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Spatial development and the law of one price: Evidence of convergence of land values

by

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Abstract

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JEL Codes: O18, R12, R14

Key words: Spatial development, land values, convergence, Philippines

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Many developing countries exhibit imbalanced spatial development, but corrective policies are hampered by lack of adequate sub-regional development data. Building on the insights of the factor price equalization theorem and by applying measures of spatial autocorrelation on land values, patterns of local development and linkages in the Philippines are traced. Evidence of convergene in provincial and urban land values is found in 1986-2000, although the clustering is more local than global. Thus, greater infrastructure investments and use of land values by local governments as policy guides should made to facilitate in-counrty trade and migration, and to disperse growth.

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1. Introduction

The spatial development of many developing countries exhibits a recurrent pattern: a rising urbanization, and a wide gap in living standards between leading and lagging regions (WORLD BANK, 2009). While the same motif is observed in high-income countries in their early stages of development, the growth catch-up among regions therein that subsequently followed however seem to take longer in developing countries. Pesistent in-counrty growth imbalances suggest inefficient use of resources and inequities in the distribution of national income. To disperse growth, policies should be adopted to integrate the economies of leading and lagging areas. Where outputs and inputs move without restraint across regions and prices freely adjust everywhere, convergence in prices across localities will signal the efficient allocation of resources. Thus, any evidence of spatial divergence in prices may be used to guide the design and targeting of growth-dispersing policies.

Economic theory predicts that under certain conditions the law of one price to prevail as well for immobile factors of production such as land and other real properties. From trade theory, the factor price equalization theorem posits that the prices of immobile factors of production will tend to equalize across borders provided there is free trade of final goods and the trading areas have access to the same (linearly homogeneous) technology (DIXIT and NORMAN, 1980; JONES and NEARY, 1984). The reason is that trade is driven by comparative cost advantages, which in turn also depend on the relative abundance and productivity of the fixed factors. As it were, the prices of the traded goods embody the factor prices. Since arbitrage will exploit any price differences until one price prevails for each traded good, it will also necessarily reduce cost differences until a single price prevails for each factor. Thus, convergence in land prices should

be observed across jurisdictions within a country, where flows of goods, labor, capital and technology are likely to be freer than across countries.

From the perspective of fiscal federalism, land values mayconverge across jurisdictions within a country due to fiscal competition. Competing local governments may undervalue land prices within their jurisdictions for tax purposes to attract capital investments or labor. In the short run, fiscal competition thus leads to convergence at low levels of land prices. However if the local governments depend solely or heavily on tax revenues from real property (e.g., land, housing facilities, office buildings), then they will also have low levels of local public good provisions. Differences in net fiscal benefits will trigger movements of people, and thus of mobile resources like labor. Also, to the extent that capital is used to build houses and offices, it will move until its net return equalizes across jurisdictions. In the long run, local land owners will ultimately bear the consequence of the local tax policy on real property. This might trigger dynamics in local political economy which will induce adjustments in official land valuations and real property tax rates. (OATES, 1972; WILDASIN, 2006)

Both the factor price equalization hypothesis and the theory of interjurisdictional fiscal competition indicate that divergences in land prices may signal inefficient land use. Where land is undervalued, poverty or low living standard may be found since land continues to be a major source of income for most people in developing counrties. In the Philippines, for example, about 36 per cent of the 33.4 million in the labor force in 2001 were employed in the agricultural sector as farmers or fishermen. Moreover, distortions in urban land prices could lead to squatting, traffic or pollution. Again, in the Philippines, a significant proportion of Metro Manila residents and those in other major urban areas illegally occupy public and private lands.

The Philippines provides an interesting case study for finding evidence consistent with the predictions of both theories. The Philippines is an archipelago of more than 7,100 islands, with some of them more closely linked economically or physically to each other than with others. Thus, land prices can be expected to vary with proximity in economic or physical sense between two areas. Moreover, the Local Government Code of 1991 vests on the 1,524 municipalities and 87 cities (as of March 2001) the authority to classify lands into residential, agricultural, commercial or industrial areas, assess the fair market price of the classified lands, and to set and collect the corresponding real property taxes. Under the Code, the local governments further full fiscal autonomy. With these fiscal powers, neighboring jurisdictions may engage in tax competition, and to the extent that they do their land valuations are likely to be correlated. The spatial correlation of provincial and city land values in the Philippines for the period 1985-2000 is explored here using data on official land valuations.

Besides presenting evidence consitent with the factor price equalization theorem, the Philippine case study also yields policy tools and lessons relavent to other developing countries that likewise decentralized. In particular, it illustrates how a well-known measure of spatial autocorrelation may be applied on local government data to assess spatial development at provincial and city levels, not otherwise possible with more aggregate development indicators or national household surveys that are not representative at the sub-regional levels. In the Philippines, for example, while previous studies find divergence in regional output per capita (PERNIA et al., 1983, MANASAN, 2003) or conditional convergence in household incomes across provinces (BALISACAN and FUWA, 2004), their findings bear more on national government policies than on local government policies. But since real property taxation is often devolved to local governments in decentralized countries, then the evidence of spatial

autocorrelation in land values will indicate the responsiveness of local governments to market forces or competitive pressures. Policies then can be devised to reduce local policy or physical barriers to integrate local economies and achieve equitable in-counrty growth.

2. Economic linkages and regional growth

This section provides an overview of the economic linkages among the 16 administrative regions in the Philippines during the period 1985-2000. The period covers six years before local governments were granted full fiscal autonomy starting in 1992 following the enactment of the Local Government Code of 1991. The focus on regional economic linkages and growth is due to lack of data on similar measures at the provincial or sub-provincial levels. Nonetheless, the patterns of interregional trade, migration and growth will indicate the economic linkages among local economies, and thus set the context of the evolution of land prices within and across regions.

