual.

4. Technical Efficiency

The extensive literature on stochastic frontier model has been summarized comprehensively by (Kumbhakar and Lovell, 2000). A cross-sectional production frontier model is given by

$$y_i = f(x_i;\beta)\exp(v_i)TE_i \text{ or } TE_i = \frac{y_i}{f(x_i;\beta)\exp(v_i)}$$

where y_i is the single output of producer i, x_i is the vector of inputs used in producing y_i, f is a parametric function, TE_i is the output-oriented technical efficiency of producer i, and v_i is a random error. There is perfect efficiency when TE=1, while inefficiency when TE<1. The shortfall in production environment characterized by $\exp(v_i)$ varies across producers. Let $TE_i = \exp(-u_i)$, then the production stochastic frontier model becomes $y_i = f(x_i;\beta)\exp(v_i)\exp(-u_i)$, the last two factors are corresponding error components. The usual parameter estimation strategy is to use the maximum likelihood estimation (MLE) in a positive-value distribution of v_i, the random component (e.g., half-normal or gamma distribution). In cases where there are many indicators of factors of production, convergence of the MLE algorithm creates a problem in estimation. (Barrios, 2007b) extended the stochastic frontier model to include the interaction between spatial and temporal dependencies, then proposed a logistic distribution for the random error and estimated the parameters using the backfitting algorithm.

The applications of the stochastic frontier models spread in a diverse sectors, and diverse production units (firms, households, community, etc.). (Paul, et. al., 2000): considered the impact of dramatic regulatory reform during the 1980's on the efficiency of New Zealand farms using unbalanced panel data. A heterogeneous inefficiency setting was postulated with determinants including regulatory variable, a time term, and a debt/equity ratio. Looking at the different channels through which public infrastructure influences overall productivity, (Mastromarco and Woitek, 2006) explained the phenomenon of different long-term growth paths. They reported that the impact of core-infrastructure investment on efficiency is always positive. (Gonzalez and Lopez, 2007) estimated farm household levels of technical efficiency and their determinants with particular reference to political violence using survey data from 822 farm households. (Melfi and Rogers, 1988) tested the presence of allocative efficiency in firms for models in which the cost function is stochastic, the possibility of technical efficiency is allowed, and the efficient input cost share equations are stochastic. The test exploits the relationships among the disturbances in the cost and share equations to derive implications of the existence of allocative efficiency.

5. Modeling Strategies

This paper adopts the definition of (Sala-i-Martin, 1996) of conditional convergence. Efficiency assessment of households uses a cross-section stochastic frontier model (SFM) with heterogeneous efficiency equation and a time-varying decay model of efficiency.

The growth and convergence models will be estimated using the 1997 and 2000 Family Income and Expenditures Survey (FIES). Growth rates are computed from the annualized, deflated 2000 FIES estimates with 1997 estimates as the benchmark values. The cross-section SFM will be fitted for 2000 data, while the time-varying decay model will be developed using the 1991, 1994, 1997, and 2000 FIES data.

The unit of analysis will be provinces, thus, 1991 to 2000 FIES can yield a panel data for provinces in the Philippines. The income, expenditures, and other household characteristics of the samples were aggregated at the provincial level for three different segments. The Low Income segment constitutes the first to third income deciles (national) or the bottom 30%. The Average Income group is the middle 40% of the population, including the fourth to the seventh deciles. The High Income group is the upper 30% or those in the eight to the tenth deciles. Provincial aggregation by segment is done to minimize the possible effect of the highly heterogeneous population to the growth and efficiency models.

Following the definition of conditional convergence in (Barro and Sala-i-Martin, 1992) and (Sala-i-Martin, 1996), the neoclassical growth model provides the framework in the assessment of growth and convergence analysis of a typical household income and expenditures in a province (unit of analysis). Household efficiency will be assessed through the cross-section stochastic frontier model and the time-varying inefficiency decay model for panel data.

For the growth models, the determinants postulated to facilitate conditional convergence included: proportion of rural households; proportion of household with head in college educational level; proportion of household head with job; average age of household heads; average number of household members; average number of employed household members; average expenditures to transportation and communication; average expenditures in clothing; average expenditures in education; average medical expenditures; and average taxes. Models for efficiency in income generation and expenditures allocation were developed. For income models, the indicators of factors of production included: proportion of household head in college educational level; proportion of household heads with a job; average number of household members; average number of household members; average number of employed household members; proportion of households with strong roof materials; and proportion of households with safe water source. For expenditure models, income is considered as a determinant. The determinants of efficiency included: proportion of households in rural areas; average expenditures to transportation and communication; average expenditures to education; average medical expenditures; proportion of household with electricity connection.

The proportion of rural households in a province is considered as an efficiency determinant because of the aggregate of socio-economic-physical conditions in rural areas that usually deter the households to become efficient in accessing factors of production. In an isolated area, there is a limitation to the production opportunities available. Expenditures in transportation and communication usually go up when an area is accessible (higher mobility). Expenditures to education and health represent the improvement of human capital from the welfare enhancing implications of health and education. Electricity connection represents efficiency-enhancing benefits from better living conditions.

