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THE DETERMINANTS OF AGGLOMERATION ECONOMIES IN INDONESIA AND THE PHILIPPINES

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The paper chiefly measures agglomeration economies in both the production and consumption sectors in Indonesia and the Philippines. Its empirical model estimates the returns to scale parameter which represents localization economies for three-digit manufacturing, and urbanization economies for the entire consumer service sector. Regression results confirm the role of agglomeration economies in explaining the concentration of producers and consumers in large urban areas. Agglomeration economies for the manufacturing sector are seen to arise from localization economies and those for the consumer service sector, from urbanization economies. The paper also features briefly a survey of literature on agglomeration economies, an assessment of industrial and consumer service distribution in the two countries, and policy recommendations.

1. Introduction

The standard economic model which treats land as a homogeneous input of production leads us to a situation of a world without cities. Given such a situation, economic activity is spread uniformly over the entire area because, under the standard economic assumption, unit costs do not vary with the level of production and transportation costs are not included, assuming all products are produced at the location at which they are consumed. In other words, there are no benefits from the agglomeration of economic activity.

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The main benefit that we can derive from the existence of cities is the economies of agglomeration. Large cities provide an essential benefit in the form of transport cost saving. Moreover, households also enjoy the external economies of cities. They have opportunities for earning higher incomes and a wider choice in jobs, shopping facilities and housing. For economists, therefore, the geographical aspects of a city's location are a secondary consideration; the key variable is economic agglomeration.

The objectives of this paper are three-fold: first, to give a brief review of literature in agglomeration economies, covering both theoretical and empirical works; second, to show empirically whether localization or urbanization economies are responsible for the concentration of industries in large urban areas; and third, to extend the empirical validation of urbanization economies to include the role of producer services and empirical validation for consumer agglomeration (the role of consumer service). The data used pertain to Indonesia and the Philippines.

This paper consists of six sections. The second section provides a brief survey of both theoretical and empirical literature on agglomeration. Section 3 provides a conceptual framework on which the empirical investigation discussed in the following parts is based. Section 4 provides an assessment of industrial and consumer service distribution in Indonesia and the Philippines. Because of data inadequacy, consumer service distribution in Indonesia is not discussed. Section 5 is an empirical investigation which specifies the specific production function according to the available data and presents the empirical results. Section 6 provides the summary and conclusions and policy recommendations.

2. Survey of Literature

2.1. Theoretical Approach

Traditionally the agglomeration theory is explained either from the production side or the consumption side. The former approach follows the theories starting from Weber's contribution. Weber (1929) was one of the first to raise the question of why several plants tended to locate near each other. According to Weber, agglomeration (deglomeration) economies determine whether industries concentrate in one place or are decentralized to more than one place. Hence, agglomeration economies result from agglomeration factors,

and not merely from causes of orientation such as transportation and labor orientation (pp. 134-135).

Hoover (1937) criticized Weber's agglomeration theory for not distinguishing three distinct forces acting upon local production costs, namely (i) large-scale economies, a scale economy internal to the firm at a particular location (see Mills, 1967, and Dixit, 1973); (ii) localization economies, external to the firm at a particular location but internal to the industry (see Henderson, 1974); and (iii) urbanization economies purely from the production side, external to the industry at a particular location but internal to the urban area (see Arnott, 1979 and Upton, 1981.)[1]

The second approach to agglomeration theory refers to the concentration of population in large urban areas because of the provision of public goods (see Flatters, *et al.* 1974 and Arnott and Stiglitz, 1979) and because of the variety of consumer goods in cities or what is known as a "city lights" phenomenon (see Stahl, 1983). Technically, this can be subsumed under urbanization economies. The recent works in agglomeration theory combined the production and consumption sides by emphasizing product differentiation in producer services (see Riviera-Batiz, 1988) and in consumer services (see Abdel-Rahman, 1988).

2.2 Empirical Approach

Rocca (1970), and Greytak and Blackley (1985), using a Cobb-Douglas (CD) production function, found localization economies to be significant. Shefer (1973) used the CES-like production function following Dhrymes (1965). Moomaw (1988), using the CES production function in the form of labor demand equation, and Henderson, (1986) using a translog production function, reached the main conclusion that external economies are predominantly localization economies.

Aaberg (1973), using a CD production function without capital data, and Sveikauskas *et al.*, (1988) using a version of the translog production function, showed that urbanization economies are the main determinant of industrial concentration in large urban areas.

[1]The discussion here about agglomeration economies focuses usually only on localization and urbanization economies.

Although there have been intense debates on whether localization or urbanization economies are the main factor in urban agglomeration, several empirical studies show the existence of the two. Carlino (1978), using the technique of Shefer and Dhrymes, showed the existence of both localization and urbanization economies. With the aid of the variable elasticity of substitution (VES) production function, Fogarty and Garofalo (1988) showed the importance of localization and urbanization economies to productivity at the SMSA level. Using a translog production function, Nakamura (1985) showed the existence of localization and urbanization economies.

2.3. Studies in Indonesia and The Philippines

Only recently have there been studies on industrial concentration in Indonesia. Giarratani and Soeroso (1985), using a CD production function, concluded that interregional differences may represent the attractive force of agglomeration economies. However, they did not explain clearly why the economic activities are concentrated in certain regions rather than diffused to other regions.

Azis (1985), using the Location Quotient (LQ), showed that manufacturing industries concentrated in Java and other oil-producing provinces. Being of a descriptive nature, this study does not say much about what factors actually determine the high value of LQ (>1) for certain regions.

Lase (1988), regressing a pair of equations, showed that market concentration or urban population is a strong incentive for most five-digit industries to agglomerate. However, his study does not shed much light on the problem because his partial approach does not present the situation wherein industrial concentration relates directly with the explanatory variables simultaneously.

In the Philippines, Miranda (1977) identified profit differentials as a strong determinant for manufacturing concentration. However, he did not explicitly test whether regional concentration is a function of the regional profit level and/or the size of the market in the region.

Moran (1978) explained that industrial concentration in Manila and its periphery was related to the adoption of import-substitution industrialization, but it does not give a clear exposition of factors which determine agglomeration economies.

Hermoso (1983) analyzed industrial concentration by regressing pairs of variables. The results of Hermoso's study show that requirements for material inputs and for imported inputs were significant factor in explaining manufacturing concentration in Manila. Among the output variables, forward industrial linkage and the locational preference for Manila. In addition, the abundance of skilled workers in Manila is a significant factor for manufacutring concentration. The effective protection rate and the size of firms also emerged as significant factors. However, she did not distinguish clearly the type of concentration or agglomeration in terms of localization and urbanization economies.

