REGIONAL IMPLICATIONS OF ECONOMIC DEVELOPMENT IN TAIWAN: THE IMPACT OF KAOHSIUNG

BY

YI-CHUNG HSUEH

A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfillment of the Requirements
for the Degree of

DOCTOR OF PHILOSOPHY

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Abstract

This study deals with the spatial restructuring phase of an urban-rural (or a core-periphery) system. Its context is one in which the impacts, be they 'positive' or 'negative', emanate from the urban places, especially big cities, to the adjacent rural areas. The concepts and theories involved are basically disequilibrium models; namely, the 'Growth-Centre Theory' and its predecessor, Schultz's 'Industrial-Urban Hypothesis'. In turn, these theories owe their inspiration to a longstanding geographical notion; that is, the 'Metropolitan Dominance Concept'. While many empirical studies drawing on this conceptual stance have been undertaken in both developed and underdeveloped countries, relatively few have addressed the problems obtaining in the so-called 'newly-industrializing countries (economies)'. This study, therefore, seeks to redress that oversight by examining aspects of urban-rural relationships and levels of development obtaining during the period of rapid economic growth in Taiwan in the past couple of decades, using the Kaohsiung-Pingtung area in the south for tracing urban impacts on rural areas. Here, Kaohsiung city --- the second largest metropolis as well as the largest heavy-industrial centre and principal harbour of Taiwan --- was regarded as the 'spontaneous growth centre' of the study area from which the development impulses were assumed to be transmitted into rural hinterlands. This development can be explained by reference to

spatial differences in well-being and the changes which have occurred in various socio-economic and demographic aspects (factors). Although the combined effect of these factors fostered overall development around Kaohsiung city somewhat similar to these postulated by the theories, there are, however, some important qualifications. Above all, some factors are decidedly more urban-biased than others, and their diffusion outwards from Kaohsiung city into surrounding rural areas is far more constrained as a result. It is evidently the case, therefore, that spatial development is an uneven phenomenon, with some factors susceptible to diffusion ('spread effects') and others resistant to it (rendering themselves visible, indeed, as 'backwash effects'). Compounding this complex pattern is the fact what some non-economic, but still critical, factors are found to play a major part in moulding the region's development, notwithstanding their glaring absence from standard theories, to say nothing of empirical studies. They coalesce, in effect, to represent a special environment --- culturally and socially --- particular to the study area. Finally, the factor of distance, theoretically the outstanding factor determining the spatial structure of development, emerges as a variable whose influence shifts with time: decreasing gradually its restraining influences in direct correspondence with the improvements of transportation and living standards. In consequence, a new interpretation of the 'distance' factor should be incorporated into the

disequilibrium theories (especially in the context of small regions); namely, to the effect that it loses its potency through time as the pace of development quickens. In short, the array of theories resting on Schultz's Industrial-Urban Hypothesis are germane to the earlier phases of rapid development but increasingly irrelevant thereafter. Truth to say, the contemporary Kaohsiung-centred region has attained a level of development in which the relevance of distance --- and the theories advocating it --- has largely evaporated.

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Chapter 1
Development and the Study Region

1.1 Introduction

It is a truism that development is a multi-faceted, multi-dimensional quality that defies easy description. It is equally obvious, however, that development devoid of economic advancement, is an absurdity. The conception of development adopted here is fully alive to the manifold social, demographic and cultural nuances of development, but maintains that economic-material progress is the heart of the matter. By the same token, development wrenched out of a spatial context is mostly meaningless. Geographical differences in access to the good things brought about by development are important to the political processes under-way at international, national and regional levels. The object here is to focus on the third; that is, how develop-ment appears at one point within a subnational unit and disperses from it to affect in various ways the quality of life of all regional residents. To be precise, the Kaoh-siung-Pingtung region of Taiwan is the focus of inquiry. Reasons for selecting the subject area are readily appar-ent; it is a dynamic, albeit peripheral, zone of a dynamic, highly-sucessful developing country, Taiwan. The epitome of a NIC (newly-industrializing country), Taiwan owes its accelerated development not only to the nurturing of indus-trialization and the urbanization attendant on it, but also to the integration of industry and agriculture or, more

explicitly, the accommodation of urban-industrial processes within the larger rural system. How these two distinct geographical entities, the industrial city and the intensively-farmed rural area, have come to terms with each other is the core of this thesis.

The process is essentially asymmetric. Material progress, subsumed under the development banner, appears in the city as a consequence of industrialization and then breaks the bonds of urban confinement to transgress into rural areas, indelibly altering them in the process.

The implication of industrialization for economic development rests principally on its promotion of per capita productivity, which results in the accelerated capital accumulation needed for reinvestment. Basically, the agricultural activities are land-demanding but have a very low efficiency in creating job opportunities. Furthermore, as a rule, the output of industrial activities are higher value-added products in comparison with those of agricultural activities(e.g. Alexander and Gibson, 1979).Consequently, industrial activities can provide the community not only with more jobs, but with higher per capita renumeration which, in turn, stimulates greater multiplier effects. The capacity of capital accumulation for the community, therefore, increases at a fast rate, and the surplus capital is continually reinvested in the establishment of new factories and workshops or the improvement of process technologies in the existing ones. This is mani-

fested through the much faster rates of creating jobs and increasing per capita income in industrial sectors which, by way of the labour and income multiplier effects, will create a momentum for a rapid growth of the service sectors. This kind of benign cycle produces a snowball effect in economic development and finally results in a significant sectoral transition; namely, the proportional share of the labour force will shift from primary industries to secondary and/or tertiary industries.

An equally important implication of industrialization for economic development is the spatial transition that it provokes. This follows from the specific characteristics of the industry. Generally, the production prerequisites for manufacturing, such as markets, capital, labour forces (unskilled and skilled), transportation, and infrastructure and services, are more favourably disposed to locate in urban places, especially large cities (Chisholm, 1982). Furthermore, as a consequence of the operation of economic efficiencies --- scale economies, agglomeration economies and industrial linkages --- both public and private entrepreneurs motivated by profit-seeking, tend to be concentrated in or near urban places. The outcome is the concentration of production resources in urban places; the increasing disparities between urban and rural areas, or between different regions; and the serious outmigration of people from rural areas or poor regions to urban areas or richer regions (e.g. Alonso, 1968). The rationale for

this kind of spatial transformation is that "the agglomeration of people into towns and cities makes it easier and cheaper to provide them with basic services of education, health care, electricity and water supply than if they remain dispersed in the countryside" (Dickenson, et al. 1983, p.247). Such a spatial outcome --- in spite of private gains and short-term efficiencies --- is replete with social problems, not least the problem of spatial disparities in the provision of material well-being and access to opportunities.