Previous studies have found that regional growth to be sensitive to trade, migration, and investments. In particular, economic performance is found weak in Philippine regions with poor road, seaport and airport facilities (LLANTO, 2007). But in regions where such infrastructures are adequate, investments are attracted and growth is higher (PERNIA and SALAS, 2005). Also, regions experience more rapid growth if they trade interntionally (PERNIA and QUISING, 2003). Arguably, the same improvements in welfare will result from interregional trade.

However, the available data on interregional trade is limited to commodities transported through airports, seaports and railways. Thus, the overall domestic trade is signficantly undervalued using the available data. Notwistanding this limitation, Table 1 shows the percentage share of the region's exports and imports in its gross domestic product for the years

1990, 1995 and 2000. The majority of the regions appear dependent on interregional trade. In 2000, for example, only four regions (Ilocos, Cagayan Valley, Central Luzon and Southern Tagalog) had values of trade that accounted for less than ten percent of their respective gross regional domestic products. The most dependent on trade are CARAGA (46.4%), Northern Mindanao (37.3%) and the three Visayas regions, all of which have island provinces and extensive coastlines. In all regions except Ilocos Region and Southern Tagalog Region, the average annual growth of the share of trade is positive during the period 1985-2000. The Cordillera Administrative Region (CAR) only appears autarkic because it is a landlocked region and its mainly agricultural products transported through land are not adequately reported in the available trade statistics.

During the period, increasing population density is likewise observed. By far, the National Capital Region (Metro Manila) is consistently the most densely populated region in the country, with more than 11,000 and 16,000 inhabitants per square kilometer in 1985 and 2000, respectively (Table 1). The other rich regions – Central Visayas and Central Luzon – also have relative high population densities, more than 300 persons per square kilometers in 2000. One reason for the rise in population densitities of these regions is the influx of migrants from other areas in the counrty. In their review of migration patterns for the period 1985-1990, GO, COLLADO and ABEJO (2001) find that nine of the 15 cities and provinces with the biggest volume of in-migrants belong to the National Capital Region. The other favorite destinations are the provinces of Rizal, Cavite and Laguna in the Southern Tagalog Region, the province of Bulacan in the Central Luzon Region, and the two cities of Davao and Cebu that belong to the other high-income regions in the country. Interestingly, they also find that many of the migrants to the Southern Luzon provinces also come from Metro Manila cities such as Manila, Quezon

City and Makati. It bears to note that in the CALABARZON provinces of Southern Tagalog Region many techno-industrial parks and upscale subdivisions were established since the 1990s.

Table 1. Regional trade, population density and gross domestic product per capita: 1985, 1990, 1995, 2000

Development indicators/ region	1985	1990	1995	2000	Average annual growth rate (1985-2000)
A. Total value of trade as percentage of gross regional domestic product*					
National Capital Region		26.6	15.1	13.7	7.02
Cordillera Administrative Region					
Ilocos Region		8.7	5.4	1.3	-2.58
Cagayan Valley Region		1.1	1.2	0.2	15.35
Central Luzon Region		26.5	20.6	7.2	1.09
Southern Tagalog Regin		25.6	15.4	6.3	-3.56
Bicol Region		58.9	53.6	14.1	5.92
Western Visayas Region		43.4	30.5	23.3	4.67
Central Visayas Region		84.4	58.8	33.9	2.37
Eastern Visayas Region		97.9	77.5	32.7	2.28
Zamboanga Peninsula		36.5	33.7	28.3	7.37
Northern Mindanao Region		45.8	45.6	37.3	7.60
Davao Region		49.7	38.1	25.5	3.49
SOCCSKSARGEN		43.0	26.2	17.0	1.54
CARAGA				46.4	
Autonomous Region of Muslim Mindanao			32.5	16.2	19.82
B. Population density (persons/sq. km.)					
National Capital Region	11,078	12,830	15,260	16,032	2.50
Cordillera Administrative Region	53	59	65	70	1.94
Ilocos Region	248	273	292	323	1.79
Cagayan Valley Region	75	83	90	100	1.91
Central Luzon Region	253	288	322	373	2.61
Southern Tagalog Region	150	175	210	250	3.45
Bicol Region	203	215	238	257	1.60
Western Visayas Region	238	259	278	299	1.54
Central Visayas Region	263	289	316	359	2.11
Eastern Visayas Region	126	131	145	155	1.42
Zamboanga Peninsula	116	130	151	166	2.40
Northern Mindanao Region	122	137	156	171	2.28
Davao Region	125	144	162	181	2.50
SOCCSKSARGEN	90	107	126	143	3.12
CARAGA	72	82	90	98	2.01
Autonomous Region of Muslim Mindanao	54	62	70	84	3.00
C. Regional Gross Domestic Product per capita (in pesos, 1985=100)					
National Capital Region	23,660	27,810	26,559	29,785	1.61
Cordillera Administrative Region		11,772	12,087	18,054	4.39
Ilocos Region	6,414	6,222	6,010	7,057	0.89
Cagayan Valley Region	6,073	6,292	5,950	8,013	2.11
Central Luzon Region	9,856	11,112	10,951	10,810	0.68
Southern Tagalog Region	11,654	13,511	12,915	12,521	0.54
Bicol Region	4,938	4,942	5,238	5,781	1.13
Western Visayas Region	8,330	8,947	9,358	10,996	1.93
Central Visayas Region	8,523	10,224	9,914	12,005	2.36
Eastern Visayas Region	5,278	5,155	5,378	6,280	1.24
Zamboanga Peninsula	6,483	6,614	7,548	8,718	2.16

Northern Mindanao Region	10,199	10,262	10,184	13,585	2.56
Davao Region	11,399	11,554	10,148	11,865	0.37
SOCCSKSARGEN	8,642	8,484	9,285	9,871	0.99
CARAGA				6,929	4.18
Autonomous Region of Muslim Mindanao			3,866	3,795	1.49

*No data for 1985. Source: National Statistical Coordination Board.