6. Income and Expenditure Growth

In the 2000 round of FIES, a wide income inequality distribution is observed from the average among the three income groups (see Table 1). The average income among households across provinces is more than double for the average income group compared to the low income group.

From the average income to the high income group, household income increase by about three-folds. Growth in expenditure pattern across income groups is less dramatic, resulting to a highly variable savings rates. The low income group is historically known in the Philippines as "dis-savers", yield an average of -1.46% savings rate, but the high income group exhibit as much as 28.89% savings rate.

Table 1: Income/Expenditure Profile of Different Income Groups in the Provinces (2000)

Group	**Mean (Annual)**	**Std. Dev.**	**Minimum**	**Maximum**
Low Income	*Savings Rate=-1.46%*			
Income	29,547	8,305	12,853	48,310
Expenditure	29,978	9,007	13,050	51,371
Average Income	*Savings Rate=11.62%*			
Income	65,966	18,793	34,540	108,731
Expenditure	58,298	18,465	24,971	105,539
High Income	*Savings Rate=28.89%*			
Income	202,315	71,715	74,644	446,088
Expenditure	143,876	53,129	50,518	385,603

While income and expenditures among the different income groups all exhibited negative growth from 1997 to 2000, the high income group yield higher standard deviations, indicating that it is possible that there are more households in the provinces in this group who actually have positive real growth in this period. From Table 2, the maximum growth in income can reach as much as 12.35% among the high income households, only by 7.92% among the low income and 6.12% among the average income households.

Table 2: Annual Provincial Growth Rates (1997-2000)

Group	**Annualized Mean (%)**	**Standard Deviation(%)**	**Minimum (%)**	**Maximum (%)**
Low Income				
Growth in Income	-0.76	2.85	-7.46	7.92
Growth in Expenditure	-0.37	2.07	-4.76	4.56
Growth in Food Expend.	-0.96	2.90	-9.54	5.15
Average Income				
Growth in Income	-0.06	2.35	-5.27	6.12
Growth in Expenditure	-0.44	1.33	-4.23	2.94
Growth in Food Expend.	-0.18	2.47	-5.83	9.26
High Income				
Growth in Income	-0.17	4.38	-11.98	12.35
Growth in Expenditure	-0.60	4.92	-13.47	12.42
Growth in Food Expend.	-1.07	4.06	-13.39	7.75

There are remarkable differences on the average income and expenditures among the three income groups. There is also a faster growth among the high income households compared to the low income households. This can clearly indicate the empirical feasibility of further widening of income inequality, supporting the inequality measurements presented earlier. These patterns cannot be observed if instead, aggregate analysis of all households is made. Thus, in subsequent discussions, the households in each of the analysis units (the provinces) are always segmented according to three income groups.

Low Income Group

The growth model with the convergence facilitating factors for income, total expenditures and food expenditures among the low income group are presented in Appendices 1 to 3. There is convergence in income ($p<0.007$) and food expenditures ($p<0.021$) among the low income households. For total expenditures however, the low income household failed to converge ($p<0.388$). Household income converges at the rate of about 9% per annum. The more important indicators that can effect the conditional convergence of the low income households include the proportion of household heads with job ($p<0.028$) and the household size ($p<0.014$). Large households can deter income growth among the low income households. To facilitate income growth among this segment, a more concrete family planning program targeting the low income households is necessary. While the proportion of household heads with a job had a significant contribution in income growth, it moves in the opposite direction. This means that better income growth prospects in the low income group can be realized if the job-generation strategy is targeted on other members of the households rather than the heads. Traditionally, the low income households common among rural areas have heads usually engaged in agriculture. Furthermore, farming for most of the farmers in the Philippines is rather subsistence than of commercial level. Thus, employment/income source diversification can be considered in addition to family planning as a possible strategy towards alleviating income growth among the low income households.

Average Income Group

There is evidence of income ($p<0.001$) and expenditures ($p<0.023$) convergence among the average income households (see Appendices 4 to 6 for details). The rate of convergence in income is about 13%, much higher than the low income group, while expenditures converge at the rate of 10%. Unlike the low income households, income-generation opportunities among average income households are similar (educational level, access and preference to jobs, etc.), facilitating income convergence. Income growth determinants in this segment of the population are different from the low-income segment. The effect of household size is similar. Larger household size can also be a disadvantage for households to access income-generating resources, resulting for slower income growth. In addition, although expenditures to transportation and communication ($p<0.089$) and medical expenditures ($p<0.085$) are moderately significant, it can contribute positively towards income growth of the middle 40% of the households. Expenditure to transportation and communication approximates the effect of isolation or accessibility of an area. Among the average income households, higher expenditures to transportation and communication can mean that they reside in accessible communities with available transportation and communication facilities. On the other hand, lower expenditures are incurred because there are no such transportation and communication facilities available to them.

