Economic Growth In the Philippines: A Spatial Econometrics Analysis At the Provincial level,1991–2000

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Introduction:

Photo By: Matthew David Johns

Economic growth in the Philippines has been studied in the past at the sub-national level through the use of neoclassical and endogenous growth theories. Balisacan and Fuwa (2004), applied the Solow model, an exogenous neoclassical growth model, using data from the provincial level in the Philippines. The study determined initial conditions and policy variables that impacted the annual growth rate of mean consumption per capita. Jolejole (2005), revisits economic growth factors in the Philippines again using the Solow model as well as the Mankiw Romer and Weil model, to focus on the role of endogenous growth in the Philippines.

The determinants of economics growth continue to have a prominent role in current economic growth literature. Most studies in this literature have tried to link economic growth and different economic factors using either neoclassical growth theories or endogenous growth approaches. These studies apply growth theories to identify the factors responsible for the observed differences/disparities between regions or countries.

Previous studies failed to account for the influence of spatial dependence in the economic growth process. The goal of this study is to re-investigate the process of regional economic growth, focusing on provincial data. Factors driving the economic growth process are examined using spatial econometrics techniques to account for spatial dependence.

Objectives:

This study revisits the Solow and Mankiw Romer and Weil growth models using spatial econometric techniques to account for spatial dependence. The goal is to investigate what factors drive economic growth at the provincial level in the Philippines.

Methods:

- The study uses economic growth data over the period 1991-2000 on 80 provinces in the Philippines.
- Per capita income and human capital data are obtained from the National Statistics Office (NSO).
- Using regional Consumer Price Indexes (CPI), per capita income were all converted into 2000 Php.
- Human capital variable is defined as the proportion of population with post secondary, college degree and higher.
- The investment in physical capital is derived from data obtained from the Bureau of Investment (BOI).
- For the spatial econometrics estimation, a distance weight matrix is used.
- Three types of growth estimation were used:
  1. Unconditional growth model
  2. Solow (1956) growth model
  3. Mankiw Romer and Weil (1992) model

Results & Discussions:

• Figure 1 shows the spatial distribution of per capita income in the years 1991, 1994, 1997 and 2000.

• The concentration of high per capita income in the National Capital Region (NCR) has remained consistent throughout these years.

• During the last two years, there has been a reduction in the number of low per capita provinces, mainly in the southern part of the country.

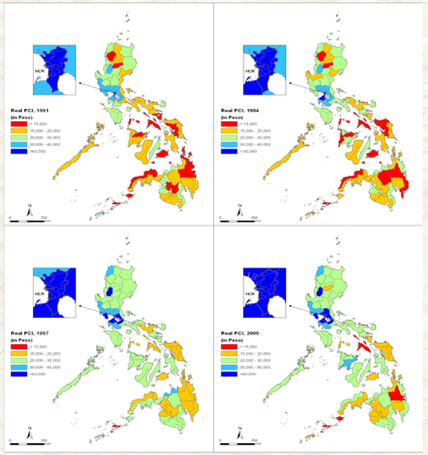

Figure 1: Real Per Capita Income, 1991-2000, Philippine Provinces (2000 Php)

• Figure 2 shows that the coefficient of variation and the Moran's *I* statistics for per capita incomes over the period 1991-2000.

• The decreasing value of the coefficient of variation (CV) shows the occurrence of sigma convergence at least over the period 1991-1997, indicating that the per capita incomes tend to become similar across space over this period.

• The same trend is observed for the Moran's *I* statistics, which denotes that the spatial concentration of similar income levels has decreased over that period.

• However, the period 1997-2000 is characterized by increased variability in the provincial incomes and the clustering of provinces with similar income levels has also increased.

Models	Unconditional a-spatial OLS	Unconditional ARAR MLE	Solow a-spatial OLS	Solow ARAR MLE	MRW a-spatial OLS	MRW ARAR MLE
Variables	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Constant	1.05**	1.61***	1.10*	1.67***	3.57***	3.84***
	(0.52)	(0.60)	(0.59)	(0.61)	(0.71)	(0.70)
ln(income 1994)	-0.09*	-0.14***	-0.09*	-0.14***	-0.45***	-0.47***
	(0.05)	(0.06)	(0.05)	(0.06)	(0.09)	(0.09)
ln(population growth)			0.05	0.02	0.14	0.10
			(0.78)	(0.15)	(0.15)	(0.13)
Ln(investment share)			0.01	0.04*	-0.01	0.02
			(0.03)	(0.02)	(0.02)	(0.02)
ln(human capital)					1.11***	1.00***
					(0.22)	(0.20)
Spatial AR parameter		-0.16		-0.18		0.03
		(0.67)		(0.58)		(0.46)
Spatial Error parameter		0.60*		0.70***		0.63**
		(0.36)		(0.25)		(0.27)
Convergence rate	0.59	0.94	0.59	0.94	3.71	3.94
Diagnostic tests						
Moran's I (error)	0.11***		0.12***		0.10***	
LM-error	7.76***		9.17***		5.04**	
Robust LM-error	6.25***		9.28***		0.58	
LM-lag	4.96***		5.41***		4.65**	
Robust LM-lag	3.46*		5.52**		0.18	
LM-SARMA	11.22***		14.70***		5.22*	