The present study basically shows localization and urbanization economies separately. It also attempts to tackle consumer agglomeration.

3. Conceptual Framework

The conceptual framework which is developed here is mainly based on the works of Fogarty and Garofalo (1988), Shefer (1973), and Dhrymes (1965). The work of Dhrymes is basically an extension of the CES production function. In their work on CES production function, Arrow, *et al.* (1961) essentially addressed the form of production function which can capture the relationship between wages and output in the form

$$W = A(X/L)^{\beta} \tag{1}$$

Finally they came up with the form of production function as follows:

$$X = F(K,L) = A\,[\tau\, K^{-\sigma} + (1-\tau)\, L^{-\sigma}]^{1/\sigma} \tag{2}$$

which assumes that there is perfect competition both in the product and factor markets. The function (2) is homogeneous of degree one.

Dhrymes (1965) suggests a generalization of eq. (1) in the form

$$W = A\; X^{\alpha} L^{\beta} \tag{3}$$

which reduces to eq. (1) when $\beta = -\alpha$. Dhrymes assumes that the unit

behaves as if it were a profit maximizer, but the market in which it operates is not perfect. He also assumes that the production function is homogeneous of degree h.

Thus

$$X = F(K,L) = L^h F(K/L, 1) = L^h f(K/L) \tag{4}$$

Dhrymes arrives at the CES-like production function in the form of

$$X=C \left(\tau_1 K^{h\theta} + \tau_2 L^{h\theta} \right) 1/\theta \tag{5}$$

where C is the efficiency parameter, τ_1, τ_2 are distribution parameters ($t_1 + t_2 = 1$), h is the homogeneity, and θ is the substitution parameter.

Thus eq. (5) is a variant of the CES production function, homogeneous of degree h, which generates eq. (3)

$$W = A X^{\alpha} L^{\beta} \tag{3}$$

Thus, a production function like (5) leads to a CD type relation (3) between wages, output, and labor.

Eq. (3) can be rewritten as

$$W = A (X/L^h)^{\alpha} L^{\beta + h\alpha} \tag{6}$$

and as a matter of notation we can write

$$s(h) = \beta + h\alpha \tag{7}$$

Now, the model shows its general characteristics which can be reducible to that of Arrow, *et al.*, in eq. (1) whenever $h = 1$ and the perfect competition assumptions hold. This requires that

$$s(1) = 0 \tag{8}$$

In its simplest form we can write

$$s(h) = h - 1 \tag{9}$$

It is clear whenever $h = 1$ that $s(h) = 0$.

Setting eq. (7) and eq. (9) equal yields the degree of increasing returns to scale h as

$$h = \frac{1+\beta}{1-\alpha} \tag{10}$$

Taking the natural logarithm of eq. (10) we have

$$\ln W = \ln A + \alpha \ln X + \beta \ln L \tag{11}$$

By estimating eq. (11), we will get the value of parameters α and β, and then we can calculate the value of h.

For the case of one firm the degree of homogeneity h represents increasing returns to scale. For our study, in industrial scale, h represents localization economies (Shefer, 1973). In addition, we can regress the localization economies parameter to urbanization economies variables according to the equation (see Carlino, 1978).

$$h = A\, f(URB) \tag{12}$$

where URB is the urbanization variable.

We can modify eq. (3) to allow the efficiency parameter A to change at the same time there is increasing returns to scale (see Fogarty and Garofalo, 1988).

(13) Letting $A = E(Ba^c)$ where a^c = vector agglomeration economies, eq. (3) thus becomes

$$W = E(Ba^c)\, X^{\alpha} L^{\beta} \tag{14}$$

where $E(Ba^c)$ is an efficiency parameter reflecting urbanization economies.

We can write eq. (14) in the logarithmic form

$$\ln W = \ln B + c \ln a + \alpha \ln X + \beta \ln L \tag{14}$$

We can use eq. (15) for measuring urbanization economies and consumer agglomeration economies for the consumer service sector, considering that in this sector wages are directly related to urbanization economies variables such as urban population, and to the consumer agglomeration variable, i.e. the number of consumer services (see Abdel-Rahman, 1988).

The main advantage in using the CES-like production function in this study is that it does not need capital data which are often prone to substantial error.

4. Manufacturing and Consumer Service Distribution in Indonesia and the Philippines

4.1. Variations Across The Countries

We can get a general view of the level of urbanization, industrialization, and economic development in the two countries from Table 1. The data presented show that the percentage of urban population, industrialization and GNP per capita are higher in the Philippines than those in Indonesia. The main reason for this is that economic development in Indonesia started only in the late 1960s. Only in the late 1960s and the early 1970s has there been an expansion of Indonesia's economy which turned around the economic outlook. As a result, urban population increased at 2.6 percent per annum during 1961-1971, and accelerated to 4 percent in the following decade (Hamer, *et al.*, 1986).

Meanwhile, in the Philippines the import substitution policies in the period 1948-1967 largely promoted urban growth. In the 1970s, the economic policy shifted to export promotion. This policy was accompanied by the government awareness of regional development, which showed in, among others, the expansion of investment and loan to further geographical diversification. The effort to develop traditional exports also directed government attention to non-urban areas (Pernia, *et al.*, 1983).

4.2 Manufacturing Distribution

Table 2 shows the regional manufacturing distribution in terms of employment in Indonesia in 1975, 1980, and 1985. It is clearly

Table 1 — Urbanization, Industrialization, and Economic Development in Indonesia and the Philippines

Indicator		Indonesia	Philippines
Urban Pop.	1965	16	32
(%)	1980	25	39
Ann. Growth Rate	1965-80	4.7	4.0
(%)	1980-85	2.3	3.2
Industrialization	1965	8.0	20
(%)	1980	14	25
Urban Concentration	1960	20	27
(%)	1980	23	30
Urban Pop. in Cities Over 500,000 People			
(%)	1960	34	27
	1980	50	34
Number of Cities of Over 500,000 People	1960	3	1
	1980	9	2

Source: World Bank (1987).
Note: Industrialization is defined by manufacturing share of GDP.
Urban concentration is defined as % of urban pop. in largest city.

shown that in these years manufacturing industries were concentrated in Java where 78.6 percent of the total employment in manufacturing sector in 1985 were working. In contrast, Sumatra only employed 12.1 percent, while the rest of Indonesia employed the remaining 8.2 percent.