The family planning program that is needed mostly by the low income group is also needed by the average income group. Rural infrastructure program emphasizing road networks along with an efficient and effective health systems can contribute in further facilitating income growth among the average income households.

High Income Group

The rate of income convergence among the high income households is 31% ($p<0.000$), almost three times the convergence rate among the average income households. Total expenditures and food expenditures among this segment failed to converge (see Appendices 7 to 9 for details). Only the household size ($p<0.000$) appeared to facilitate convergence in income among the high income households. Since this policy-related indicator cuts across all income groups, it means that the family planning program should not exclude the high income group, but emphasis will be towards the low income group who needed this most.

While income growth converges significantly in all three groups, the rate of convergence varies remarkably. At the rate the three groups convergences, it can be predicted that the general population cannot converge eventually, but rather a clustered convergence pattern can be achieved. Note that the low income group accounts for 30% of the population, the average income group accounts for 40% while the high income group accounts for 30% of the population. The low and high income groups are definitely not outlying groups here. Thus, while each group can converge within, a potential widening of the income gap between the low and the high income group is

inevitable at the present condition in the Philippines. The only way for inequality to be averted is to implement more targeted intervention among the low income group so that their rate of convergence will speed up. Once the rate of converge of the low income group surpasses the one for the high income group, then possibly, income convergence of the general population can be achieved.

7. Income and Expenditure Efficiency in 2000

Cross-section stochastic frontier models were used in assessing efficiency in income generation and expenditure allocation among the households across provinces in the Philippines. Only the proximate indicators of labor and capital that are available in FIES are used. For the determinants of efficiency, accessibility/isolation is represented by proportion of households in rural areas and expenditures to transportation and communication. Education and medical expenditures are interpreted as the amount of investments on human capital development, expected to yield efficiency-enhancing effect among the households in both their income-generation and expenditures allocation. The proportion of households with electricity connection indicates the availability of amenities that should improve the living conditions of the households, hence, induce efficiency in their activities.

Low Income Group

The results of estimating the stochastic frontier models for income and total expenditures among the low income households are presented in Appendices 10 and 11. Among the determinants of income, proportion of households with heads who are at least college level of education contributed most to income ($p<0.074$). Higher average expenditures to transportation and communication implying availability of accessibility network, contributed significantly ($p<0.027$) in enhancing income efficiency among the low-income households. This will again justify the necessity for rural infrastructures (road especially) to induced efficiency among the low income households in their income-generation activities. The average technical efficiency is 0.9185, with some households having efficiency as low as 0.7778 and some have as high as 0.9890. The technical efficiencies are highly correlated to expenditures to transportation and communication (0.6502) and medical expenditures (0.4507). The technical efficiency yield negative correlation with the proportion of households in rural areas (-0.4442), indicating that the more inefficient low income households are located in rural areas.

For total expenditures of the low income group, total income ($p<0.000$) and average number of household members ($p<0.049$) contributed significantly in the production function part of the model. The allocative efficiency enhancing factors included expenditures to education ($p<0.008$) and medical expenditures ($p<0.001$). Low income households investing in education and health appeared to be the more efficient in allocating total expenditures. This can be augmented through the provision of basic welfare services by the government. The average technical efficiency is 0.9169 and is strongly correlated with medical expenditures (0.588), transportation and communication expenditures (0.4575) and expenditures to education (0.4531).

Average Income Group

Income determinants among average income households included a wider spectrum (see Appendix 12). The proportion of households with strong roof materials is a proximate indicator capital accumulation among the households, yield a significant positive effect on income generation ($p<0.000$). Household size consistently yields negative effect in income generation, with larger households more likely to earn lower income than households will fewer members. Although proportion of household heads with college education has significant effect on income ($p<0.039$), the effect is negative. This can be explained by the possibility that a bigger part of the income raised by average income households is actually not coming from the head but from other household members. The most significant determinant of efficiency is expenditures to transportation and communication ($p<0.013$). Higher proportion of households in rural areas results to inefficiency ($p<0.057$) among the average income group. The average technical efficiency is 0.9445, higher than the low income households. There is also a strong correlation between technical efficiency and expenditures on transportation and communication (0.6483), proportion of rural households (-0.5420), and medical expenditures (0.5016).

Appendix 13 contains the estimates of the stochastic frontier model for expenditures of average income households. Total expenditure react sensitively to income ($p<0.000$). Only the medical expenditures of average income households can enhance their allocative efficiency ($p<0.067$). The average technical efficiency is 0.9654, also higher compared to the low income households.

High Income Group

Income of high income group is significantly affected (negative) only by the proportion of households in the rural areas ($p<0.004$). Efficiency is affected only by their medical expenditures ($p<0.057$). The average technical efficiency is 0.9296, strongly correlated to their medical expenditures (0.07446) and education expenditures (0.4712). No viable stochastic frontier model can be estimated for total expenditures among the high income group, possibly explained by the wider options of expenditure allocations available to them. (see Appendices 14 and 15 for details).