The more concerned governments have reacted through an implicit form of regional policy designed to steer development activities into those regions unfortunate enough to miss out on spontaneous industrialization. This government strategy of regional development may provide an ameliorating solution to the unbalanced pattern of industrial development. Unfortunately, most of the strategies of industrialization used in the Third World have, contrary to expectation, worked to further unbalanced development. This occurrence, again, is understandable given that economic efficiency, as expressed through maximizing the growth rate of industrial output, was considered the prime priority before the balanced development of the regions. What is worse, the decision-making for industrial location often tended to be politically-biased, and more often than not, was decided by politicians rather than development planners. Usually, the rich, developed core regions capture a dispro-

portionate amount of political power and, thus, have much more influence in the decision-making of the industrial locations. Whether for this reason or whether for the more likely reason that governments have been content to allow spontaneous development to go its untrammeled way, Taiwan conforms to this pattern. It boasts a highly-developed core based on the capital, Taipei. A counter-pole is evident, however, outside the core, one that is centred on the southern industrial and port city of Kaohsiung: the focus of this inquiry. It is no accident that the Taiwanese government has recognized the need to offset the core's dominances by encouraging industrialization in this counter-pole. Official efforts are aided by the structure of the Taiwan's industrial systems as the next section makes clear.

1.2 The Taiwan Context : A Thumbnail Sketch

Basically, Taiwan's industrialization followed Schumacher's line in putting much emphasis on the development of small-sized and medium-sized industries (Schumacher, 1973); a process, which incidentally, was quite successful in promoting industrialization in medium-sized and small towns as well as the major centres (e.g. Ho, 1979; Williams, 1988). As a result, measures of spatial disparity, either between rural areas and urban areas, or between different regions, are much smaller than in that other leading NIC, South Korea, and are even less than those occurring in China, a communist country which has actually achieved less

regional equality than many had once thought (Cole, 1987; Kuo, 1983; Fei etal. , 1979; L.S. Chang, 1984). South Korea, following Japan's model, placed more emphasis on the development of heavy industries, which resulted in the emergence of a select number of large, industrial-urban complexs. The kind of relatively-footloose industrialization in Taiwan has been forthcoming with both positive and negative consequences. On the one hand, it has provided the people of non-metropolitan areas with in situ alternative employment opportunities; that is, non-farm jobs. By 1982, for example, 83 percentage of the farmers were part-time operators and only one-third of farm-household income was derived from agriculture (Taiwan Provincial Government, 1985). The major proportion of that non-farm income came from employment in manufacturing industries. On the other hand, this industrialization has had the effect of worsening the farm-labour shortage, resulting in increased farm production costs, and has exacerbated the difficulty of making a living from full-time farming on small holdings. Moreover, some scholars argue that industrial efficiency is enhanced by concentrating industrial activities in the key urban centres, because of their superior infrastructure and other assets for industrialization (e.g. Fuchs & Street, 1980). Small scale, relatively-footloose manufacturing is therefore carrying a burden of inefficiency and may suffer at the hands of larger, concentrated competitors in South Korea. However, with a small area, an excellent transporta-

tion and communication system, and a large skilled labour pool in the rural areas arising from the popularity of education, the dispersion of industries outside the industrial-urban complex in Taiwan speaks well for the island's ability to overcome such liabilities (numerous examples of which might be found in many developing countries)(e.g. Hodder, 1969; Frank, 1966, 1969, 1970). Ho (1979), for one, insisted that non-metropolitan industrialization has, on balance, played a positive role in promoting equitable regional development in Taiwan.

An appreciation of how this industrial structure impacts on the spatial economy in clearly warranted at this stage. To reiterate, one of the most prominent characteristics of Taiwan's industrial development is that manufacturing establishments are mostly small and medium scale in size. This fact is shown in Table 1-1 where it can be elicited that: (1) the percentage share of small manufacturing establishment, that is, establishments employing from 1-9 workers, was as high as 68.16 in 1971 and 69.58 in 1981; (2) the percentage share of medium-size manufacturing establishment (10-49 workers) was 23.33 in 1971 and 20.01 in 1981; and (3) the combined percentage share of small and medium-sized manufacturing establishments was 91.49 in 1971 and 91.59 in 1981. The most important implication of small- and medium-sized firms for regional development is that they are usually of low capital-intensity coupled with fairly high labour-intensity and low-technological endow-

ment and thus are easy to introduce into all levels of urban places, even small towns which are scattered widely over the island (Tsai, 1982).

Following from the rapid industrialization and lack of adequate location policy during the 1960s and 1970s, the spatial distribution of industries in Taiwan during that period was highly concentrated in metropolitan areas. According to Hsueh (1979), in 1970 the three metropolitan areas combined contained over 70 per cent of the total industries in Taiwan when measured in terms of employment.

Table 1-1 Size Distribution of Manufacturing Establishments in Taiwan

No. of workers	No. of establishments		percentage of establishments	
	1971	1981	1971	1981
1-9	30,055	65,789	68.16	69.58
10-49	10,286	20,810	23.33	22.01
50-99	1,676	3,948	3.80	4.17
100-499	1,707	3,491	3.87	3.69
500+	368	508	0.83	0.54
Total	44,092	94,546	100.00	100.00

(Source: Tsai Hung-hsiung, 1984, p.21)

H.C. Tsai's (1984) study, moreover, showed that in 1979 the number of factories located in the five big cities of Taipei, Kaohsiung, Taichung, Tainan and Keelung, and the four counties within their metropolitan areas (i.e., Taipei county, Taoyuan county, Taichung county, and Kaohsiung county) comprised 65 per cent of the total number of factories in Taiwan, as compared with 51.5 per cent of the total number in 1958. This evidence demonstrated that, through two decades of industrial development, rural areas shared

a relatively small portion of the increase in the total number of factories. This overconcentration of industries in metropolitan areas would be partly responsible for serious rural-to-urban migration which occurred during the period extending from the 1960s until the mid-1970s.

However, after the mid 1970s, the government assumed an increasingly active role in the process of industrialization, entertaining the view that overdevelopment of the core was detrimental to the national interest. Well-formulated policies, their effective implementation and the display of initiative on the part of private investors resulted in rapid advances in decentralized industrialization which, in turn, contributed significantly to a rapid growth of spatial dispersion in the past decade. One of the most crucial indications of government's decentralization of industry is the change in the locational patterns of industrial districts after the mid-1970s. For the purpose of reducing industrial production cost and increasing industrial output, especially for the small- and-medium-sized industries, the development of industrial districts was deemed to be the most effective measure. Therefore, a 20-year plan was formulated by the government for the development of industrial districts in Taiwan. The goal of the 20-year development plan is to realize regionally well-balanced development of industries. Under this plan, a total of over 10,000 hectares of industrial land will be developed to create employment for 500,000 people.

Some 75 industrial districts have been developed, while seven additional industrial districts of a total area of 5,516 hectares are presently under development (Industrial Development Bureau, 1986).