While the intensity of trade and the density of population correlate with regional growth, the overall regional growth patterns since the mid-1980's is characterized by traditional growth leaders continuing to surge ahead, with a few neighboing regions slowly catching up, and the traditional laggards continuing to lag behind. In Table 1, the National Capital Region (NCR) had the highest regional gross domestic product (RGDP) per capita at 23,660 pesos in1985, or more than four times than either the Bicol Region or Eastern Visayas Region. Ten years later, the NCR still had the highest at around 26,600 pesos, or more than six times than the Autonomous Region of Muslim Mindanao (ARMM), created in late 1980s. The growth disparity between the two regions further widened in 2000.

Next to NCR, Central Luzon and Southern Tagalog, Central Visayas, and Northern Mindanao and Davaoregions also had very high RGDP per capita during the period 1985-2000. The first two of these four regionsare adjacent to NCR, while the third and last are considered the traditional economic hubs in the Visayas and Mindanao islands, the central and southern parts of the Philippines. While the Cordillera Administrative Region also achieved very high RGDP per capita, next only to NCR in 2000, and the highest average annual growth rate during the period, its apparent superior economic performance is due more to its relatively sparse population. Consistently over the period, the CAR had the lowest population density among all 16 regions in the country.

Since the regions are linked by trade and migration, their land values can be reasonably expected to adjust with economic linkages. Where such linkages are strong and land values are

found to converge, then evidence is found consistent with the predictions of the theory. Where land values do not converge, especially between regions with weak economic integration or where local governments heavily regulate their land markets, the results could suggest policy directions to disperse growth or to improve the efficiency of land use.

3. Methods

To determine the convergence in land and values, two measures of spatial autocorrelation are used, namely: the global Moran *I* statistic and the local Moran I_i statistic. Both statistics have been employed to trace spatial patterns in household demand (CASE, 1991), international prices (ATEN, 1996), local unemployment rates (PATACCHINI and ZENOU, 2007) and clustering of industries (CHAKRAVORTY, KOO and LALL, 2003). Following UPTON and FINGLETON (1985) and CHEN and GETIS (2008), let the value at the *i*th location be denoted by x_i and let W_{ij} be a measure of spatial proximity of locations *i* and *j*. If there are *N* locations, the summary matrix **W** is an $n \times n$ matrix whose elements denote the spatial proximity of any two distinct locations, *i* and *j*. The global Moran *I* statistic is defined as

$$I = \frac{N}{S_0} \frac{\sum_{i=1}^{N} \sum_{j=1, j \neq i}^{N} W_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{N} (x_i - \bar{x})^2}$$

where $\bar{x}$ is the mean of $\{x_i\}$ over the *N* locations and $S_0 = \sum_{i=1}^{N} \sum_{j=1, j \neq i}^{N} W_{ij}$. The local Moran I_i statistic for location *i* is defined as

$$I_i = \frac{x_i - \bar{x}}{S^2} \sum_{j=1}^{N} W_{ij}(x_j - \bar{x}),$$

where $S^2 = \left(\sum_{j=1, j \neq i}^{N} x_j^2 / N - 1\right) - \bar{x}^2$.

Under randomization, the expected values and variances of the two measures are

$$E(I) = -\frac{1}{N-1}, \qquad E(I_i) = -\frac{\sum_{j=1}^{N} W_{ij}}{N-1}$$

$$\mathrm{Var}(I) = \frac{N(S_1(N^2-3N+3) - NS_2 + 3S_0^2)}{(N-1)(N-2)(N-3)S_0^2} - \frac{K(S_1(N^2-N) - 2NS_2 + 6S_0^2)}{(N-1)(N-2)(N-3)S_0^2} - \left(\frac{1}{N-1}\right)^2,$$

$$\mathrm{Var}(I_i) = \frac{(N-K)\sum_{j=1, j\neq i}^{N} W_{ij}^2}{N-1} + \frac{(2K-N)\sum_{k=1,k\neq i}^{N}\sum_{h=1,h\neq i}^{N} W_{ik}W_{ih}}{(N-1)(N-2)} - [E(I_i)]^2,$$

where

$$S_1 = 1/2\sum_{i=1}^{N}\sum_{j=1}^{N}\left(W_{ij} + W_{ji}\right)^2,\ S_2 = \sum_{i=1}^{N}\left(\sum_{j=1}^{N} W_{ij} + W_{ji}\right)^2 \text{ and}$$

$$K = N\sum_{i=1}^{N}(x_i - \bar{x})^2 \Big/ \left(\sum_{i=1}^{N}(x_i - \bar{x})^2\right)^2.$$

The expected values of I range from -1 to 1, while that of I_i can be any negative or positive value. For both measures, a positive coefficient estimate indicates positive spatial autocorrelation which means that high or low values are cluster or converge together in space. Conversely, a negative coefficient estimate indicates negative spatial autocorrelation which means that high and low values are located closely together. No autocorrelation is detected when the coefficient zero.