8. Expenditure Efficiency Pattern (1991-2000)

Time-varying efficiency stochastic frontier models were fitted using data for 1991, 1994, 1997 and 2000. Estimation results are summarized in Appendices 16 to 18.

Total expenditures of the three income groups are significantly affected by total income. The efficiency of the learning curve of low income group yields insignificant decay parameter ($p<0.575$). The average technical efficiency for the decade is 0.5287 implying that allocative efficiency among the low income households are still very far away from the frontier. The decay parameter for the average income households is significant ($p<0.008$), also true for the high income group ($p<0.017$). The decay of inefficiency or improvement in efficiency learning curve among the high income group is high compared to the average income households.

9. Concluding Notes

Income growth converges significantly among the low income, average income and the high income groups. The rate of convergence however, varies remarkably, lower among the low income group, and very high among the high income group. At the rate the three groups convergences, it can be predicted that the general population cannot converge eventually, but rather a clustered convergence pattern can be achieved. While each group can converge within, a potential widening of the income gap between the low and the high income group is inevitable at the present condition in the Philippines. The only way for inequality to be averted is to implement more targeted intervention among the low income group so that their rate of convergence will speed up. Once the rate of convergence of the low income group surpasses the one for the high income group, then possibly income convergence of the general population can perhaps be achieved resulting to equality.

High average expenditures to transportation and communication imply availability of accessibility network. This can enhance income efficiency among the low-income households, justifying the necessity for rural infrastructures (road, especially) to induce efficiency among the low income households in their income-generation activities. Low income households investing in education and health appeared to be the more efficient in allocating total expenditures. This can be augmented through the provision of basic welfare services by the government. Household size yields negative effect in income generation of the households, with larger households more likely to earn lower income than households with fewer members. The average technical efficiency is generally higher among high income group than the low income group.

The efficiency learning curve of low income group yields insignificant decay parameter. The decay of inefficiency or improvement in efficiency among the high income group is high compared to the average income households and over the low income group.

Higher speed of income convergence among the high income group compared to the low income group could mean continuous widening of income gap (worsening inequality). A poverty alleviation strategy should necessarily target the low income group. The conditional cash transfer

(CCT) is one example of such targeted intervention strategy towards poverty alleviation. Similar targeting of the low income group for efficiency enhancing interventions like rural infrastructure can push them nearer the production frontier.

Acknowledgement: The author would like to acknowledge the financial support of Bangko Sentral ng Pilipinas through the BSP Sterling Professorial Chair granted to the UP School of Statistics.

References:

Albanesi, S., 2007, Inflation and Inequality, *Journal of Monetary Economics*, 54(4): 1088-1114.

Balisacan, A., and Fuwa, N., 2004, Going Beyond Cross-Country Averages: Growth, Inequality and Poverty Reduction in the Philippines, *World Development*, 32(11):1891-1907.

Barrios, E., 2007a, Access to rural development:Household perceptions on rural development, ABDI Discussion Paper No. 61, Asian Development Bank Institute, Tokyo, Japan.

Barrios, E., 2007b, Spatial effect in the efficient access of rural development, ABDI Discussion Paper No. 65, Asian Development Bank Institute, Tokyo, Japan.

Barro, R., and Sala-i-Martin, X., 1992, Convergence, *Journal of Political Economy*, 100(2):223-251.

Binswanger, H. and Deininger, K., 1997, Explaining Agricultural and Agrarian Policies in Developing Countries, *Journal of Economic Literature*, 25: 1958-2005.

Farmer, R., and Lahiri, A., 2006, Economic Growth in an Interdependent World Economy, *The Economic Journal*, 116: 969-990.

Forster, J., 1998, Absolute Vesus Relative Poverty, *The American Economic Review*, 88(2): 335-341.

Gonzalez, M., and Lopez, R., 2007, Political Violence and Farm Household Efficiency in Colombia, *Economic Development and Cultural Change*, 55:367-392.

Kikuchi, M., and Hayami, Y., 1978, Agricultural Growth Against a Land Resource Constraint: A Comparative History of Japan, Taiwan, Korea, and the Philippines, *Journal of Economic History*, 38(4):839-864.

Krugman, P., and Venables, A., 1995, Globalization and the Inequality of Nations, *The Quarterly Journal of Economics*, 110(4):857-880.

Kumbhakar S, Lovell K. 2000. *Stochastic Frontier Analysis*. UK: Cambridge University Press.

Kumar, S., and Russel, R., 2002, Technological Change, Technological Catch-up, and Capital Deepening: Relative Contributions to Growth and Convergence, *The American Economic Review*, 92(3): 527-548.

Mastromarco, C., and Woitek, U., 2006, Public Infrastructure Investment and Efficiency in Italian Regions, *Journal of Productivity Analysis*, 25: 57-65.

Melfi, C., and Rogers, A., 1988, A Test for the Existence of Allocative Inefficiency in Firms, *Journal of Applied Econometrics*, 3:69-80.