Before the mid-1970s and prior to serious implementation, industrial districts tended to be localized in the northern and southern planning regions, notably around Taipei and Kaohsiung. However, after the mid-1970s, the industrial districts started to spread out to the central planning region and the non-metropolitan areas. From Table 1-2 and Figure 1-1 it is evident that after the 1970s, industrial districts were more widely distributed in the non-metropolitan areas. For instance, during the period of 1971-1976, the total areas of the industrial districts in process of establishment in metropolitan areas and non-metropolitan areas were 2,627 hectares and 2,735 hectares respectively. In the period of 1976-1981, the trend became more discernible, with the contrasting values of 790 hectares for metropolitan areas and 2,819 hectares for non-metropolitan areas highlighting the divergence. Such a dichotomy can be taken further. Shih (1982) defined Taiwan's 'urban area' as including five big cities (Taipei, Kaohsiung, Taichung, Tainan and Keelung) and three metropolitan counties (Taipei, Taoyuan and Hsinchu) and the rest of the island was relegated to the category of rural area. The annual percentage growth rates of employment in manufacturing for 'urban area' and 'rural areas' were respec-

tively 9.4 and 10.28 in 1966-1980 as opposed to 7.52 and 8.04 in the earlier span encompassing the years 1956 to 1966. Most of the dispersed small- and medium-scale industries and industrial districts are located in or near the scattered small- or medium-sized cities. In contrast to many other developing countries, Taiwan has been relatively successful in promoting rural industrialization as an effective strategy to increase the income level of rural families and to promote the development of rural society as a whole. Ho (1979) linked the level of rural nonfarm activities to the spatial pattern of industrialization. He further pointed out that, in Taiwan, the share of income from nonfarm sources in total farm- household income increased from 25 per cent in 1960 to 43 per cent in 1975, while in South Korea, which like Taiwan has experienced rapid industrialization since the early 1960s, the figures remained constant at about 23 per cent for the same period of time. In a word, Taiwan's success can, in large part, be attributed to the prevalence of the small- and medium-scale industries on the one hand, and their tendency to form in relatively scattered urban places on the other. Obviously, this pattern of industrialization has imposed a distinct stamp on the island's recent experience of urbanization.

This is readily apparent from the fact that the urban population accounted for only 59 per cent of the total population in 1970, but had increased to 73 per cent of the

total by 1984 (Li, 1986). The increasing proportion of the urban population to the total population can be attributed

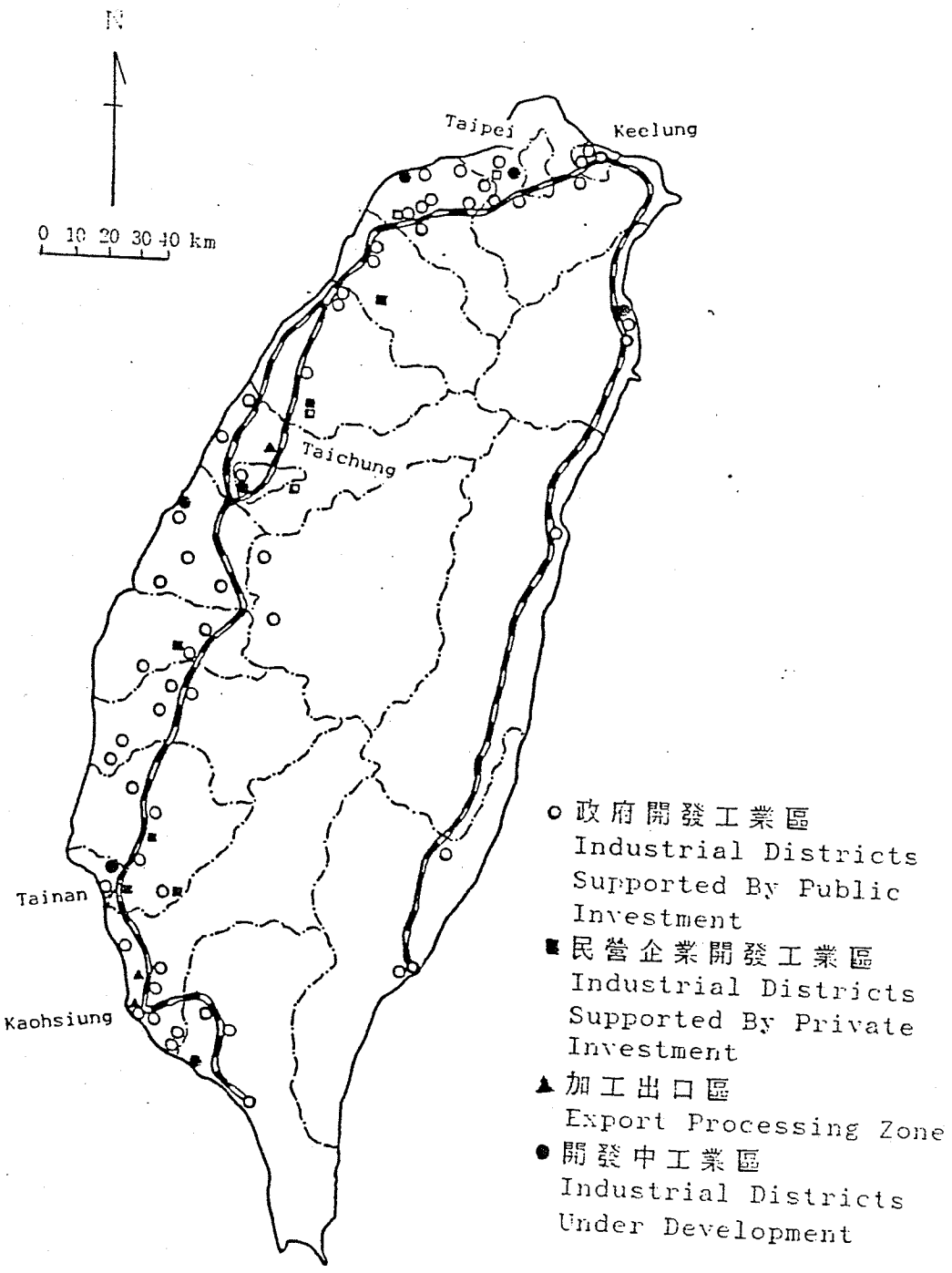
Table 1-2 The Distribution of Industrial Districts in Taiwan, unit: ha.