Ideally, the W_{ij} should capture the extent to which two areas are linked economically through trade of commodities, labor migration or movement of other factors of production. Such economic linkages are specified here using inter-provincial trade data in the case of provinces, and also with measures of spatial distance for both provinces and cities. Specifically, in the case of provinces, the W_{ij} is the share of the combined values of province i's export to province j and its import from j to its total value of exports to and imports from all provinces. Due to trade data limitations, three other specifications of W_{ij} are used to capture the notion that economic linkage

is stronger among areas that are closer than farther each other in spatial distance. In the first alternative specification, W_{ij} is set equal to one if the *i*th and *j*th jurisdictions share a border, and zero if they do not. The second proximity measure is based on political-administrative clustering, wherein W_{ij} is set equal to one if both jurisdictions belong to the same administrative region, and zero if not. The final proximity measure used is the inverse of the absolute linear distance (in kilometers) separating the two jurisdictions. In the case of two provinces, the linear distance is measured between their respective capitals.

4. Data

This paper uses the assessed values of alienable (or taxable) and inalienable (tax-exempt) lands and the values of inter-provincial trade. These data are obtained from the Philippine Commission on Audit and the National Statistics Office. The dataset covers 74 provinces and 72 cities in the Philippines for the years 1986-2000. The land values are made by municipal and city governments for tax purposes based on fair market prices. By law, these local governments should review and, if warranted, revise the land values and the schedules of real property tax rates every three years. The provinces get a share of the real property tax revenues, but their role is limited to ensuring the consistency of land uses across the cities and municipalities under their jurisdictions. The provincial land values are an average of the assessed municipal land values. All land values used here are adjusted to 1985 pesos per square kilometer.

The sample provinces and cities include only those in existence in 1986 and for which land values data are available for the years 1986, 1989, 1992, 1996, 1998 and 2000 (Table 2). The excluded provinces are Apayao, Mountain Province, Zamboanga Sibugay, Compostella Valley and South Cotabato. There are 26 excluded cities, most of which were converted n the 1990s

from their previous classification as municipalities. For these newly created cities, their assessed land values as municipalities are included in the assessed land values of the provinces. Also note that during the period of study new administrative regions were created and some provinces were re-classified to different regions. For example, Western Mindanao was renamed as Zamboanga Sibugay with the creation of a new province (Zamboanga Sibugay) and the re-assignment of Basilan to the Autonomous Region of Muslim Mindanao. The Southern Mindanao Region was renamed as Davao Region that comprises the original three Davao provinces and now includes the newly created province of Compostella Valley. Originally part of Southern Mindanao, South Cotabato province is transferred to the new SOCCSKARGEN region, which also encompasses provinces of Sultan Kudarat and Sarangani, and the cities of Cotabato and General Santos.

The National Capital Region (NCR) is treated as a special case. In 1986, the NCR comprised four cities and 13 municipalities, of the latter 12 were subsequently converted into cities. Each of the 17 Metro Manila local governments is autonomous and does not belong to any province. However, in the assesssement of province-level land values, the NCR is artificially treated as a province, whose assessed land value is equal to the weighted assessed land values of all its component local governments. But in the assessesment of city land values, the 17 component local governments are treated as separate units. There are two reasons for this special treatment of NCR. First, excluding the 17 NCR cities and municipalities in the provincial assessment would miss the important economic linkages of Metro Manila with the neighboring provinces of Cavite, Batangas and Laguna (in Southern Tagalog Region) and Bulacan and Pampanga (in Central Luzon Region). Second, in 1986 all of the 13 NCR municipalities were already highly urbanized and had some of the highest fiscal revenues among all local governments in the

Philipines. Hence, the 13 municipalities were already as economically important as other cities in the counrty as early as twenty five years ago.

Table 2. List of study provinces and cities by region, Philippines

Region (16)	Provinces (74)	Cities (72)
National Capital Region	NCR (all 17 cities and municipalities)	Malabon, Navotas, Pateros, San Juan, Taguig, Caloocan, Las Pinas, Makati, Manila, Mandaluyong, Marikina, Muntinlupa, Paranaque, Pasay, Pasig, Quezon City, Valenzuela
Cordillera Administrative Region	Abra, Benguet, Ifugao, Kalinga	Baguio
Ilocos Region	Ilocos Norte, Ilocos Sur, La Union, Pangasinan	Dagupan, Laoag, San Carlos
Cagayan Valley Region	Batanes, Cagayan, Isabela, Nueva Vizcaya, Quirino	
Central Luzon Region	Bataan, Bulacan, Nueva Ecija, Pampanga, Tarlac, Zambales	Angeles, Cabanatuan, Palayan, Olongapo
Southern Tagalog Region	Aurora, Batangas, Cavite, Laguna, Quezon, Rizal, Marinduque, Occidental Mindoro, Oriental Mindoro, Palawan, Romblon	Batangas, Cavite, Lipa, Lucena, Puerto Princesa, Tagaytay, Trece Martires, San Pablo
Bicol Region	Albay, Camarines Norte, Camarines Sur, Catanduanes, Masbate, Sorsogon	Iriga, Legazpi, Naga
Western Visayas Region	Aklan, Antique, Capiz, Guimaras, Iloilo, Negros Occidental	Bacolod, Bago, Cadiz, Iloilo, La Carlota, Roxas, San Carlos, Silay
Central Visayas Region	Bohol, Cebu, Negros Oriental, Siquijor	Bais, Canlaon, Cebu, Danao, Dumaguete, Lapu-Lapu, Mandaue, Tagbilaran, Toledo
Eastern Visayas Region	Biliran, Eastern Samar, Leyte, Northern Samar, Southern Leyte, Western Samar	Calbayog, Ormoc, Tacloban
Western Mindanao Region	Zamboanga del Norte, Zamboanga del Sur, Basilan	Dapitan, Dipolog, Pagadian, Zamboanga
Northern Mindanao Region	Bukidnon, Camiguin, Misamis Occidental, Misamis Oriental	Cagayan de Oro, Gingoog, Oroquieta, Ozamis, Tangub
Southern Mindanao	Davao del Norte, Davao del Sur, Davao Oriental, South Cotabato	Davao, General Santos
Central Mindanao	North Cotabato, Sultan Kudarat, Lanao del Norte	Cotabato, Iligan, Marawi
CARAGA	Agusan del Norte, Agusan del Sur, Surigao del Norte	Butuan, Surigao
Autonomous Region of Muslim Mindanao	Lanao del Sur, Maguindanao, Sulu, Tawi-Tawi	