A similar pattern is observed for manufacturing distribution according to value added as shown by Table 3. In 1985, Java contributed 77.9 percent of total manufacturing value added, while Sumatra contributed 13.4 percent, and the rest of Indonesia contributed 8.7 percent.

The Philippines exhibits a pattern in manufacturing distribution similar to that in Indonesia. Manufacturing location is concentrated in a few provinces comprising the Central Industrial Region (CIR), namely, Manila and Rizal, Central Luzon, and Southern Tagalog.

In 1985 they contributed 74.5 percent of employment in manufacturing (Table 4), and 74.7 percent in manufacturing value added (Table 5).

Table 2 — Percentage Distribution of Manufacturing Employment by Province in Indonesia

Province	1975	1980	1985
Aceh	0.3	0.3	0.7
North Sumatra	3.2	3.9	5.3
West Sumatra	0.6	0.6	0.7
Riau	0.4	0.6	1.2
Jambi	0.2	0.5	0.8
South Sumatra	1.3	2.0	2.1
Bengkulu	0.0	0.0	0.0
Lampung	0.4	0.4	1.4
DKI Jakarta	15.2	17.4	13.8
West Java	17.6	19.7	23.2
Central Java	23.5	19.1	16.0
D.I. Yogyakarta	2.2	1.6	1.0
East Java	30.7	28.3	24.5
West Kalimantan	0.8	1.5	1.2
Central Kalimantan	0.2	0.7	0.9
South Kalimantan	0.5	0.7	1.4
East Kalimantan	0.3	0.6	2.0
North Kalimantan	0.1	0.2	0.3
Central Sulawesi	0.0	0.0	0.3
South Sulawesi	0.8	0.7	1.1
South East Sulawesi	0.1	0.1	0.1
Bali	1.0	0.6	1.0
West Nusa Tenggara	0.5	0.2	0.2
East Nusa Tenggara	0.1	0.1	0.1
Maluku	0.1	0.1	0.5
Irian Jaya	0.2	0.1	0.1
Indonesia	100.0	100.0	100.0

Source: Central Bureau of Statistics.

Table 3 -- Percentage Distribution of Manufacturing Value-Added by Province in Indonesia

Province	1975	1980	1985
Aceh	0.1	0.2	1.6
North Sumatra	3.2	4.0	5.1
West Sumatra	0.7	0.8	0.5
Riau	0.3	0.4	1.8
Jambi	0.1	0.3	0.7
South Sumatra	4.3	3.2	2.2
Bengkulu	0.0	0.0	0.0
Lampung	0.3	0.4	1.4
DKI Jakarta	24.8	23.8	17.9
West Java	16.1	18.6	25.5
Central Java	17.2	12.7	12.3
D.I. Yogyakarta	0.8	0.9	0.4
East Java	28.6	28.9	21.9
West Kalimantan	0.8	2.1	1.6
Central Kalimantan	0.3	1.2	0.7
South Kalimantan	0.4	0.6	1.7
East Kalimantan	0.3	0.6	2.8
North Sulawesi	0.1	0.1	0.4
Central Sulawesi	0.0	0.0	0.1
South Sulawesi	1.1	0.7	0.7
South East Sulawesi	0.0	0.0	0.0
Bali	0.3	0.3	0.3
West Nusa Tenggara	0.1	0.1	0.1
East Nusa Tenggara	0.0	0.0	0.0
Maluku	0.0	0.0	0.0
Irian Jaya	0.0	0.0	0.1
Indonesia	100.0	100.0	100.0

Source: Central Bureau of Statistics.

Table 4 — Percentage Distribution of Manufacturing Employment by Region in the Philippines

Region	1975	1978	1981	1983
Ilocos	3.7	1.1	2.6	1.5
Cagayan Valley	2.6	0.9	1.7	1.6
Central Luzon	7.7	6.3	8.2	7.1
NCR and Rizal	46.8	57.1	49.9	55.7
Southern Tagalog	10.9	9.7	12.7	11.6
Bicol	3.6	0.8	2.2	0.7
Western Visayas	6.5	2.8	5.1	4.3
Central Visayas	5.8	12.9	5.1	5.6
Eastern Visayas	1.2	0.4	0.8	0.4
Western Mindanao	1.4	0.7	1.1	1.0
Northern Mindanao	3.5	2.2	3.3	3.6
Southern Mindanao	4.7	3.8	4.8	4.7
Central Mindanao	2.5	1.4	2.5	2.2
Philippines	100.0	100.0	100.0	100.0

Source: National Census and Statistics Office.

Table 5 — Percentage Distribution of Manufacturing Value-Added by Region in the Philippines

Region	1975	1978	1981	1983
Ilocos	1.2	0.9	1.2	0.8
Cagayan Valley	0.6	1.1	0.8	0.5
Central Luzon	13.3	10.2	9.8	7.2
NCR and Rizal	47.2	56.3	53.6	46.2
Southern Tagalog	13.8	19.0	15.6	21.3
Bicol	0.7	0.7	0.9	0.5
Western Visayas	9.2	2.9	3.7	2.7
Central Visayas	5.4	3.6	5.1	5.0
Eastern Visayas	0.9	0.5	0.4	0.3
Western Mindanao	0.6	0.8	0.6	1.1
Northern Mindanao	2.6	1.6	3.2	4.5
South Mindanao	2.2	1.4	3.0	3.8
Central Mindanao	2.3	1.1	2.1	6.1
Philippines	100.0	100.0	100.0	100.0

Source: National Census and Statistics Office.

4.3. *Consumer Service Distribution*

Since data are unavailable for Indonesia, this part only presents consumer service distribution in the Philippines. As in the manufacturing sector, consumer services are concentrated in Manila. The figures are 51.1 percent in 1975 and 56.5 percent in 1983 for consumer service employment (Table 6) and 60.9 percent in 1975 to 79 percent in 1983 for consumer service value added (Table 7).

5. Empirical Method and Results

5.1. *Manufacturing Sector*

5.1.1. Method and Results

Following Dhrymes (1965), the dependent variable in our empirical model is the wages in each province (region) and in each industry (three-digit manufacturing industry). W_{ij} represents the total wages of the ith industry in the jth province (region).

The first explanatory variable L_{ij} refers to total number of employees in the ith industry (three-digit manufacturing industry) in the jth province (region). The second variable is X_{ij} or total value added for the ith industry in the jth province (region).