Regions	Ares developed and under development				
	1961-1966	1966-1971	1971-1976	1976-1981	subtotal
Taiwan	208	557	5,362	3,486	9,613
N.Region	59	267	1,346	1,113	2,785
C.Region	---	---	617	1,368	1,985
S.Region	149	290	3,259	986	4,684
E.Region	---	---	140	19	159
Metro. Areas	208	290	2,362	790	3,915
Taipei M.	59	---	159	91	309
Taichung M.	---	---	169	233	402
Tainan M.	---	---	198	75	283
Kaohsiung M.	149	290	2,101	391	2,931
Non-metro. Areas	---	267	2,735	2,819	5,821

(Source: Industrial Development Bureau)

to two reasons: (1) the emergence of new urban places; and (2) the growth of existing urban places through natural growth or in-migration of population. However, and more importantly from the vantage of regional development, the question in need of addressing is: what is the spatial and rank-size distribution of the urban places in Taiwan? Many studies pertaining to the rank-size distribution of urban places in Taiwan have come to conclude that, as economic development gained momentum, the city growth pattern gradually corresponded to Zipf's rank-size rule (e.g. Chang, 1984; Sun, 1985). As a matter of fact, both Hsueh (1980) and H.H.Tsai (1984), although using different methodologies, also concluded that the rank-size distribution of urban places in Taiwan conforms very closely to Zipf's

Fig. 1-1: Development Status of Industrial Districts on Taiwan



Source: Industrial Bureau, Ministry of Economic Affair, 1986

rank-size rule. Furthermore, they both insisted that the rapid industrialization in the past decades did not disturb the rank-size distribution. In other words, the rank-size distribution of urban places in Taiwan is a balanced one.

The spatial distribution of the urban places, meanwhile, tended to conform to Christaller's 'central-place' type of distribution, especially in the central and southern parts of Taiwan (Hsueh, 1980; Tsai, H.H., 1984). Controversy has arisen, however, in respect of the question as to whether the population became more concentrated or more dispersed in the process of city growth since World War II:. Shih's (1982) study indicated first a dispersion process, followed by a concentration process, for the geographical distribution of population between 1950 and 1980. The concentration process in later periods was also supported by Wilber (1981). In his analysis of urbanization in Taiwan, this analyst pointed out that, in contrast to the argument that absolute deprivation in rural areas is the major cause pushing people to cities, in Taiwan urban economic development was not only able to accommodate the influx but also to hasten city growth. According to Hsueh (1986), the distribution of urban places in Taiwan before World War II was quite even, clustered basically along three axes from north to south; namely, the western coastal axis, the central axis and the eastern piedmont axis. Most of the major cities are located along the central axis. However, as a result of rapid urbanization taking place after World

War II, the three contemporary metropolitan areas of Keelung-Taipei in northern Taiwan, Kaohsiung-Tainan in southern Taiwan, and, to a lesser extent, Taichung in central Taiwan became forces to be reckoned with, and they overlapped the original three axes pattern of distribution. The clustering of urban developments in three metropolitan areas was very noticeable by 1970 and the trend of concentration still continues, albeit not so markedly (Hsueh, 1980; H.H. Tsai, 1984; Li, 1973).

One noteworthy point is that growth rates for different sizes of urban places vary with different periods of time. As H.H. Tsai (1984) has remarked, the municipalities of Taipei and Kaohsiung, along with the five provincial cities, recorded their fastest population growth during the years 1953 to 1973, while the county-level (i.e. prefectural) cities were the sole category which experienced rapid population growth during the decade extending from 1973 (see Table 1-3). Both of the two high-level cities witnessed decelerations in their population growth rates during the period of 1973-1983. The populations of chen (town) and hsiang (rural district) grew at a slower rate than the natural growth rate (growth rate of total population in Taiwan) over the entire period of 1953-1983; that is, chen and hsiang constantly experienced a declining share of the total population. In short, before the mid-1970s, the population tended to concentrate in the seven biggest cities (the two municipalities and five provincial

cities), resulting in a somewhat unbalanced distribution during that period of time. After the mid-1970s, the trend slowed down and obviously the medium-sized cities (prefectural cities) enjoyed the fastest growth rates. However, from the spatial point of view, the more dynamic prefectural cities are mostly located within the commuting perimeter of the three metropolitan areas. Notwithstanding the trend of increasing concentration of urban places around the three metropolitan perimeter, most of Taiwan's regions contain scattered cities and towns inherited from earlier phases of historical development. It would be true to say that, on average, with the improvement of transportation, any rural-area resident (except those found in mountain districts) can reach a town or small city within one hour (by driving); a medium-sized city or large city within 1-2 hours; and one of the three metropolises within 2-3 hours. This more scattered distribution of urban places has had the effect of allowing the people in rural areas to commute between their homes and urban places, and, therefore, has worked to ameliorate serious population losses through outmigration. By the same token, economic activities, specifically industries or services, can be easily diffused to the non-metropolitan areas in order to provide rural residents with local employment opportunities.

These forces hint at the welding of urban-industrial processes and rural economies, a phenomenon which has pivotal relevance to theoretical justifications for urban-

centred spatial development, the basis for that link is introduced in the next section.

Table 1-3 Population Growth by Administrative
(unit: annual growth rate percentage)

Administrative Units	1953-1963	1963-1973	1973-1983
Central Municipalities (2) *	5.23	4.04	2.15
Provincial cities (5)	3.98	3.13	1.53
Prefectural (county) cities	5.12	4.88	4.68
Chen (town) & Hsiangs	2.73	1.56	0.95
Taiwan area	3.48	2.74	1.87

* ( ): No. of administrative Units.
(Source: Tsai, 1986, p.16)

1.3 The Indispensable link : Industry and Agriculture, Urban and Rural Development

Because regional inequality correlates rather closely with differences in urban development, the question arises as to what role cities can play in the process of regional development. Generally speaking, there are two extremely opposite opinions. One school, represented by A.F. Frank (1966,1969,1970), regards the role of cities as negative; that is, the countryside in the Third World is exploited by the cities which, within the international capitalist system, are satellites of the rich countries that exploit the Third World. In other words, cities of the Third World work as an agent of the developed countries to exploit the rural areas of their own countries through the so-called mechanism of internal colonialism. In this view, instead of being centres of growth and development, the cities in the Third World are just centres of foreign domination and exploitation. On the other hand, another

school, led by Hirschman (1958) and Friedmann (1959), see the role of cities as more positive. They maintain that growth of urban centres made possible the development of rural areas in the Third World. McGee (1971) took a middle course between these two opposite opinions. He considered the role of cities in the Third World as embracing both positive and negative influences on the well-being of rural areas. Hoselitz (1960) used the terms 'parasitic' cities and 'generative' cities to represent the urban centres which have 'negative' and 'positive' roles respectively. In this viewpoint, a city is generative whenever its formation, continued existence and growth are elements accountable for the economic development of the region or country in which it is located. A parasitic city exerts an opposite impact. It is evident that the urbanization-agriculture interactions in combination are a significant theme infusing the debate revolving round the impact of urban places on rural areas. The concept directly addressing the linkages, Schultz's 'Industrial-Urban Hypothesis' claims that the average income of rural farm people per county depends greatly upon the county's location relative to centres of industrial-urban growth. In other words, industrial-urban centres have, in general, positive impact on the welfare of the rural economy. These impacts have usually a distance-decay effect --- i.e., the closer to the urban centres, the more the impact, and vice versa (Schultz, 1951, 1953).