National Statistical Coordination Board (NSCB), 2007, *Poverty Statistics*, Makati, NSCB.

Paul, C., Johnston, W., and Frengley, G., 2000, Efficiency in New Zealand Sheep And Beef Farming: The Impacts of Regulatory Reform, *The Review of Economics and Statistics*, 82(2): 325-337.

Sala-i-Martin, X., 1996, The Classical Approach to Convergence Analysis, *The Economic Journal*, 106: 1019-1036.

Scheve, K., and Slaughter, M., 2004, Economic Insecurity and the Globalization of Production, *American Journal of Political Science*, 48(4): 662-674.

Walby, S., 2000, Analyzing Social Inequality in the Twenty-First Century: Globalization and Modernity Restructure Inequality, *Contemporary Sociology*, 29(6):813-818.

Zhou Z., and Wan, G., 2003, Determinants of Income Inequality in Rural China: Decomposition Using Household Data, International Conference on Inequality, Poverty and Human Well-Being, World Institute for Development Economics Research, UN University.

Appendix 1: Growth Model for Income of Low Income Group (1997-2000)

Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Per Capital Total Income in 1997	-0.08724	0.03148	0.007
Proportion of Rural Households (97)	0.00515	0.01439	0.722
Proportion of HH with Head College Level/Graduate(97)	0.00367	0.00340	0.285
Proportion of HH with Head with a Job (97)	-0.08905	0.03956	0.028
Average Age if HH Heads (97)	-0.01697	0.04352	0.698
Average Number of HH Members (97)	-0.10786	0.04249	0.014
Average Number of Employed HH Members (97)	0.00187	0.01627	0.909
Average Expenditures in Transportation and Comm. (97)	-0.00146	0.00898	0.872
Average Expenditures in Clothing (97)	-0.00857	0.01034	0.410
Average Expenditures in Education (97)	0.00487	0.00542	0.373
Average Medical Expenditures (97)	-0.00586	0.00553	0.293
Average Taxes (97)	-0.00310	0.00336	0.359
Constant	1.08913	0.38639	0.006

Appendix 2: Growth Model for Expenditures of Low Income Group (1997-2000)

Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Per Capita Total Expenditure in 1997	-0.03179	0.03660	0.388
Proportion of Rural Households (97)	0.02405	0.01889	0.207
Proportion of HH with Head College Level/Graduate(97)	0.00350	0.00444	0.433
Proportion of HH with Head with a Job (97)	-0.06002	0.05277	0.260
Average Age if HH Heads (97)	-0.10118	0.05700	0.081
Average Number of HH Members (97)	-0.09119	0.04772	0.061
Average Number of Employed HH Members (97)	0.00170	0.02155	0.937
Average Expenditures in Transportation and Comm. (97)	-0.01154	0.01228	0.351
Average Expenditures in Clothing (97)	-0.02701	0.01355	0.050
Average Expenditures in Education (97)	-0.00656	0.00772	0.399
Average Medical Expenditures (97)	-0.00703	0.00720	0.333
Average Taxes (97)	0.00976	0.00441	0.030
Constant	1.12080	0.43331	0.012

Appendix 3: Growth Model for Expenditures on Food of Low Income Group (1997-2000)

Determinants (All in Logarithm	Coefficient	Std. Error	p-value
Per Capita Expenditure on Food in 1997	-0.08460	0.03571	0.021
Proportion of Rural Households (97)	0.03789	0.02112	0.078
Proportion of HH with Head College Level/Graduate(97)	-0.00379	0.00491	0.444
Proportion of HH with Head with a Job (97)	-0.08289	0.05832	0.160
Average Age if HH Heads (97)	-0.09690	0.06339	0.131
Average Number of HH Members (97)	-0.12313	0.04571	0.009
Average Number of Employed HH Members (97)	0.00168	0.02369	0.944
Average Expenditures in Transportation and Comm. (97)	-0.00878	0.01305	0.504
Average Expenditures in Clothing (97)	-0.01374	0.01425	0.339
Average Expenditures in Education (97)	-0.00520	0.00875	0.554
Average Medical Expenditures (97)	-0.00282	0.00794	0.723
Average Taxes (97)	0.00492	0.00483	0.312
Constant	1.43251	0.45323	0.002

Appendix 4: Growth Model for Income of Average Income Group (1997-2000)

Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Per Capita Total Income in 1997	-0.13351	0.03974	0.001
Proportion of Rural Households (97)	-0.00807	0.00644	0.215
Proportion of HH with Head College Level/Graduate(97)	0.00012	0.00356	0.973
Proportion of HH with Head with a Job (97)	0.05351	0.04262	0.214
Average Age if HH Heads (97)	0.01194	0.03991	0.766
Average Number of HH Members (97)	-0.19063	0.05558	0.001
Average Number of Employed HH Members (97)	-0.02296	0.01465	0.122
Average Expenditures in Transportation and Comm. (97)	0.01187	0.00686	0.089
Average Expenditures in Clothing (97)	0.01223	0.00714	0.092
Average Expenditures in Education (97)	-0.00595	0.00482	0.222
Average Medical Expenditures (97)	0.00679	0.00388	0.085
Average Taxes (97)	-0.00100	0.00334	0.765
Constant	1.37476	0.52981	0.012