In natural logarithms the equation

$$W_{ij} = A\, X_{ij}^{\alpha} \cdot L_{ij}^{\beta} \tag{16}$$

yields

$$\ln W_{ij} = \ln A + \alpha_i \ln X_{ij} + \beta_i \ln L_{ij} \tag{17}$$

with α_i and β_i obtained by estimating eq. (17), we can in turn estimate the homogeneity parameter as

$$h_i = \frac{1 + \beta_i}{1 - \alpha_i} \tag{18}$$

where h_i = homogeneity parameter for the ith industry, α_i = employees parameter for the ith industry, and β_i = value added parameter for the ith industry.

Table 6 — Percentage Distribution of Consumer Service Employment by Region in the Philippines

Region	1975	1981	1983
Ilocos	4.1	6.3	3.6
Cagayan Valley	1.4	1.8	1.1
Central Luzon	7.7	6.0	3.2
NCR and Rizal	51.1	42.7	56.5
Southern Tagalog	4.0	7.2	3.1
Bicol	2.5	3.1	1.4
Western Visayas	6.2	6.6	5.3
Central Visayas	8.1	5.6	7.7
Eastern Visayas	1.3	2.1	1.3
Western Mindanao	2.3	3.5	2.8
Northern Mindanao	4.1	6.5	4.1
Southern Mindanao	5.6	6.1	8.2
Central Mindanao	1.6	2.5	1.7
Philippines	100.0	100.0	100.0

Source: National Census and Statistics Office.

Table 7 — Percentage Distribution of Consumer Service Value-Added by Region in the Philippines

Region	1975	1981	1983
Ilocos	2.2	2.8	1.3
Cagayan Valley	1.3	1.2	0.7
Central Luzon	3.4	6.3	1.1
NCR and Rizal	60.9	59.6	79.0
Southern Tagalog	3.1	3.3	1.4
Bicol	2.3	2.3	0.5
Western Visayas	7.6	4.2	2.7
Central Visayas	7.5	3.7	4.3
Eastern Visayas	3.1	1.3	0.2
Western Mindanao	1.6	1.7	1.5
Northern Mindanao	3.0	5.3	1.9
Southern Mindanao	3.1	5.8	4.5
Central Mindanao	0.9	2.5	0.9
Philippines	100.0	100.0	100.0

Source: National Census and Statistics Office.

The value of h is the parameter for increasing returns to scale for one firm but it represents localization economies for an industry (see Shefer, 1973). Thus, the presence of localization economies is shown by the value of h being greater than unity ($h>1$).

The analysis and results to be presented are based on pooled cross sectional data available in Indonesia (1985 and 1986) and the Philippines (1975 and 1978). The unit of observation is value added, wages, and number of all employees for a given three-digit SIC industry in 26 provinces in Indonesia, and 13 regions in the Philippines. For the Indonesian case, data are taken from the *Industrial Statistics 1986, Survey of Manufacturing Industries Large and Medium*, and the *Economic Census of Large and Medium Manufacturing Establishments Sector 1985*. For the Philippines, the data sources are the 1975 and 1978 *Census of Establishments, Manufacturing Sector*.

Tables 8 and 9 give the results of the cross-section study for Indonesia and the Philippines, respectively.

In addition to measuring localization economies in the three-digit manufacturing industries, we also estimate urbanization economies in the entire manufacturing industry. To do this, we regress the estimated h_i in eq. (17) using explanatory variables for urbanization economies in the equation form

$$h_i = A\, f(URB_i) \tag{19}$$

where h_i is the estimated localization economies parameter in the ith industry, and URB_i refers to the urbanization economies variables in the ith industry.

Our estimated localization economies are used as dependent variable in an industry-by-industry cross-sectional regression model designed to find the influence of economies external to the industry but internal to a location. This approach is based merely on empirical insight rather than a theoretical one. The previous theoretical survey suggests the following proxies for urbanization economies:

1. Urban Population Variable. The following coefficient could capture the influence of urban population to h

$$URBP_i = \frac{UPOP}{L_i} \tag{20}$$

Table 8 — Localization Economies in Three-Digit Manufacturing Industries in Indonesia

SIC	h	R-squared	N
311	2.7732	0.9778	50
312	4.1231	0.9871	44
313	2.2979	0.9543	32
314	1.7074	0.3161	18
321	2.9107	0.9886	32
322	2.2951	0.9892	22
323	2.2059	0.9714	16
324	3.3779	0.9932	14
331	2.4277	0.9325	52
332	2.3061	0.8405	40
342	2.0861	0.9356	44
351	5.2346	0.9551	38
352	2.6875	0.9109	35
355	2.3896	0.9562	36
356	5.9009	0.9518	28
361	3.6681	0.9316	16
362	2.4742	0.9939	12
363	5.4724	0.9545	44
364	5.2196	0.9848	32
369	3.0852	0.9347	23
371	2.2602	0.9709	16
381	3.3815	0.9747	44
382	3.5429	0.9652	20
383	1.7742	0.1971	14
384	3.7001	0.9739	34
385	2.7366	0.7083	12
390	3.2413	0.9567	22

Note: h is localization economies parameter.
R-squared is adjusted R-squared.
N is number of observations.

Table 9 — Localization Economies in Three-Digit Manufacturing Industries in the Philippines

SIC	h	R-Squared	N
311	2.4366	0.9846	26
312	3.2734	0.9264	12
313	2.6565	0.8616	20
321	2.7602	0.9511	18
331	3.3211	0.9531	26
332	3.0036	0.9621	21
342	2.1361	0.9859	24
351	1.6652	0.2146	13
352	2.9022	0.9732	10
355	1.7357	0.9213	12
369	2.6597	0.9515	22
381	2.5087	0.9017	22
382	2.5493	0.9578	24
384	2.3817	0.9809	17
390	2.9644	0.9813	15

Note: h is localization economies parameter.
R-squared is adjusted r-squared.
N is number of observations.

where $URBP_i$ is urbanization economies variable caused by urban population in the ith industry, *UPOP* is total urban population, and L_i is total employees in the *i*th industry. $URBP_i$ will be higher the higher the total urban population, so that this coefficient could capture the influence of urban population in the agglomeration economies.

2. *Producer Service Variable.* As the number of producer services increase in a particular location, the possibility that economies which are external to the industry but internal to a location may develop (Rivera-Batriz, 1988). One approach that can be used to measure the influence of producer service to agglomeration economies is represented by the following:

$$URBS_i = \frac{TPS}{IN_i} \tag{21}$$

where $URBS_i$ is the urbanization economies variable caused by producer services in the *i*th industry. *TPS* is total producer services (which in this study is financial services), and IN_i is the number of

establishments in the ith industry. The higher the number of producer services, the higher the urbanization economies coefficient $URBS_i$.