Following this line of thinking, the impact of urbanization on agricultural development alone may be equally positive, with a similar distance-decay effect. Theoretically, industrial-urban development may expand the supply of nonfarm jobs, draw labour out of agriculture, raise agriculture's capital-labour ratio, and expand the demand for farm products. These developments may stimulate the more intensive land-uses of agriculture, promote mechanization of agriculture, induce changes from low-value to high-value crops and from traditional self-sufficient agriculture to a more market-oriented agriculture in order to capture the expanding market of urban places. However, in recent research, the negative effects of industrial-based urbanization of agriculture have been particularly emphasized (Bryant, 1981). These effects include direct loss of farmland to other land-uses (industrial, residential or commercial), to say nothing of high land prices and taxes. Sinclair (1967) demonstrated a conceptual framework to express the relation between agricultural land-use and farmers' anticipations of urban expansion, which may be interpreted as an evaluation by the farmer of the potential urbanization forces in the surrounding environment. In Sinclair's model, there are two significant viewpoints. First, the strength of the urbanization forces is inversely related to distance from the edge of urban expansion and, consequently, the degree of anticipation of urban expansion, in turn, is directly related to the strength of these

forces. Secondly, the overall evaluation of probability of an agricultural future by farmers is related inversely to the strength of potential urbanization forces. The stance adopted in this thesis adheres closely to the view held by Schultz; namely, that urban-industrial development is for the most part benign, provided that conditions in surrounding rural areas are receptive to development and the adjustment that it requires. Mindful of restraining factors, the 'generative' role of Kaohsiung is investigated along the lines proposed in the next chapter, an elaboration of theoretical implications, and the one following, a presentation of appropriate methodologies. To conclude this chapter, however, calls for a succinct statement of thesis objectives : a necessary prerequisite for all that follows.

1.4 Approach Adopted in this Thesis

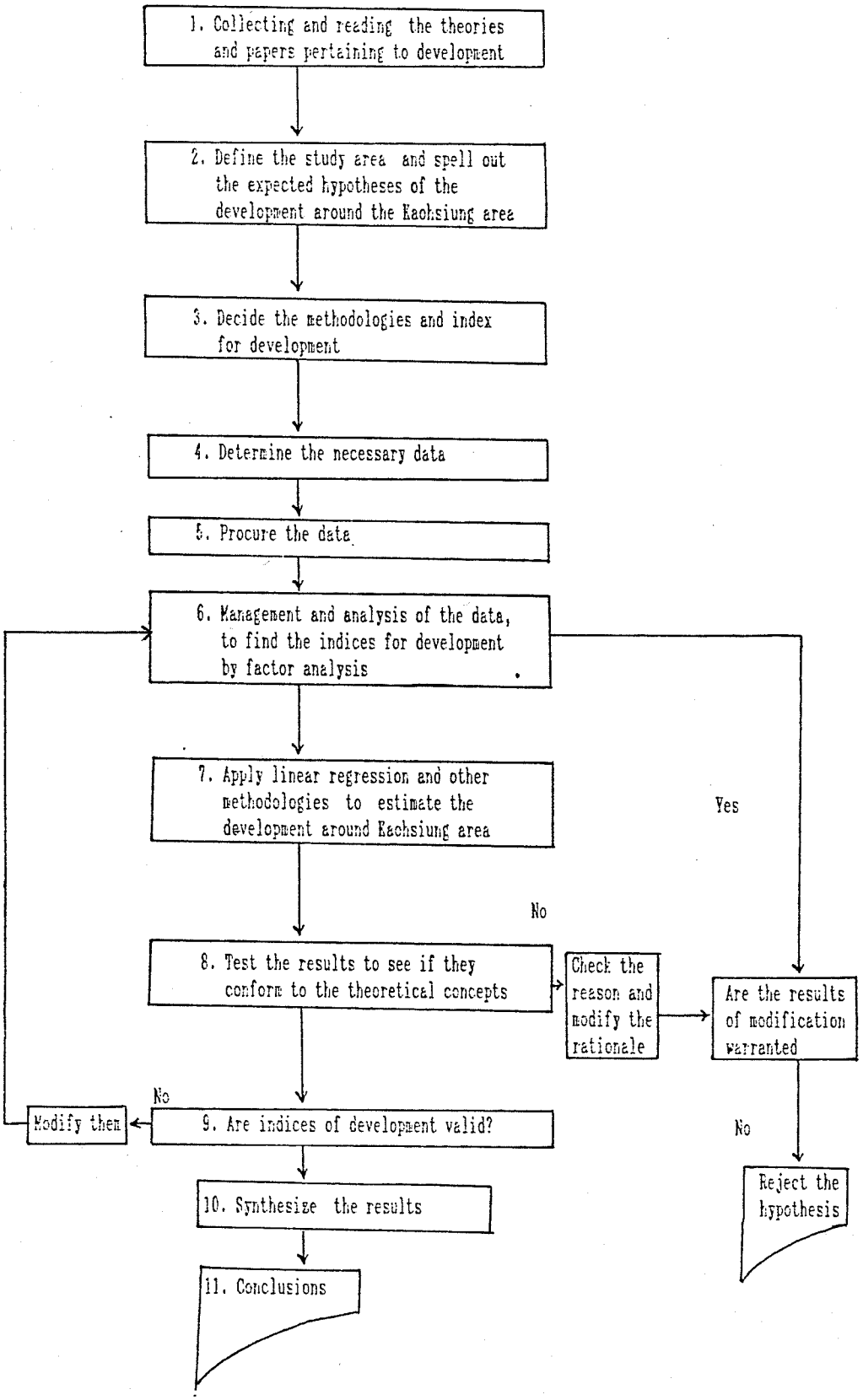
It is the purpose of this thesis to try to investigate the validity of the critical development theories inspired by Schultz's Industrial-Urban Hypothesis set against the backdrop of the Kaohsiung area in south Taiwan. Basically, the thesis aims to discover the relationships between Kaohsiung municipality and its hinterlands, mainly in Kaohsiung and Pingtung counties. What is more, great emphasis is put on unraveleing the spatial pattern of the development around the Kaohsiung area which has occurred during the past one or two decades.