Notes: No data for the provinces of Apayao, Mountain Province, Compostella Valley, andSarangani.
Source: Philippine Statistical Yearbook, NSO Yearbook.

As in the case of inter-regional trade, the inter-provincial trade data include goods and commodities carried only through air, sea and rail transports, and only for the years 1996, 1998 and 2000. The trade data do not include the value of services or commodities transported through land (i.e., vehicles, trucks, delivery vans). The effects of this data limitation is to underestimate the economic linkages of neighboring provinces that share common land borders, and overestimate those between distant provinceslinked only through seaports, airports and railways. Thus, the estimates of spatial autocorrelation based on partial trade data should be interpreted with caution. At best, they can identify the provinces with (statistically) important trade linkages – possibly as markets or trans-shipment points - with the rest of the counrty. Hence, they should be taken together with the results based on other weight measures.

For both provinces and cities, their average assessed land values have gone up during the period. In the case of the provinces, the average value (in 1985 pesos) per square kilometer grew from 18,569 pesos in 1986 to 33,665 pesos in 1996 to 47,589 in 2000. Also in the case of the cities, the corresponding avarage land valuations (also in 1985 pesos) per square kilometers rose from 64,249 pesos in 1986 to 108,186 pesos in 1996 to 151,929 pesos in 2000. Over the period, however, the dispersion in land values per square kilometer also widened. For provinces, the standard deviation increased from 130,194 pesos in 1986 to 337,052 pesos in 2000. For provinces, the standard deviation rose faster, from 163,206 pesos in 1986 to 456,493 pesos in 2000. While these figures suggest that both provincial and urban land values diverged through time, they do not rule out convergence in space.

5. Evidence of spatial autocorrelation

Provincial land values

The estimates of the global Moran *I* statistic for Philippine provinces are shown in Table 3. The estimated coefficients are negative and statitiscally significant (from zero) based on trade weights and on distance weights for the earlier years. For alienable lands, the coefficients are -0.320, -0.257 and -0.245 for the years 2000, 1998 and 1996, respectively. The negative coefficients suggest that lands with high and low values tend to cluster together. While this result seems to contradict the prediction of thefactor price equalization theorem, the result can be expected given the nature of the available inter-provincial trade data, which account for commodities transported only through seaports, airports and rail. Hence, the available trade data is biased towards trading provinces that are spatially distant from each other.This is usually the case when agricultural products from rural provinces, where land prices are typically low, are shipped toindustrialized, urban centers, where land prices are usually steep. Moreover, the data does not capture the fact that a proportion of the traded commodities that are shipped to Manila, Cebu and Davao – three regional trading centers with big seaports and airports – are then transported to the inland provinces.

The provincial estimates are likewise motsly negative for the Moran I_i based on trade weighst for the years 1996, 1998 and 2000 (Table 4). While the local Moran I_i statistic is more sensitive to local associations, the estimates here still reflect "global" associations since land-based trade are undervalued in available data. Hence, in the case of Metro Manila, where some of the best seaport and airport facilities are located, the estimates are nearly equalt to -1.1 in 1998 and 2000, respectively. At best, the results in this table only identify the key provinces that either serve as markets or trans-shipment hubs of the produce of other provinces. An interesting case is

Benguet, whose estimated coefficients are -1.163 and -1.193 in 1998 and 2000, respectively. While Benguet is a landlocked province high up in mountains of the CAR, its capital (Baguio City) is popular summer resort that can also be reached by air travel from Manila.

Table 3. Estimates of global Moran's *I* statistic for Philippine provinces, 1986-2000

Year/ weight basis	Alienable lands		Combined alienable and inalienable lands*	
	Coefficient	Standard error	Coefficient	Standard error
Trade				
2000	-0.320[a]	0.039	-0.320[a]	0.039
1998	-0.257[a]	0.034	-0.251[a]	0.034
1996	-0.245[a]	0.035	-0.245[a]	0.035
Border				
2000	0.104[a]	0.025	0.105[a]	0.025
1998	0.094[a]	0.024	0.090[a]	0.024
1996	0.078[a]	0.024	0.076[a]	0.024
1992	0.037[b]	0.022	0.037[b]	0.022
1989	0.033[b]	0.022	0.033[b]	0.022
1986	0.042[a]	0.023	0.042[a]	0.023
Region				
2000	0.011[c]	0.018	0.011[c]	0.018
1998	0.011[c]	0.018	0.011[c]	0.018
1996	0.011[c]	0.017	0.011[c]	0.017
1992	0.011[c]	0.016	0.011[c]	0.016
1989	0.012[c]	0.016	0.012[c]	0.016
1986	0.012[c]	0.016	0.012[c]	0.016
Distance				
2000	0.007[a]	0.007	0.007[a]	0.007
1998	0.003[b]	0.007	0.002[b]	0.007
1996	0.006[a]	0.007	0.005[a]	0.007
1992	-0.006	0.007	-0.006	0.007
1989	-0.006	0.007	-0.006	0.007
1986	-0.000[b]	0.007	-0.000[b]	0.007

*No data for inalienable lands for years 1986, 1989 and 1992.
[a]Significant at the 1 percent level.
[b]Significant at the 5percent level.
[c]Significant at the 10 percent level.