By applying the logarithm transformation to eq. (19) we get

$$(22) \quad \ln h_i = \ln A + \pi \ln URBP_i + \sigma (\ln URBP_i)^2 + \mu \ln URBS_i$$

The squared variables in eq. (22) intend to capture the non-linearity factor. We expect that the parameters π, and μ are positive, and σ is negative. The negative sign of parameter σ represents urbanization diseconomies as urban population is above the optimum level, while the positive parameter of π represents the positive influence of the urban population to agglomeration economies. We also expect that the number of producer services positively influences agglomeration economies; the higher the number of producer services, the stronger the agglomeration economies.

The empirical results are shown in Tables 10 and 11 for Indonesia and the Philippines, respectively.

5.1.2. Findings for the Manufacturing Sector

Tables 9 and 10 present the results of the estimation of returns to scale (homogeneity) parameter which, when applied to industry, becomes the localization economies parameter. It is evident from the results reported in the tables that in all three-digit manufacturing industries recorded, the degree of homogeneity exceeds unity, meaning localization economies do prevail in the three-digit manufacturing industries.

The statistical fit R^2 is very good with almost all three-digit manufacturing industries recording a value of R^2 around 0.9.

As shown in the estimation results for urbanization economies (Tables 10 and 11) in Indonesia and the Philippines, the urban population is an important variable as shown by the positive sign and the statistical significance at 5 percent for the Indonesian case and 0 percent for the Philippine case. Furthermore, the square of the urban population variable represents urban diseconomies as shown by the negative sign and the t-statistics significance at 5 percent for the case of Indonesia and 0 percent for the case of the Philippines. These

results conform to our prediction that beyond the optimum level, the urban population will no longer positively influence agglomeration economies.

Table 10 — Urbanization Economies in Three-Digit Manufacturing Industries in Indonesia

Variable	Coefficient
Intercept	−1.974
	(−1.371)
ln URBP	0.9089
	(2.1246) ***
SQR ln URBP	−0.061
	(−1.963) ***
ln URBS	−0.121
	(−1.201)

Note: Adjusted R-Squared = 0.0763.
F-statistics = 1.7159
N(number of observations) = 27.
t-statistics in parentheses.
*** significant at 5%.

Table 11 — Urbanization Economies in Manufacturing Industries in the Philippines

Variable	Coefficient
Intercept	−0.641
	(−1.521)
ln URBP	0.5933
	(7.9621)*
SQR ln URBP	−0.052
	(−8.076) *
In URBS	−0.043
	(−0.541)

Note: Adjusted R-Squared = 0.9962.
F-statistics = 1329.292.
N (number of observations) = 16.
t-statistics in parentheses.
* significant at 0%.

The producer service variable did not have significant results and yielded a negative coefficient, contrary to what we expected. The results are similar for the two countries. We can not interpret something meaningful from this set of findings.

Tne fit ($R^2 = 0.9$) is very high for the case of the Philippines, but is very low for that of Indonesia, $R^2 = 0.1$. It shows that the empirical model for urbanization economies is not stable.

The detailed regression results for the manufacturing sector are presented in the appendices.

5.2. *Consumer Service Sector*

5.2.1. Method and Results

We modify eq. (17) by substituting agglomeration variables with efficiency parameter A

$$W_{ij} = (Ba_j^{c^j})\ X_{ij}L_{ij} \tag{23}$$

Taking the natural logarithm we get

$$\ln W_{ij} = \ln\ B + c_j \ln a_j + \alpha \ln X_{ij} + \beta \ln L_{ij} \tag{24}$$

Specifying agglomeration variables and putting regional dummy variables we have

$$\ln W_{ij} = \ln \beta + c_1\ \ln POP_j + c_2\ \ln SRC_j + c_3\ (\ln SRC_i)^2 + \alpha \ln X_{ij} + \beta \ln L_{ij} + \pi_1\ NCR + \pi_2\ MPR \tag{25}$$

where

W_{ij} = total wages in the ith consumer service in the jth province (region).
POP_j = urban population in the jth region.
SRC_j = the number of consumer services in the jth region.
X_{ij} = total value added in the ith consumer service in the jth region.
L_{ij} = total employees in the ith consumer service in the jth region.
NCR (National Capital Region) = a region dummy variable equal to 1 if the regions are Metro Manila and Rizal, zero otherwise.

MPR (Metropolitan Periphery Region) = a region dummy variable equal to 1 if the regions are Central Luzon and Southern Tagalog, zero otherwise.
B = intercept which represents the third dummy region variable *FAR* (Frontier and Agricultural Region) and equal to 1 if the regions are Ilocos, Bicol, Visayas, Cagayan Valley and Mindanao, and zero otherwise.

We expect the following results:
(1) The urban population size measures the effect of urbanization economies on the consumer service sector. We expect the sign of its coefficient to be positive.
(2) The number of service establishments represents consumer agglomeration. According to the theoretical framework, the sign of this variable's coefficient is negative, but its square has a positive sign (Abdel-Rahman, 1988).
(3) Urbanization economies are also represented by the value of $h > 1$. The h represents urbanization economies instead of localization economies because we take the entire consumer service sector as the unit of observation.

For the Philippine case, the data source is the *1975 Census of Establishments, Wholesale and Retail Trade.* Lack of data prevents us from analyzing the Indonesian case.

Table 12 shows the estimated production function for consumer service in the Philippines.

5.2.2. Findings for the Consumer Service Sector

The results in Table 12 show that only one variable is not significant and all variables yielded the expected signs. The coefficient for population size is significant at the 5 percent level and it has a positive sign as we expected. Therefore, urbanization economies caused by a large urban population is a strong determinant of the concentration of consumer services in large urban areas.

As expected, the coefficient of number of consumer service establishments yielded a negative sign and was significant at 5 percent. This result shows the existence of consumer agglomeration. Consumers are willing to immigrate to large cities in order to derive a higher utility which is derived from product variety, although they have to sacrifice in terms of lower real income (Stahl, 1983). The coefficient of the square of this variable on number of consumer

Table 12 — Urbanization and Consumer Agglomeration Economies in the Consumer Service Sector in the Philippines

Variable	Coefficient
Intercept	−1.712
	(−2.111) ***
ln POP	0.1277
	(2.255) ***
ln SRC	−0.379
	(−2.902) ***
SQR ln SRC	0.7292
	(1.551)
ln L	0.9822
	(25.371) *
ln X	0.1645
	(7.149) *
NCR	0.2889
	(1.941) ***
MPR	−0.153
	(−1.911) ***

Note: Adjusted R-Squared = 0.9675.
F-statistics = 939.9466.
N(number of observations) = 222.
t-statistics in parentheses.
* significant at 1 %.
*** significant at 5 %.

services came out as significant with the positive sign, in conformity with the theoretical framework. This result means that beyond a certain number of consumer services, the income will increase as the number of consumer services increase, thus validating our theory.