Table 1: Estimations of Unconditional, Solow, and Mankiw Romer and Weil models
Note: *, ** and *** are statistically significant at 10%, 5% and 1% level.

Estimation results of the three growth models are presented in Table 1. The a-spatial model is estimated with OLS (labeled a), while the spatial models are estimated with Maximum likelihood (labeled b). The coefficient of initial income shows a consistent negative correlation with growth, indicating the occurrence of beta convergence. In all models, the LM misspecification tests were statistically significant, in particular the LM tests for lag and error dependence as well as the LM-SARMA. We therefore consider appropriate re-specifications, estimating the ARAR model in all cases. The population growth variable shows the wrong sign across all models, but remains insignificant. However, the Solow model indicates a significant role of investment while the MRW points to human capital as a significant driver of economic growth. The spatial error parameter was significant in all models, which indicates the presence of omitted variables which exhibit spatial autocorrelation. However, the spatial lag parameter was insignificant in all models, meaning that growth in a specific province isn't dependent upon the growth of its neighbors.

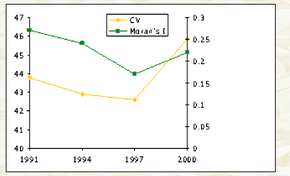

Figure 2: Coefficient of variation and Moran's *I* of real per capita income, Philippines provinces, 1991 – 2000.

• Figure 3 shows the standardized real per capita income in 1991 and 2000.
• There is a concentration of points in the upper right and lower left, denoting that provinces with above-average per capita in 1991 tend to have above-average per capita income in 2000 and the same is observed for the below-average per capita incomes provinces.

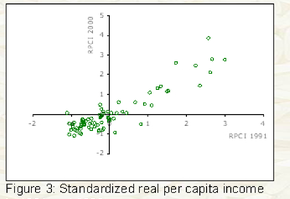

Figure 3: Standardized real per capita income in 1991 and 2000

• Figure 4 shows a scatter plot of the average annual growth rate of real per capita income over the period 1994 – 2000 against the per capita income in 1994.
• The negative trend of the fitted line indicates the occurrence of beta convergence.
• High income provinces tend to grow slower while low income provinces grow faster.

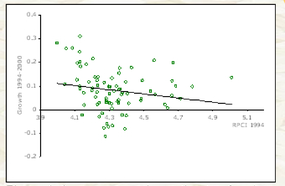

Figure 4: Average annual growth rate of real per capita income and initial per capita income.

• Figure 5 shows the Moran's scatter plot for the average growth of per capita income over the period 1994-2000.
• The average annual growth of each province is regressed against the spatially weighted average of the annual growth rate of its neighbors.
• The fitted line has a positive slope which is small in magnitude, indicating that the neighbors influence is minor.

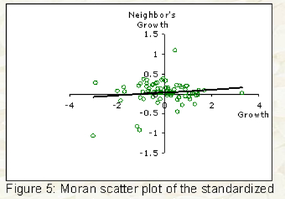

Figure 5: Moran scatter plot of the standardized average annual growth rate of per capita income, 80 provinces Philippines, 1994 - 2000.

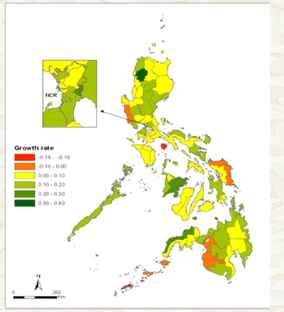

Figure 6: Growth Rate,1991-2000

Conclusions:

This study reveals the influence of spatial effects in the economic growth process of provinces in the Philippines, which justifies the use of spatial econometrics techniques in estimating growth models. Using the traditional growth models (Solow and MRW), this study reveals that investment and human capital are the main drivers of the economic growth process. However, given the strong evidence of spatially correlated errors in these models, it may well be that the Solow and MRW growth models are not enough to fully explain the provincial growth process. Further studies should extend the MRW to include more conditioning variables. For instance, given the importance of rice in the Philippines, it could be beneficial to investigate the role of rice production on economic growth.

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