Table 4. Estimates of local Moran I_i statistics for alienable lands in selected Philippine provinces, based on trade weights, 1986-2000

Selected provinces	1996		1998		2000	
	Coeff.	*z*-value	Coeff.	*z*-value	Coeff.	*z*-value
Metro Manila	-1.029[a]	-8.336	-1.088[a]	-8.763	-1.090[a]	-8.730
Ilocos Sur	0.011	0.151	n.d.	n.d.	-1.054[a]	-5.378
Benguet	-0.415[a]	-2.906	-0.277[b]	-1.941	-1.158[a]	-5.517
Batanes	-0.101	-0.489	-1.163[a]	-5.822	-1.193[a]	-5.688
Cagayan	-0.178	-1.185	-0.126	-0.765	-0.819[a]	-4.830
Isabela	-1.184[a]	-6.066	n.d.	n.d.	n.d.	n.d.
Bataan	-0.199[c]	-1.309	-0.380[a]	-2.561	-0.226[c]	-1.357
Zambales	-0.301[b]	-2.173	0.015	0.159	-0.276[c]	-1.619
Occidental Mindoro	-0.237[b]	-1.764	-0.125	-0.828	-0.180	-1.189
Palawan	-0.912[a]	-5.571	-0.693[a]	-4.571	-0.909[a]	-5.295
Romblon	-0.256[c]	-1.617	-0.528[a]	-3.597	-0.167	-0.897
Masbate	-0.159	-1.135	-0.138	-0.945	-0.340[a]	-2.442
Aklan	-0.685[a]	-4.348	-0.722[a]	-4.436	-0.981[a]	-5.168
Antique	-0.095	-0.613	-0.697[a]	-4.298	-0.058	-0.286
Capiz	-0.617[a]	-4.133	-0.788[a]	-4.771	-0.847[a]	-4.945
Iloilo	-0.337[a]	-2.391	-0.359[a]	-2.512	-0.465[a]	-3.107
Negros Occidental	-0.422[a]	-2.902	-0.413[a]	-2.823	-0.593[a]	-3.687
Bohol	-0.236[c]	-1.584	-0.211[c]	-1.331	-0.312[b]	-2.075
Cebu	-0.400[a]	-2.985	-0.386[a]	-2.854	-0.455[a]	-3.232
Negros Oriental	-0.439[a]	-3.222	-0.530[a]	-3.723	-0.597[a]	-4.003
Leyte	-0.331[a]	-2.355	-0.256[b]	-1.768	-0.445[a]	-3.054
Zamboanga del Norte	-0.206[c]	-1.414	-0.137	-0.954	-0.374[a]	-2.613
Zamboanga del Sur	-0.327[a]	-2.485	-0.442[a]	-3.228	-0.550[a]	-3.811
Misamis Occidental	-0.398[a]	-2.632	-0.319[b]	-2.217	-0.509[a]	-3.442
Misamis Oriental	-0.605[a]	-4.051	-0.562[a]	-3.809	-0.553[a]	-3.647
Davao del Sur	-0.725[a]	-4.818	-0.613[a]	-4.168	-0.866[a]	-4.994
Davao Oriental	0.016	0.203	-1.044[a]	-5.621	0.019	0.201
South Cotabato	-0.802[a]	-5.162	-0.881[a]	-5.182	-0.852[a]	-4.993
Lanao del Norte	-0.564[a]	-3.962	-0.462[a]	-3.336	-0.264[b]	-1.991
Agusan del Norte	-0.515[a]	-3.539	-0.489[a]	-3.311	-0.558[a]	-3.705
Maguindanao	-0.491[a]	-3.547	-0.444[a]	-3.083	-0.804[a]	-4.882

[a]Significant at the 1 percent level.
[b]Significant at the 5 percent level.
[c]Significant at the 10 percent level.
n.d. means no data available.

The bias of the trade-based proximityweights becomes apparent when the previous estimates of the Moran *I* statistic are compared with those based on physical proximity measures. The alternative proximity weights build on the idea that provinces that share physical boundary or

common regional assignations are likely to be economically integrated. As can be seen in Table 3, the estimates are positive, although close to zero, but all statistically significant. For example, the estimates for alienable lands based on border weights are 0.104, 0.078 and 0.042 in 2000, 1996 and 1986, respectively. The correspodning estimates based on regional assignations are 0.011, 0.011 and 0.012, which are all statistically significant only at the 10 percent level of significance. While these particular results indicate that economic linkages may be greater among neighboring provinces than those physically distant, such relationship may only be true for selected clusters than for the entire Philippines.

The extent of local association in provincial land values can be seen in Table 5. Using border weights, evidence of positive spatial autocorrelation is found only in the cases of Metro Manila and in three of its neighboring provinces. Since the 1990s, some of the investments orginallu intended for Metro Manila spilled over to Cavite and Laguna. These two provinces now have some of the biggest industrial and export processing zones and modern, upscale residential areas in the country. Just east of Metro Manila, Rizal is also one of the favored residential areas of many workers in Metro Manila as well as factory sites for companies that still want access to Metro Manila market.

Only weak evidence of local spatial clustering is foundf for weights based on linear distance. For 2000, for example, the estimate of I_i for Metro Manila (-0.052) is not statistically different from zero. The estimates for Cavite (0.052) and Laguna (0.053) are statistically significant only at the 10 percent level. But these results suggest a nascent spatial development outside Metro Manila. Only the estimate for Rizal (0.078) can be accepted to be positive with high degree of confidence. Hence, its close economic integration and physical proximity with its neighbors (inlcuding Metro Manila) have the effect of increasing its land values.