The presence of urbanization economies is further supported by the value of h which is 2.35. Moreover, all of the regional variables and the intercept are significant at the 5 percent level, thus showing a clear regional agglomeration economies pattern. Agglomeration economies are highest in the *NCR*, followed by *MPR*, and *FAR* (contained in the intercept). The positive sign of *NCR* and the negative sign for the rest might support the idea that the higher wage in larger urban areas compensates for the higher transportation cost and land rent because of urban congestion.

The very high $\dot{R}^2$ (0.9) shows that the regression equation explains the variation of wages in the consumer service sector very well.

6. Summary and Conclusions

The main objective of this study was to measure agglomeration economies both in the production and consumption sectors in Indonesia as well as in the Philippines using an appropriate conceptual framework. The conceptual analysis consisted of the production function estimation of the class CES while allowing the degree of homogeneity to be higher than unity. The empirical model estimated the returns to scale parameter as a representation of localization economies for three-digit manufacturing industries, and of urbanization economies for the entire consumer service sector.

The results of our cross-sectional regression analysis confirm the role of agglomeration economies in explaining the concentration of producers and consumers in large urban areas. The empirical results support the contention that the presence of agglomeration economies is a result of external economies, both for the manufacturing and consumer service sectors. The agglomeration economies for the manufacturing sector mainly come from localization economies, while that for the consumer service sector mainly arises from urbanization economies.

Localization economies as a result of the presence of other similar industries strongly determine the concentration of manufacturing industries in large urban reas, both for the cases of the Philippines and Indonesia. Almost all of the three-digit manufacturing industries recorded a value of h higher than unity. Urbanization economies, which refer to the advantage to firms in all industries as a result of total economies of scale due to the size, is shown only by the variable of urban population. Urban population as an urbanization economies variable has a positive effect for agglomeration economies in both Indonesian and Philippine cases. However, the square of urban population shows a negative relationship and is significant for the two countries. It means that beyond a certain level, urban population no longer creates urbanization economies, but urbanization diseconomies. Producer service as another urbanization economies variable is not significant.

For the consumer service sector, the estimated production function shows significant results for urbanization economies which are represented by the population size and the value of $h>1$ for the entire consumer service sector, and consumer agglomeration which is represented by the number of consumer services. All of these are the key factors in determining the concentration of consumer service firms in large urban areas which attract immigrants to large cities.

An interesting result concerns the presence of consumer agglomeration economies. The theory predicts that although consumers will suffer decreasing real income as a consequence of migrating to larger cities, they are willing to bear the sacrifice in order to gain a higher utility level which is derived from product variety. Likewise, they can tolerate this condition because, later on, as the number of consumer services increase beyond a certain point, their income will rise. The increase in income could be influenced not only by the absorption of more workers into the consumer service sector, but also by diseconomies brought about by the increasing population in terms of higher commuting cost and land rent.

Policy Implications

The empirical results show that for the Indonesian case, some industries such as chemicals, plastic and cement have very high localization economies parameter. All of these industries are highly protected industries, so that we can conclude that the high value of h may not come from localization economies, but from protection.

On the other hand, for other kinds of industries which have the least or even no protection at all, the localization economies parameter, h, is significantly higher than unity. Industries such as food, tobacco, textile, wearing apparel, and leather are those without protection.

In the case of the Philippines, there is no particular industry with very high localization economies parameter unlike those in the Indonesian case. Industries in the Philippines are less distributed than those in Indonesia as shown by very few industries found in the regions outside the CIR. In the Philippines, industries with little or no protection such as food, textile, and wearing apparel show localization economies parameter significantly greater than unity.

What policy implications can be drawn from such results? We

might say that a policy to spread industries to other provinces (regions) outside the traditional high-concentration region (Java in Indonesia and CIR in the Philippines) would not result to much without considering the importance of localization economies in industrial location.

Moreover, the empirical results also show the importance of urban population in creating urbanization economies. It means urban areas are more profitable for industries to locate in because of external economies created by large populations.

It does not mean that we oppose decentralization of industrial location. It must be emphasized, though, that there is a strong rationale behind the decision of industrialists to choose large urban areas as the "ideal" location of their industries, that is the existence of agglomeration economies. Decentralization of industrial location should best be accompanied by government provision of adequate infrastructure and access to markets. There is a growing phenomenon in developed countries particularly in the U.S. characterized by industries voluntarily moving to rural areas because of the fast growth of highway and communication technologies. In this case, the role of agglomeration economies declines and is substituted by the modern technology which is capable of bridging the distance efficiently (Carlino, 1985).

In the service sector, evidences clearly show that services are always located where people are concentrated. The availability of differentiated services in large urban areas attracts more migrants to large cities. Restricting the number of immigrants is an inappropriate policy which is unmindful of the factors underlying the rationale for migration towards large cities. Imposing a higher land tax and toll to ease the problem of traffic congestion in the city, and proposing a remittance program for the losing provinces (regions) are some alternatives which are worth considering (see Flatters, *et al.*, 1974; and Arnott and Stiglitz, 1979.) The recent phenomenon in developed countries, particularly in the U.S., of people moving out of the cities has been triggered by reasons similar to those in the case of manufacturing industries, among them the fast growth of the highway and communication technologies (Carlino, 1985).