The prime reason for choosing the Kaohsiung area as the empirical case study in this thesis is that, being the

largest harbour, the second largest city and one of the biggest industrial centres in Taiwan, Kaohsiung municipality can definitely be claimed as an ideal industrial-urban growth point. It follows, quite logically, that growth of Kaohsiung municipality should have great and obvious impacts on the surrounding hinterlands of the Kaohsiung and Pingtung areas that were basically agricultural zones but are now rapidly undergoing drastic changes. Therefore, the Kaohsiung region can be regarded as an ideal place to test the theories underpinning regional development. Figure 1-2 sets out the course of action which will be followed in this study. In reference to that figure, items (1) and (2) peruse and distill the theories and postulates pertaining to development. In that light, they spell out the expected form of spatial development provoked by industrial expansion in Kaohsiung. This leads to item (3), formulation of appropriate measurements of that development. Subsequently, items (4) and (5) require that data are collected, including data from field work and a questionnaire survey, and indirect data from government and other sources. Item (6) centres on the production of composite indices representing development by means of factor analysis. For its part, item (7) involves interpretation of the factor loadings to infer: (a) the relation between the development of Kaohsiung municipality and its hinterlands, and (b) the spatial patterns of development within the study area. The methodologies which will be employed in this study are the

linear regression model and other techniques such as the coefficient of variation. Next, items (8) and (9) focus on testing the results from (6) and (7). If the results can validate the existence of spatial development as postulated in (1) and (2), then, the object becomes one of examining the relevance of the indices of development. Some development in the hinterland may be created independently from the influence of Kaohsiung city, or may be created from the activities present in other urban centres. If the results cannot substantiate what is supposed to occur, it becomes necessary to check the reasons and adjust them in such a fashion which prompts one to decide either to reject the theory or to recast it. Finally, items (10) and (11) justify the entire exercise, providing a synthesis of the results from the aforementioned analyses before giving rise to a set of prescriptive conclusions.

Fig 1-2 : Preferred Format for 'Development' Study



Chapter 2
Relevant Concepts and Theories

2.1 Introduction

With rapid urbanization in the world in general and developing countries in particular after World War II, a number of scholars --- regional scientists, economists, geographers and planners --- began to recognize the importance of cities in regional development (e.g. Jones, 1986; Ironside and Williams, 1980; Lamb, 1975; Blair, 1980; Brierley and Todd, 1978). Over the years, a range of policies of a rough urban-regional development stamp crystallized in the leading western nations (e.g. McCrone, 1969). They were taken up by developing countries and duly modified as a set of regional strategies. Common to them all is the widely accepted view that rural development --- or at least rural well-being --- is in large part determined by the urban sector. Todd even insisted that "rural development tends to be viewed as a factor of urban development in the sense that rural areas are expected to be recipients of positive urban spill-overs" (Todd, 1983, p.45). It is, therefore, more fruitful for the regional development analyst to think of spatial expressions of well-being in terms of an urban-rural dimension in national economic development rather than in terms of urban development and rural development as issues in their own right. Egan and Bendick (1986) argued that urban growth should be evaluated less as either good or bad in itself but more in

terms of whether it promotes the efficient and equitable performance of vital economic functions within a nation. Miller (1971) tried, albeit without obvious success, to build a model to explain the urban-rural relationships. Yet, these latter-day appraisals ultimately owe their inspiration to a pair of theories, the 'Growth Centre Theory' and the 'Industrial-Urban Hypothesis' (IUH), which were formulated in the 1950s. These two theories are the cornerstone of the conceptual position adopted in this thesis. Despite evident similarities, they have some basic conceptual differences, as shall now be made apparent.

2.2 The Evolution of the Critical Theories

The growth centre theory (or growth pole concept as originally conceived) was introduced by French economist Francois Perroux as a counterpoint to the then current equilibrium models of neo-classical theories of regional development. The equilibrium models focus on deviation-counteracting mechanisms; that is, those which combine as a process that operates to reduce differences within a system (Maruyama, 1963; Thomas, 1972). Their advocates hypothesize that the advantage of the urban-industrial centre is only temporary. In other words, the economic processes steer a system naturally towards an optimal equilibrium state. Therefore, regional development inequalities can be corrected by a free flow of factors of production which eventually brings about an equalization between centre and periphery (or, in an explicit spatial

sense, between urban and rural areas). According to this reasoning, no government intervention is required in the periphery; economic development will spread automatically from centre to peripheral areas (de Souza and Foust, 1979).

By way of contrast, Perroux's concept of the process of development as polarized is an essential point of departure in growth centre theory. This concept of polarized development is based on Perroux's assumption that "development does not appear everywhere and all at once; it appears in points or development poles with variable intensities; it spreads along diverse channels and has varying effects for the whole of the economy" (Perroux, 1955, p.94). In order to explain his idea of the growth pole, Perroux introduced three important concepts: namely, 'domination effects'; 'propulsive unit (industry)'; and 'growth pole'. 'Domination effects' were visualised as "occurring between two economic units, A and B, when, in a definite field, unit A exercises on unit B an irreversible or partially irreversible influence" (Gore, 1984, p.85). The 'propulsive unit (or industry)' is a type of dominant economic unit which upon expansion can induce growth in other economic units (industries) through industrial linkages (i.e. of the backward and forward kind). One qualification is in order here, which is that Perroux's concept of polarized development is closely related to his particular notion of abstract economic space as a field of forces. For Perroux, the main problem confronting growth centre theory is the

need to explain the nature of the structural changes in the economy (Blaug, 1964). Thus, if an economy in which domination effects occur is characterized as a field of forces, then, propulsive units located within this field may be described as 'poles of growth'. Although Perroux did not exclude completely the geographical space in his growth pole concept, he seemed to put emphasis on abstract economic space at its expense. To Perroux, the geographical space rigidly limits the efficacy of economic forces.

Because of the prevailing concern with abstract economic space, the effects of distance were overlooked by Perroux. In other words, the growth of the centre may have effects, be they positive or negative, on the areas far away from the centre, instead of just in geographic areas contiguous to growth centres. As mentioned above, Perroux's analysis is confined to structural changes, change in mutual production relationships, differences in rates of growth of the various economic sectors, and the diffusion of growth from one sector to another. Consequently, the growth pole concept, as originally defined, had scarcely any bearing on questions of regional development and thus can hardly be used as a strategy of regional development (e.g. Hansen, 1968, 1972). Perhaps this is Perroux's reaction to the over-emphasis on distance by classical economists such as Von Thunen, Weber, Losch and Palander, etc. For those classical economists, distance is an overwhelming factor deciding their prime objectives of minimum-cost or

maximum-profit strategic locations.