Table 5. Estimates of local Moran's I_i statistics for alienable lands in selected Philippine provinces, by border and distance weight basis,1986-2000

Selected provinces/ Weight basis	1986		1992		1996		2000	
	Coeffi-cient	Std. dev.	Coeffi-cient	Std. dev.	Coeffi-cient	Std. dev.	Coeffi-cient	Std. dev.
Border								
Metro Manila	2.480[a]	0.536	1.979[a]	0.532	5.344[a]	0.551	7.498[a]	0.570
Cavite	0.525[c]	0.420	0.522[c]	0.416	1.702[a]	0.434	2.224[a]	0.453
Laguna	0.121	0.651	0.756[c]	0.647	1.371[b]	0.666	3.802[a]	0.685
Rizal	1.947[a]	0.536	1.051[b]	0.532	2.147[a]	0.551	1.745[a]	0.570
Distance								
Metro Manila	-0.119[a]	0.043	-0.166[a]	0.043	-0.065[c]	0.043	-0.052	0.043
Cavite	0.013	0.037	0.012	0.037	0.040	0.037	0.052[c]	0.037
Laguna	0.002	0.036	0.011	0.036	0.019	0.036	0.053[c]	0.036
Rizal	0.089[b]	0.041	0.048[c]	0.041	0.097[a]	0.041	0.078[b]	0.041

[a]Significant at the 1 percent level.
[b]Significant at the 5 percent level.
[c]Significant at the 10 percent level.

City land values

For the cities, the estimates for the cities of the global Moran's *I* statistic for both alienable lands and all lands (alienable and inalienable) for six years are shown in Table 5. When city borders are used as proximity weights, consistently in each year the estimated coefficients are all near one and statistically significant at the one-percent level of significance. When regional designations are used as proximity weights, the estimated coefficients are much less than one, but still positive and highly statistically significant. However, when geographical distance is used no evidence of spatial autocorrelation is found. These two findings suggest that urban lands with high or low values cluster together, but the convergence is perhaps more local than global.

The estimates of I_i for Philippines cities with statistically significant results are shown in Table 6. The complete results do not indicate an overall systematic clustering of urban land values.There is no convergence detected in the high growth regions of Central Visayas, whose nine cities are separated by seas, and Southern Mindanao, whose two cities (Davao City and

General Santos) are separated by a two-hour land travel. Evidence of local spatial clustering is found only Metro Manila.

Table 7 shows the estimates of I_i for alienable lands in the 17 urban areas in Metro Manila. Based on border weights, the estimated coefficients are positive, among the highest, and statistically significant in 2000 in Makati (70.20), the country's premier financial district, as well as its neighboring cities, namely, Pasay (61.79), Pasig (64.02) and Manila (29.03). Another Makati neighbor, Taguig also experienced increased in land values in the same year, as indicated by its estimated I_i of 9.75. However, when distance weights are used, only the results for Makati, Manila, Pasay and Pasig are robust. Interestingly, no evidence of local spatial autocorrelation emerges for Marikina, Valenzuela and Malabon, which all lie along the boundary of Metro Manila.

In sum, the results show systematic spatial clustering of land values in the Philippines. However, the convergence in land values is more local than global. The evidence on local clustering suggests that local governments respond to market forces. In particular, the cities in Metro Manila appear to adjust their land valuations in the face of increasing population density and economic activities in their areas and, perhaps, in the light of similar adjustments by their neigbors. The weak evidence on global clustering suggest that there are still significant cost or physical barriers that separate the economies of the county's 7,100 islands. Nonetheless, the results-based on trade weights identified a number of provinces outside the traditional trade hubs whose linkage with other provinces can be strengthened to disperse growth. Among these are Zambales, Palawan, Occidental Mindoro, Leyte, South Cotabato and Maguindanao.

Table 6. Estimates of global Moran's *I* statistic for Philippine cities, 1986-2000

Year/ weight basis	Alienable lands		Combined alienable and inalienable lands*	
	Coefficient	Standard error	Coefficient	Standard error
City Border				
2000	0.913[a]	0.059	0.882[a]	0.059
1998	0.970[a]	0.058	0.937[a]	0.058
1996	0.988[a]	0.057	0.978[a]	0.057
1992	1.007[a]	0.059	1.007[a]	0.059
1989	1.046[a]	0.059	1.046[a]	0.059
1986	1.096[a]	0.060	1.096[a]	0.060
Region				
2000	0.658[a]	0.050	0.635[a]	0.050
1998	0.701[a]	0.050	0.676[a]	0.049
1996	0.714[a]	0.048	0.707[a]	0.049
1992	0.727[a]	0.051	0.727[a]	0.051
1989	0.755[a]	0.051	0.755[a]	0.051
1986	0.788[a]	0.051	0.788[a]	0.051
Distance				
2000	0.205	0.472	0.205	0.470
1998	0.198	0.464	0.203	0.462
1996	0.198	0.450	0.202	0.453
1992	0.211	0.478	0.211	0.478
1989	0.231	0.476	0.231	0.476
1986	0.250	0.484	0.250	0.484

*No data for inalienable lands for years 1986, 1989 and 1992.
[a]Significant at the 1 percent level.