APPENDIX A — REGRESSION RESULTS FOR THREE–DIGIT MANUFACTURING INDUSTRIES IN INDONESIA

SIC	C	Ln L	Ln VA	R-Squared	F-Statistic	N
311	3.0589	0.6607	0.4012	0.9778	1081.824	50
	(4.62105)*	(7.6667)*	(4.9619)*			
312	1.4789	0.2375	0.6998	0.9871	1647.707	44
	(4.3852)*	(2.9428)**	(12.007)*			
313	5.0931	1.0607	0.1032	0.9543	1348.809	32
	(6.0352)*	(6.0732)*	(0.8263)			
314	7.2823	1.0071	−0.176	0.3161	4.929271	18
	(2.2875)***	(1.6608)	(−0.412)			
321	2.2219	0.6686	0.4268	0.9889	1348.809	32
	(5.7227)*	(7.9074)*	(6.6120)*			
322	4.6754	0.8329	0.2013	0.9892	966.4834	22
	(8.6779)*	(12.302)*	(3.0862)**			
323	5.2034	0.9866	0.099	0.9714	255.9168	16
	(11.640)*	(8.6724)*	(1.4732)			
324	1.5486	0.6258	0.5187	0.9932	945.9394	14
	(2.3441)***	(3.1782)**	(3.8464)**			
331	4.2851	0.7942	0.2609	0.9325	339.4186	52
	(6.8610)*	(7.2822)*	(3.1932)**			
332	4.9659	0.5906	0.3102	0.8405	103.7426	40
	(3.7848)**	(2.9049)***	(1.7174)			
342	6.2589	0.9963	0.0431	0.9356	313.2261	44
	(5.1193)*	(6.2781)*	(0.2850)			
351	1.0227	0.1712	0.7763	0.9551	394.1497	38
	(1.7415)	(1.5606)	(10.021)*			
352	3.3912	0.7438	0.3511	0.9109	174.7440	35
	(3.3568)**	(5.3406)*	(2.9792)**			
355	4.5504	0.7851	0.2529	0.9562	383.1768	36
	(6.1986)*	(9.0156)*	(3.1252)**			
356	0.6256	0.1397	0.8068	0.9518	267.8759	28
	(10.984)*	(1.7898)	(0.9526)			
361	2.2168	0.3127	0.6421	0.9157	103.0975	16
	(0.9316)	(1.1751)	(2.8266)***			
362	3.7424	1.3222	0.0614	0.9939	900.9151	12
	(9.8625)*	(11.546)*	(9.8625)*			

Appendix A (continued)

363	−0.382	0.4652	0.7323	0.95447	451.7608	44
	(−0.459)	(2.2559)***	(5.3339)*			
364	0.6014	0.2958	0.7517	0.9848	1005.402	32
	(1.4329)	(2.7296)***	(9.4689)*			
369	2.9445	0.2592	0.5918	0.9347	158.4300	23
	(3.8539)**	(1.8261)	(5.4427)*			
371	5.4298	1.1189	0.0625	0.9709	252.0063	16
	(12.584)*	(9.8119)*	(1.1040)			
381	1.9155	0.5957	0.5281	0.9747	830.5591	44
	(3.6042)**	(4.6361)*	(6.0907)*			
382	2.5719	0.2254	0.6541	0.9652	264.3366	20
	(3.6286)**	(1.8271)	(6.8374)*			
383	7.7933	0.4797	0.1659	0.1971	2.595324	14
	(0.1499)	(0.3216)	(1.1479)			
384	2.1266	0.3993	0.6218	0.9739	618.7974	34
	(4.4703)*	(5.8968)*	(10.9860)*			
385	3.0376	0.8892	0.3096	0.7083	14.35626	12
	(1.6190)	(4.0420)*	(2.4931)***			
390	2.5731	0.3757	0.5756	0.9567	232.7919	22
	(3.5330)**	(2.1590)***	(4.6452)*			

Note: R-Squared is adjusted R-Squared.
* significant at 0%.
** significant at 1%.
*** significant at 5%.
t-statistics in parentheses.
C is constant.
ln X is natural logarithm of value added.
ln L is natural logarithm of employees.
N is number of observations.

APPENDIX B — REGRESSION RESULTS FOR THREE-DIGIT MANUFACTURING INDUSTRIES IN THE PHILIPPINES

SIC	C	Ln L	Ln VA	R-Squared	F-Statistics	N
311	−0.381	0.9463	0.2012	0.9846	799.1704	26
	(−1.275)	(12.728)*	(3.3156)**			
312	−0.0747	0.4182	0.5667	0.9263	70.19287	12
	(−0.108)	(1.5422)	(2.7184)***			
313	1.3362	0.3107	0.5066	0.8616	60.15191	20
	(1.8196)	(2.4182)***	(5.6662)*			
321	−1.085	0.08169	0.3417	0.9511	166.0364	18
	(−2.009)***	(4.1834)*	(2.2045)***			
331	0.0752	0.9956	0.1402	0.9531	254.9182	26
	(0.1574)	(6.4833)*	(1.0726)			
332	−0.186	0.596	0.4683	0.9621	254.8245	21
	(−0.496)	(3.0852)**	(2.8437)***			
342	0.7675	1.0662	0.0327	0.9859	808.3012	24
	(4.0987)*	(12.684)*	(0.4891)			
351	4.0163	0.4804	0.1109	0.2146	2.639016	13
	(2.0169)***	(1.0122)	(0.4281)			
352	−0.368	0.7002	0.4142	0.9732	164.1307	10
	(−0.514)	(5.4376)*	(3.3969)**			
355	3.1115	1.2953	−0.322	0.9213	65.35568	12
	(2.4098)***	(2.4039)***	(−0.660)			
369	0.4928	0.4851	0.4416	0.9515	207.0208	22
	(1.2726)	(5.0388)*	(5.5976)*			
381	0.3181	0.7361	0.3079	0.9017	97.3498	22
	(0.6117)	(3.0854)**	(1.6913)			
382	0.5816	0.6491	0.3531	0.9578	262.0460	24
	(1.7406)	(5.5368)*	(3.7088)**			
384	0.5646	0.8298	0.2317	0.9809	413.1029	17
	(1.7786)	(6.2564)*	(2.2304)***			
390	0.0273	0.5369	0.4816	0.9813	368.9004	15
	(0.0997)	(3.0431)**	(3.5593)**			

Note: R-squared is adjusted R-squared.
* significant at 0%.
** significant at 1 %.
*** significant at 5 %.
t-statistics in parentheses.
C is constant.
In X is natural logarithm of value-added.
In L is natural logarithm of employees.
N is number of observations.

References

Abdel-Rahman, H.M. (1988), "Product Differentiation, Monopolistic Competition, and City Size," *Regional Science and Urban Economics*, 18:69-86.

Aberg, I. (1973), "Regional Productivity Differential in Swedish Manufacturing," *Regional and Urban Economics*, 3: 131-156.

Arnott; R. (1979), "Optimal City Size in a Spatial Economy," *Journal of Urban Economics*, 6: 65-89.

Arnott, R. and Stiglitz, J. (1979), "Aggregate Land Rents, Expenditure on Public Goods, and Optimal City Size," *Quarterly Journal of Economics*, 93: 471-500.