Appendix 5: Growth Model for Expenditures of Average Income Group (1997-2000)

Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Per Capita Total Expenditure in 1997	-0.10279	0.04408	0.023
Proportion of Rural Households (97)	-0.01927	0.01024	0.064
Proportion of HH with Head College Level/Graduate(97)	0.00182	0.00573	0.752
Proportion of HH with Head with a Job (97)	0.17225	0.06648	0.012
Average Age if HH Heads (97)	0.02144	0.05795	0.713
Average Number of HH Members (97)	-0.21723	0.06175	0.001
Average Number of Employed HH Members (97)	0.00699	0.02314	0.764
Average Expenditures in Transportation and Comm. (97)	0.00468	0.01238	0.706
Average Expenditures in Clothing (97)	-0.00672	0.01138	0.557
Average Expenditures in Education (97)	-0.01396	0.00795	0.084
Average Medical Expenditures (97)	0.01387	0.00652	0.037
Average Taxes (97)	-0.00326	0.00527	0.538
Constant	1.30277	0.51269	0.013

Appendix 6: Growth Model for Expend. on Food of Average Income Group (1997-2000)

Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Per Capita Expenditures on Food in 1997	-0.07045	0.03780	0.067
Proportion of Rural Households (97)	-0.00874	0.01113	0.435
Proportion of HH with Head College Level/Graduate(97)	0.00584	0.00652	0.374
Proportion of HH with Head with a Job (97)	0.14605	0.07323	0.050
Average Age if HH Heads (97)	0.01095	0.06445	0.866
Average Number of HH Members (97)	-0.16343	0.06002	0.008
Average Number of Employed HH Members (97)	-0.01835	0.02522	0.470
Average Expenditures in Transportation and Comm. (97)	-0.01177	0.01264	0.355
Average Expenditures in Clothing (97)	0.00161	0.01215	0.895
Average Expenditures in Education (97)	-0.00990	0.00811	0.227
Average Medical Expenditures (97)	0.00770	0.00697	0.273
Average Taxes (97)	-0.00182	0.00598	0.762
Constant	0.99389	0.51269	0.057

Appendix 7: Growth Model for Income of High Income Group (1997-2000)

Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Per Capita Total Income in 1997	-0.30644	0.04523	0.000
Proportion of Rural Households (97)	-0.02724	0.01109	0.017
Proportion of HH with Head College Level/Graduate(97)	-0.02583	0.02236	0.252
Proportion of HH with Head with a Job (97)	0.01039	0.06743	0.878
Average Age if HH Heads (97)	-0.05208	0.10504	0.619
Average Number of HH Members (97)	-0.30660	0.07873	0.000
Average Number of Employed HH Members (97)	-0.09870	0.05124	0.059
Average Expenditures in Transportation and Comm. (97)	-0.01699	0.01616	0.297
Average Expenditures in Clothing (97)	0.02833	0.02214	0.205
Average Expenditures in Education (97)	0.01408	0.01584	0.377
Average Medical Expenditures (97)	0.00586	0.00953	0.541
Average Taxes (97)	0.01258	0.01151	0.278
Constant	3.63667	0.59561	0.000

Appendix 8: Growth Model for Expenditures of High Income Group (1997-2000)

Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Per Capita Total Expenditure in 1997	-0.09751	0.07757	0.213
Proportion of Rural Households (97)	-0.02497	0.01195	0.041
Proportion of HH with Head College Level/Graduate(97)	-0.03682	0.02369	0.125
Proportion of HH with Head with a Job (97)	0.05781	0.07136	0.421
Average Age if HH Heads (97)	0.05881	0.11019	0.595
Average Number of HH Members (97)	-0.17713	0.09514	0.067
Average Number of Employed HH Members (97)	-0.06586	0.05365	0.224
Average Expenditures in Transportation and Comm. (97)	-0.02875	0.02284	0.213
Average Expenditures in Clothing (97)	0.00796	0.02458	0.747
Average Expenditures in Education (97)	-0.01063	0.01753	9.547
Average Medical Expenditures (97)	-0.00038	0.01034	0.971
Average Taxes (97)	0.00372	0.01212	0.760
Constant	1.34202	0.69369	0.057

Appendix 9: Growth Model for Expenditures on Food of High Income Group (1997-2000)

Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Per Capita Expenditures on Food in 1997	-0.08458	0.08114	0.103
Proportion of Rural Households (97)	-0.00733	0.01158	0.529
Proportion of HH with Head College Level/Graduate(97)	-0.02387	0.02350	0.314
Proportion of HH with Head with a Job (97)	0.03839	0.07019	0.586
Average Age if HH Heads (97)	-0.07828	0.10717	0.468
Average Number of HH Members (97)	-0.26333	0.07528	0.001
Average Number of Employed HH Members (97)	-0.02369	0.05259	0.654
Average Expenditures in Transportation and Comm. (97)	0.00409	0.01907	0.831
Average Expenditures in Clothing (97)	-0.02736	0.02264	0.231
Average Expenditures in Education (97)	0.01677	0.01570	0.289
Average Medical Expenditures (97)	0.00581	0.00968	0.551
Average Taxes (97)	-0.00328	0.01128	0.772
Constant	1.56072	0.57257	0.008

Appendix 10: Estimates of Parameters of Stochastic Frontier Model for Income Among Low Income Households in 2000

Production Determinants	Coefficient	Std. Error	p-value
Log(Proportion of HH with Head College Level/Graduate)	0.01843	0.01033	0.074
Log(Proportion of HH with Head Having a Job)	-0.09825	0.12220	0.421
Log(Average Number of HH Members)	-0.07516	0.09308	0.419
Log(Average Number of Employed HH Members)	0.00496	0.08054	0.951
Log(Proportion of HH with Strong Roof Materials)	-0.01819	0.02406	0.450
Log(Proportion of HH with "Safe" Water Source)	-0.01781	0.02334	0.445
Constant	10.80526	0.15892	0.000
Efficiency Determinants			
Proportion of HH in Rural Areas	0.25444	0.18646	0.172
Average Expenditures to Transportation&Communication	-0.00014	0.00006	0.027
Average Expenditures to Education	-0.00006	0.00008	0.431
Average Medical Expenditures	-0.00014	0.00010	0.189
Proportion of HH with Electricity Connection	0.04233	0.09853	0.667
Constant	0.09207	0.16277	0.572

Appendix 11: Estimate of Parameters of Stochastic Frontier Model for Expenditures Among Low Income Households in 2000

Production Determinants	Coefficient	Std. Error	p-value
Log(Total Income)	0.97220	0.08410	0.000
Log(Proportion of HH with Head College Level/Graduate)	-0.00653	0.00639	0.306
Log(Proportion of HH with Head Having a Job)	-0.02165	0.08860	0.807
Log(Average Number of HH Members)	0.13950	0.07088	0.049
Log(Average Number of Employed HH Members)	-0.01012	0.04726	0.831
Log(Proportion of HH with Strong Roof Materials)	0.01453	0.01520	0.339
Constant	0.17195	0.88995	0.847
Efficiency Determinants			
Proportion of HH in Rural Areas	0.05179	0.05547	0.350
Average Expenditures to Transportation&Communication	-0.00003	0.00003	0.312
Average Expenditures to Education	-0.00016	0.00006	0.008
Average Medical Expenditures	-0.00014	0.00004	0.001
Proportion of HH with Electricity Connection	-0.08542	0.05698	0.134
Constant	0.26000	0.06019	0.000

Appendix 12: Estimate of Parameters of Stochastic Frontier Model for Income Among Average Income Households in 2000

Production Determinants	Coefficient	Std. Error	p-value
Log(Proportion of HH with Head College Level/Graduate)	-0.02081	0.01007	0.039
Log(Proportion of HH with Head Having a Job)	-0.06022	0.08822	0.495
Log(Average Number of HH Members)	-0.26740	0.06915	0.000
Log(Average Number of Employed HH Members)	-0.18806	0.04355	0.000
Log(Proportion of HH with Strong Roof Materials)	0.07126	0.01756	0.000
Log(Proportion of HH with "Safe" Water Source)	-0.00130	0.01957	0.947
Constant	11.96954	0.12992	0.000
Efficiency Determinants			
Proportion of HH in Rural Areas	0.19596	0.10303	0.057
Average Expenditures to Transportation&Communication	-0.00003	0.00001	0.013
Average Expenditures to Education	-0.00001	0.000009	0.188
Average Medical Expenditures	-0.00006	0.00004	0.152
Proportion of HH with Electricity Connection	0.07958	0.06811	0.243
Constant	0.05517	0.09861	0.576

Appendix 13: Estimate of Parameters of Stochastic Frontier Model for Expenditures Among Average Income Households in 2000

Production Determinants	Coefficient	Std. Error	p-value
Log(Total Income)	1.13436	0.16965	0.000
Log(Proportion of HH with Head College Level/Graduate)	-0.01611	0.01310	0.219
Log(Average Number of HH Members)	0.08905	0.08762	0.309
Log(Average Number of Employed HH Members)	-0.00992	0.06076	0.870
Constant	-1.80666	2.00998	0.369
Efficiency Determinants			
Proportion of HH in Rural Areas	0.42396	0.35708	0.235
Average Expenditures to Education	-0.00001	0.00001	0.451
Average Medical Expenditures	-0.00009	0.00005	0.067
Constant	-0.15141	0.29693	0.610

Appendix 14: Estimate of Parameters of Stochastic Frontier Model for Total Income Among High Income Households in 2000