Notwithstanding Perroux's non-geographical orientation, growth centre theory has, paradoxically, come to be applied mainly in a regional context; that is, in geographical space. As a matter of fact, by the early 1970s, "reliance on growth pole analysis was a dominant characteristics of operational planning in both developed and developing countries" (Richardson and Richardson, 1974, p.163). The history of how Perroux's original concept of growth pole came to be transformed for the purpose of regional planning would be an interesting line of inquiry, but cannot be pursued here because it is tangential to ends. Suffice it to say that, since all economic activities necessarily occur in geographical space, the structural changes and diffusion of growth in Perroux's functional space can be projected into geographical space. From this basis, there have been further reinterpretations of a growth pole. For example, McCrone (1969) and Lasuen (1969, 1974) defined a growth pole as a spatial agglomeration of related industries which contains a growing propulsive industry, while Boudeville (1966) and Nicholls (1969) considered a growth pole to be a spatial agglomeration of related industries, located in an urban centre, which can induce growth in its surrounding hinterland. Parr (1973) defined a growth pole in an even simpler way as " a growing urban centre". Despite their different reinterpretations of a growth pole, there is one thing that these scholars (and others) hold in

common; that is, what began as a growing economic unit in Perroux's definition has become a growing spatial unit, a city. In short, Perroux's sectoral process of polarization has turned out to be a spatial process. To be specific, a propulsive industry which may induce growth in other parts of an economy has become a place which may induce growth in other places. As Gore has pointed out,"once the growth pole is defined in purely spatial terms, it is possible to bring any body of theory, whether neoclassical, Schumpeterian, dualist, dependista, sociological or political, to bear on the understanding of the spatial relationships between growing centres and their linked hinterland" (Gore, 1984, p.92). In practice, the various manifestations of the growth centre strategy have been shown to be very effective in promoting the economic development of the region as a while (e.g. Moseley, 1973; Robinson and Salih, 1971; Kinsey, 1978). Given that resources are scarce, planners promoting development must select priorities --- spatial as well as sectoral priorities --- since it is impossible to develop all places equally at the same time. The rationale for the growth centre strategy may rest on the assertion that a few selected urban places acting as growth centres may offer particular advantages because of their potentiality for development. Once the investment efforts are concentrated in these centres, they may yield economies in the provision of public infrastructure and create agglomeration and scale economies; outcomes hardly likely to be

occasioned in the case of all investment efforts being distributed evenly everywhere. What is more, since the urban places selected as growth centres are the ones where the propulsive industries are located, it is reasonable to maintain that the growth centre strategy can be more narrowly, but more properly, defined as the urban-industrial growth centre strategy. Boudeville, for instance, defines a growth pole (centre) as "a set of expanding industries located in an urban area and inducing further development of economic activity throughout its zone of influence" (Boudeville, 1966, p.11). Basically, Boudeville's idea of developmental space is a polarized one; that is, a heterogeneous space whose different parts complement and support one another and where these parts have more exchanges of goods and services with a dominant intra-regional urban centre than with neighbouring regions. Admittedly, major urban centres are often the key centres of growth in their region owing to their high market potential and their being socially and culturally more attractive to managers. This may seem to fly in the face of the desire of planners for regional balance on first appearances (e.g. Storper, 1985). According to Richardson and Richardson (1974), most of the external economies that make some areas preferable to others are, in effect, localization economies and urbanization economies. It is obviously the case that a major urban centre which has substantial positive external economies will tend to be the focus of growth.

So far have concentrated our discussions on the growth centre itself, and little has been said about the relationships between growth centres and peripheral areas, or, more precisely, between urban centres and their surrounding rural areas. Whether the urban-industrial growth centre concept can be used as an efficient strategy of regional development depends greatly on the relationship between these centres and their surrounding rural areas. In fact, the impacts of growth centres on their surrounding peripheral areas have been shown to occasion two opposite effects: positive and negative. The positive effect derives from the reasoning that the growth of the centre stimulates economic development of peripheral areas, whereas the negative effect is occasioned when the growth of centres occurs at the expense of economic development of their peripheral areas. The terminologies used for these two opposite effects are varied and sometimes ambiguous. To take one celebrated example, Hirschman used 'trickling-down effect' for positive effect and 'polarization' for negative effect; while Myrdal preferred to use the terms 'spread-effect' and 'backwash-effect' for the positive and negative effects respectively. Since these two opposite effects exist simultaneously, the resultant outcomes in the long run will decide the validity of the growth centre strategy as a meaningful instrument in countering development inequalities. Logically, the validity of the growth centre strategy is based on two conceptual assumptions: first, the

net impact of growth centres on the surrounding rural areas must be positive; and, secondly, that impact must be felt in the geographically-contiguous areas of growth centres. As Coraggio (1974, p.291) has noted, the problem of achieving the development of a region by the growth centre strategy can be subdivided into two parts: (a) how to ensure the localization of a propulsive activity in the region; and (b) how to prevent it from becoming an "enclave". The latter situation occurs when the impact of the growth centres is not contained within the geographically surrounding region of the centres, but mainly prevail outside the region. If we couple this idea with Boudeville's definition of the growth centre, as mentioned above, the ideal strategy can be paraphrased to require the establishment of a set of propulsive industries in an urban area in the first place before inducing further development throughout its zone of influence in the second. However, while easy to voice, the strategy is far more difficult to implement (e.g. King, 1974); as will become evident in what follows.

Using the same assumptions of Perroux and Boudeville that economic development is an essentially unbalanced process propagated through chains of disequilibria, Hirschman (1958) came to conclude that 'polarization effects' (i.e. negative effects) are natural in the early stage of development. Once investment has ensured that the propulsive industries are concentrated at growth centres, devel-

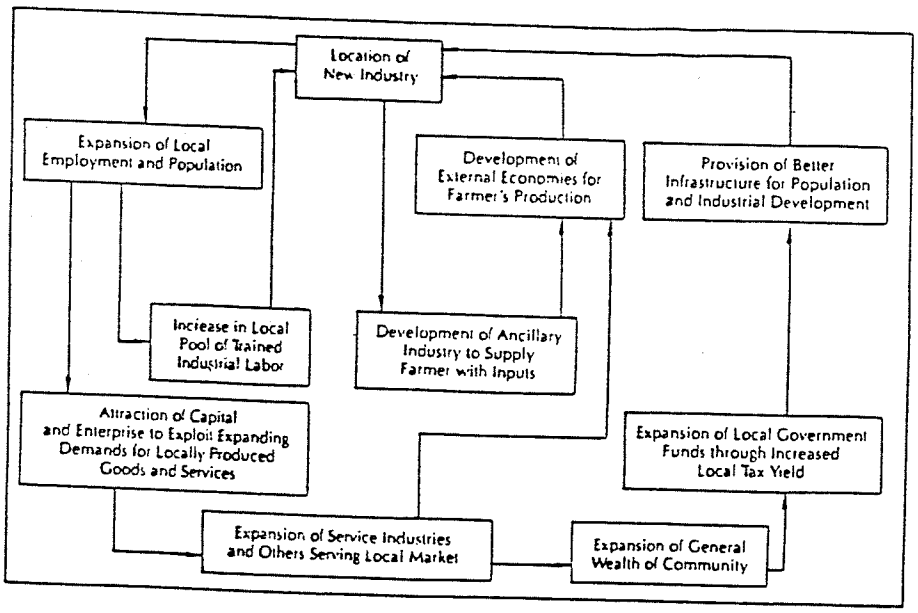
opment becomes increasingly unbalanced. The growth of the 'north' --- the developing region --- will attract skilled labour and capital from the 'south'; which is to say, the poorer periphery. What is more, since income elasticity of demand is greater for northern manufactured goods, the trade balance between the north and the south tends to be in favour of the former. Yet, in the long run, these polarization effects will be offset eventually by 'trickling-down effects'. As envisaged by Hirschman, trickling-down effects include: the northern purchase of commodities produced in the south; the flow of capital from the north to the south; the dispersal of industries from the north to the south following from agglomeration diseconomies; and, finally, the northern attraction of southern labour which effects an increase both in the south's marginal productivity of labour and its per capita consumption levels.