Arrow, J.J., Chenery, H.B. and Solow, R.M. (1961), "Capital Labor Substitution and Economic Efficiency," *Review of Economics and Statistics*, 43: 225-250.

Azis, I. (1985), "Pembangunan Daerah dan Aspek Alokasi Investment Antar Daerah (Regional Development and Investment Allocation)," *Prisma*, 6.

Blackley, P.R. (1986), "Urban-Rural Variations in the Structure of Manufacturing Production," *Urban Studies*, 23: 471-483.

Carlino, G. (1978), *Economies of Scale in Manufacturing Location*, Leiden: Martinus Neijhoff.

Carlino, G. (1985), Declining City Productivity and the Growth of Rural Regions: A Test of Alternative Explanation," *Journal of Urban Economics*, 18: pp. 11-27.

Center of Statistical Bureau, *Industrial Statistics 1986, Survey of Manufacturing Industries Large and Medium*, Jakarta.

Center of Statistical Bureau, *Economic Census 1986, Banking Insurance, and Other Financial Institutions Statistics*, Jakarta.

Dixit, A. (1973), "The Optimum Factory Town," *Bell Journal of Economics*, 4: 637-651.

Dhrymes, P.J. (1965), "Some Extensions and Tests for the CES Class of Production Functions," *Review of Economics and Statistics*, 57: 357-366.

Flatters, F., Henderson, J.V., and Mieszkowsky, P. (1974), "Public Good, Efficiency, and Regional Fiscal Equalization," *Journal of Public Economics*, 3: 99-112.

Fogarty, M.S. and Garofalo, G.A., (1988),"Urban Spatial Structure and Production Growth in the Manufacturing Sector of Cities," *Journal of Urban Economics*, 23: 60-70.

Giarratani, F. and Soeroso (1985), "A Neoclassical Model of Regional Growth in Indonesia," *Journal of Regional Science*, Vol. 25, No. 3.

Greytak, D. and Blackley, P. (1985), "Labor Productivity and Local Industry Size: Further Issues," *Southern Economic Journal*, 51: 1121-1129.

Hamer, A. *et al.* "Indonesia, The Challenge of Urbanization," World Bank Staff Working Paper, No. 787, 1986.

Henderson, J. (1974), "The Size and Types of Cities," *American Economic Review*, 64: 640-656.

Henderson, J. V. (1986), "Efficiency of Resource Usage and City Size," *Journal of Urban Economics*, 19:47-70.

Hermoso, V. (1983). "The Development of the Philippine Space Economy," Unpublished Ph.D. Dissertation, School of Economics, University of the Philippines.

Hoover, E.M. (1937), "*Location Theory and The Shoe and Leather Industries*,": Cambridge, MA: Harvard University Press.

Juoro, Umar (1989), "Agglomeration Economies in Production and Consumption: The Cases of Indonesia and the Philippines," Unpublished M.A. thesis, School of Economics, University of the Philippines.

Kawashima, T. (1975), "Urban Agglomeration Economies in Manufacturing Industries," *Papers of Regional Science Association*, 34: 157-175.

Lase, Y. (1988), "Persebaran Lokasi Industri Besar dan Sedang Antar Propinsi di Indonesia Ditinjau Berdasarkan Pendekatan Parsial (Industrial Location for Large and Medium Industries Among Provinces in Indonesia Using A Partial Approach)" Unpublished undergraduate thesis, Dept. of City and Regional Planning, Bandung Institute of Technology.

Mills, E.S. (1967), "An Aggregative Model of Resource Allocation in A Metropolitan Area," *American Economic Review*, 57: 197-210.

Miranda, Jr., C. (1978), "The Spatial Pattern of Philippine Manufacturing, "*Philippine Review of Business and Economics*, 15.

Moomaw, R.L. (1981), "Productive Efficiency and Region," *Southern Economic Journal*, 48: 344-357.

Moomaw, R.L. (1983), "Spatial Productivity Variations in Manufacturing: A Critical Survey of Cross-Section Analysis," *International Regional Science Review*, 8: 1-22.

Moomaw, R.L. (1988), "Agglomeration Economies: Localization or Urbanization," *Urban Studies*, 25: 150-161.

Moran, P. (1978), "Regional Structure of Philippine Manufacturing," *Philippine Review of Economics and Business*, 15.

Nakamura, R. (1985), "Agglomeration Economies in Urban Manufacturing Industries: A Case of Japanese Cities," *Journal of Urban Economics*, 17: 108-124.

National Census and Statistics Office (1978) *Census of Establishments (Large Non-Industrial), Transportation, Storage, and Communication, Financing, Insurance, Real Estate, and Business Services*, Manila, Philippines.

National Census and Statistics Office (1978), *Census of Establishments, Manufacturing*, Manila, Philippines

National Census and Statistics Office, (1975), *Census of Establishments, Vol. IV, Wholesale Trade and Retail Trade, Restaurants, and Hotels*, Manila, Philippines.

Pernia, E., *et al.* (1983), *The Spatial and Urban Dimensions of Development in the Philippines*, Manila: Philippine Institute of Development Studies (PIDS).

Rivera-Batiz, F.L. (1988), "Increasing Returns, Monopolistic Competition, and Agglomeration Economies," *Regional Science and Urban Economics*, 18: 125-153.

Rocca, C.A. (1970), "Productivity in Brazilian Manufacturing," In *Brazil: Industrialization and Trade Policies*, ed. J. Bergman, Cambridge, England: Oxford University Press.

Segal, D. (1976), "Are There Returns to Scale in City Size? " *Review of Economics and Statistics*, 58: 339-350.

Shefer, D. (1973), "Localization Economies in SMSAs: A Production Analysis," *Journal of Regional Science*, 13:55-64.

Stahl, K. (1983), "A Note on the Microeconomics of Migration," *Journal of Urban Economics*, 14:318-326.

Sveikauskas, L. (1975), "The Productivity of Cities," *Quarterly Journal of Economics*, 89: 393-413.

Sveikauskas, L., Gowdy, J. and Funk, M. (1988), "Urban Productivity: City Size or Industry Size," *Journal of Regional Science*, 28: 185-202.

Upton, C. (1981), "An Equilibrium Model of City Size," *Journal of Urban Economics*, 10: 15-36.

Weber, A. (1929), *Alfred Weber's Theory of the Location of Industries*, Translated by C.J. Friedrich, Chicago: Chicago University Press.