Production Determinants	Coefficient	Std. Error	p-value
Log(Proportion of households in rural areas)	-0.06951	0.02446	0.004
Log(Proportion of HH with Head College Level/Graduate)	0.04319	0.02952	0.143
Log(Proportion of HH with Head Having a Job)	0.09583	0.15492	0.536
Log(Average Number of HH Members)	0.06079	0.14400	0.673
Log(Average Number of Employed HH Members)	0.05252	0.13605	0.699
Log(Proportion of HH with Strong Roof Materials)	0.14099	0.08959	0.116
Constant	12.48503	0.23704	0.000
Efficiency Determinants			
Average Expenditures to Education	-0.00001	0.00001	0.154
Average Medical Expenditures	-0.00003	0.00002	0.057
Constant	0.32452	0.10005	0.001

Appendix 15: Estimate of Parameters of Stochastic Frontier Model for Total Expenditures Among High Income Households in 2000

Production Determinants	Coefficient	Std. Error	p-value
Log(Total Income)	1.12146	0.06997	0.000
Log(Average Number of HH Members)	-0.12473	0.13028	0.338
Constant	-1.57998	0.92237	0.087
Efficiency Determinants (None, Homogeneous TE)			

Appendix 16: Estimate of Parameters of Stochastic Frontier Model (With Time Varying Decay) for Total Expenditures Among Low Income Households in (1991-2000)

Production Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Total Income	0.9007	0.0466	0.000
Proportion of HH in Rural Areas	0.0180	0.0191	0.347
Proportion of HH with Head Without Formal Education	-0.0080	0.0073	0.269
Proportion of HH with Head College Level/Graduate	-0.0004	0.0057	0.943
Proportion of HH with Head Having a Job	-0.0817	0.0786	0.299
Average Age of HH Heads	-0.2887	0.0874	0.001
Average Number of HH Members	0.0783	0.0581	0.178
Average Number of Employed HH Members	-0.0170	0.0364	0.642
Proportion of HH with Strong Roof Materials	0.0544	0.0116	0.000
Proportion of HH with Strong Wall Materials	-0.0308	0.0100	0.002
Proportion of HH with Sanitary Toilet	-0.0063	0.0087	0.469
Proportion of HH with Electricity Connection	0.0173	0.0111	0.117
Proportion of HH with “Safe” Water Source	0.0299	0.0135	0.026
Constant	2.7005	1.4632	0.065
Decay Parameter(δ)	0.0152	0.0271	0.575

Appendix 17: Estimate of Parameters of Stochastic Frontier Model (With Time Varying Decay) for Total Expenditures Among Average Income Households in (1991-2000)

Production Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Total Income	0.9664	0.0293	0.000
Proportion of HH in Rural Areas	-0.0360	0.0208	0.084
Proportion of HH with Head Without Formal Education	-0.0193	0.0057	0.001
Proportion of HH with Head College Level/Graduate	0.0009	0.0062	0.884
Proportion of HH with Head Having a Job	-0.2938	0.1067	0.006
Average Age of HH Heads	-0.2978	0.1121	0.008
Average Number of HH Members	0.1685	0.0722	0.020
Average Number of Employed HH Members	0.1042	0.0423	0.014
Proportion of HH with Strong Roof Materials	0.0562	0.0195	0.004
Proportion of HH with Strong Wall Materials	-0.0512	0.0198	0.010
Proportion of HH with Sanitary Toilet	-0.0143	0.0114	0.208
Proportion of HH with Electricity Connection	0.0079	0.0207	0.704
Proportion of HH with “Safe” Water Source	0.0158	0.0194	0.414
Constant	1.0176	0.5647	0.072
Decay Parameter(δ)	0.0672	0.0252	0.008

Appendix 18: Estimate of Parameters of Stochastic Frontier Model (With Time Varying Decay) for Total Expenditures Among High Income Households in (1991-2000)

Production Determinants (All in Logarithm)	Coefficient	Std. Error	p-value
Total Income	0.6303	0.0427	0.000
Proportion of HH in Rural Areas	0.0362	0.0269	0.178
Proportion of HH with Head Without Formal Education	0.0203	0.0127	0.109
Proportion of HH with Head College Level/Graduate	-0.0858	0.0247	0.001
Proportion of HH with Head Having a Job	0.1026	0.1351	0.448
Average Age of HH Heads	-0.0739	0.2389	0.757
Average Number of HH Members	0.4300	0.1341	0.001
Average Number of Employed HH Members	0.1136	0.0981	0.246
Proportion of HH with Strong Roof Materials	0.2907	0.1199	0.015
Proportion of HH with Strong Wall Materials	-0.3577	0.1100	0.001
Proportion of HH with Sanitary Toilet	-0.1683	0.0411	0.000
Proportion of HH with Electricity Connection	-0.0275	0.0507	0.587
Proportion of HH with “Safe” Water Source	0.1490	0.0387	0.000
Constant	1.5130	1.1273	0.180
Decay Parameter(δ)	0.0778	0.0326	0.017