Table 7. Estimates of local Moran's I_i statistics for alienable land s in selected Philippine cities, 1986-2000

Selected Cities/Weight basis	1986		1992		1996		2000	
	Coeffi-cient	*z*-value	Coeffi-cient	*z*-value	Coeffi-cient	*z*-value	Coeffi-cient	*z*-value
Border								
Malabon	5.87	1.82	3.72	1.19	6.45[b]	2.10	0.42	0.20
Navotas	43.75[a]	13.15	75.63[a]	22.90	58.76[a]	18.55	31.81[a]	9.76
Pateros	-7.67[b]	-2.23	-7.64[b]	-2.24	-5.75[b]	-1.74	-6.38[b]	-1.87
San Juan	33.55[a]	10.10	23.94[a]	7.29	12.74[a]	4.08	14.39[a]	4.45
Taguig	-2.46	-0.67	0.47	0.21	3.03	1.02	9.75[a]	3.04
Caloocan	6.34[b]	1.96	2.77	0.90	12.47[a]	3.99	2.13	0.72
Las Pinas	1.83	0.62	-2.72	-0.75	3.48	1.16	-1.16	-0.29
Makati	68.62[a]	20.59	44.44[a]	13.48	5.62[b]	1.84	70.20[a]	21.45
Manila	72.04[a]	21.61	50.48[a]	15.31	30.52[a]	9.67	29.03[a]	8.91
Mandaluyong	12.58[a]	3.83	22.07[a]	6.73	17.95[a]	5.71	11.94[a]	3.71
Marikina	6.48[b]	2.01	-0.42	-0.06	2.57	0.88	-1.15	-0.28
Muntinlupa	3.80	1.20	4.89[c]	1.54	7.85[a]	2.54	3.73	1.21
Paranaque	22.32[a]	6.74	23.01[a]	7.02	30.45[a]	9.64	19.34[a]	5.96
Pasay	38.04[a]	11.44	40.45[a]	12.28	50.90[a]	16.08	61.79[a]	18.89
Pasig	64.24[a]	19.28	65.17[a]	19.74	84.24[a]	26.56	64.02[a]	19.57
Quezon City	12.95[a]	3.94	6.24[b]	1.95	6.61[b]	2.15	6.35[b]	2.00
Valenzuela	-1.21	-0.30	-2.16	-0.58	16.19[a]	5.16	1.93	0.66
Distance								
Malabon	0.81	1.24	0.77	1.20	1.14[b]	1.84	0.05	0.12
Navotas	3.69[a]	0.54	5.78[a]	8.60	5.28[a]	8.26	2.14[a]	3.25
Pateros	-1.50[b]	-2.06	-1.49[b]	-2.07	-1.32[b]	-1.91	-1.50[b]	-2.10
San Juan	4.85[a]	10.55	2.91[a]	6.43	1.35[a]	3.14	1.77[a]	3.98
Taguig	0.01	0.02	-0.03	0.02	-0.23	-0.00	-0.76	-0.05
Caloocan	0.81[b]	1.80	0.39	0.91	1.54[a]	3.55	0.22	0.56
Las Pinas	0.11	0.39	-0.15	-0.38	0.20	0.69	-0.07	-0.15
Makati	9.81[a]	19.90	6.05[a]	12.41	0.81[b]	1.79	11.82[a]	24.38
Manila	9.30[a]	21.91	6.29[a]	14.98	3.45[a]	8.56	3.58[a]	8.62
Mandaluyong	1.60[a]	2.59	2.45[a]	4.00	1.89[a]	3.24	1.31[b]	2.18
Marikina	0.55[c]	1.51	-0.03	-0.02	0.21	0.66	-0.10	-0.18
Muntinlupa	0.16	0.88	0.19	1.03	0.31[b]	1.70	0.16	0.90
Paranaque	2.26[a]	4.72	2.12[a]	4.48	2.77[a]	6.08	2.32[a]	4.94
Pasay	5.45[a]	12.47	5.02[a]	11.60	5.29[a]	12.70	9.61[a]	22.34
Pasig	5.82[a]	7.93	4.91[a]	6.77	5.19[a]	7.52	6.63[a]	9.22
Quezon City	1.61[a]	2.63	0.81[c]	1.37	0.78[c]	1.38	0.71	1.22
Valenzuela	-0.11	-0.21	-0.23	-0.53	1.55[a]	4.26	0.14	0.44

[a]Significant at the 1 percent level.
[b]Significant at the 5 percent level.
[c]Significant at the 10 percent level.

6. Conclusions

The geography of land prices within a counrty may be explained by the patterns of economic linkages among its component jurisdictions. The patterns of spatial autocorrelation in land values in the Philippines are consistent with the predictions of the factor price equalization theorem. In particular, there is strong local clustering of land values in densely populated areas, like in Metro Manila where about 10 million people reside and nearly half of the counrty's registered vehicles are found. With the relocation of factories, offices and residential areas away from Metro Manila and towards its neigboring provinces, an increase in land values in the provinces of Rizal, Laguna and Cavite are likewise detected. With these local adjustments in land values, it may be surmised that local governments exercise land regulations also in response to market forces.

Using two well-known measures of spatial autocorrelation, the approach is particularly useful when there are only inadequate estimates of sub-regional domestic output or when official living standards surveys are not representative at the provincial or municipal levels. Applying the methods on a panel of regulated land values, the resulting spatial mapping will indicate where economic linkages are strong or can be strengthened to disperse economic growth.

The results have a few implications for policy. First, local governments should be trained and encouraged to use land valuations as indicators of spatial development. Where land values reflect fair maket prices and free to adjust, they can be used as policy guides to minimize congestion, illegal squatting and other externalities. Second, public investments in infrastructures should be made to integrate local economies and raise land values. The spatial correlation of land values can identify primary and secondary trade hubs where investments in seaports, land transportation and communication facilities can be targeted to promote an equitable in-counrty growth.

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