One thing should be stressed here; namely, that Hirschman believed government intervention was necessary not only to reduce the spatial disparity between the growth centre and the periphery but to guarantee the final result of regional convergence. Friedmann and Alonso (1964) also presented the same opinions. This condition is quite different from anything proposed in the theories of spatial equilibrium, which insist that economic development will automatically reduce the spatial disparity between the growth centre and the periphery which is characteristic of

the early stage of economic development. In contradistinction to these 'mechanistic' views, Hirschman implied that a spatial pattern in which development is concentrated in a few growth centres can be diagnosed as being inherently unfair, and in need of policies to ensure more 'even development'.

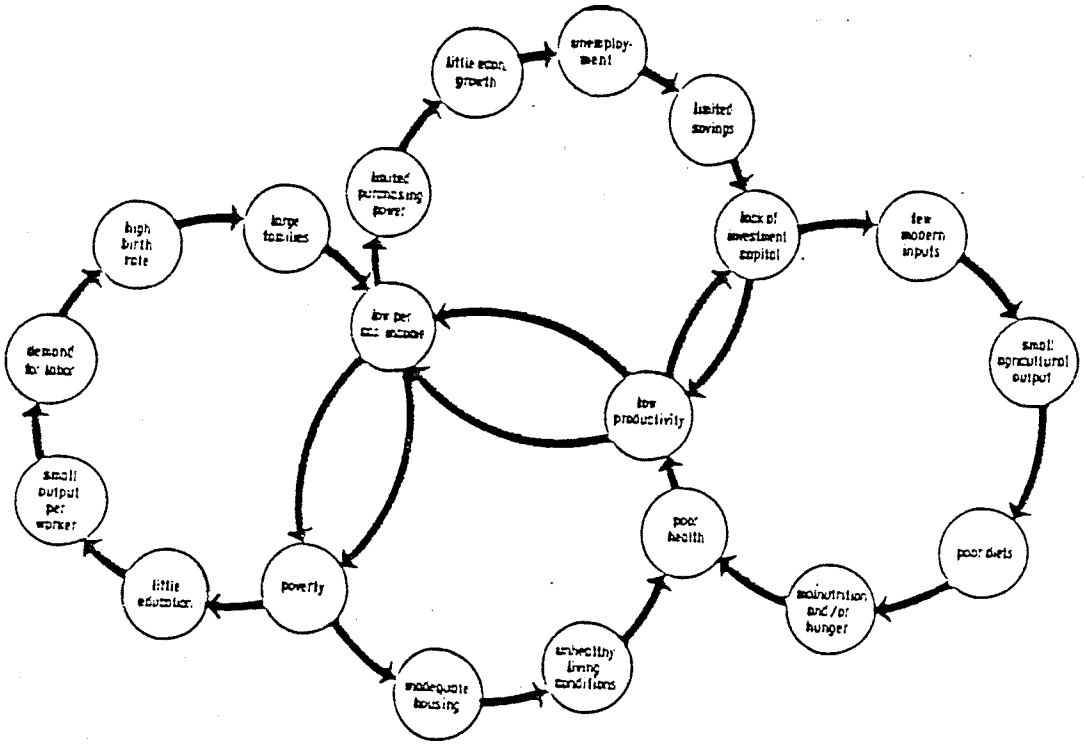
Like his contemporary, Myrdal (1957) also attacked equilibrium notions in economic theory and put forward basic ideas about polarized development. He argued that increasing economic inequalities are generated through what he called 'circular or cumulative upward' effects during the early stages of development (Fig. 2-1). Myrdal coined the terms 'spread' and 'backwash' effects to respectively represent the positive and negative impacts of the centres on the peripheries. For development to occur, centrifugal spread effects of expanding momentum must on average, be stronger than backwash effects. It is important to recognize that both Hirschman and Myrdal were in agreement in asserting that, in a free enterprise economy, increasing disparities between the centres and the peripheral areas are typical of early stages of economic development. However, as to the later stages of development, the two scholars adopted markedly different positions. Unlike Hirschman, Myrdal was pessimistic and insisted that the vicious cycle of backwash effects would continue in the underdeveloped countries, notwithstanding the interventions from government. Reitsma and Kleinpenning (1985) also presented a

Fig. 2-1: Myrdal's Model of Circular or Cumulative Upward Causation



(Source: D.E. Keeble, 1967)

Fig. 2-2: Four Interlocking Vicious Circles of Development in the Third World



(Source: H.A. Reitsma and J.M.G. Kleinpenning, 1985)

similar idea of vicious circles of development applying in a Third World context, as shown in Figure 2-2. On the other hand, Hirschman insisted that eventual convergence is the inevitable outcome. He believed that government intervention, can and will reduce the inequalities. In this respect he anticipated much of the early work of the prolific regional planner, Friedmann (1959, 1966), although the latter's work is notable for its more explicit linkage of urbanization with rural development.

Schultz presented an alternative approach to the problem of urban influence on rural areas, with his so-called 'Industrial-Urban Hypothesis' (IUH). At one and the same time, it avoids the controversy surrounding the outcomes expected from growth centre strategies while stressing the dependence of rural development on urban conditions. Moreover, it advocates a simple transference mechanism, one based on elementary notions of distance decay. The IUH idea derives directly from the location matrix promulgated by Schultz in the 1950s. From his study of the variations in agricultural income in the USA, Schultz concluded that some communities burdened with relative poverty owed their disadvantaged standing not to physical characteristics of land but rather their remoteness from 'centres of economic progress'. He formalized this idea into what he called 'the retardation hypothesis', which can be summarized in three parts. In the first place, economic development occurs in a specific locational matrix; secondly, these

locational matrices are primarily industrial-urban in composition; and finally, the existing economic organization works best at or near the centre of a particular matrix of economic development. Similarly, optimum operations occur in those aspects of agriculture which are situated favourably in relation to such a centre. The other side of the coin is that the system works badly in those elements of agriculture which are situated at the periphery of the matrix (Schultz, 1951, pp. 205-6; 1953, p.147).

In a word, the IUH model explicitly links rural, and in particular, agricultural prosperity with spatial proximity to an urban centre. Theoretically, the urban centre acts to efficiently allocate labour, capital and land supply on the one hand, and also to absorb rural products on the other. Consequently, any agriculture that is located closer to the urban places will profit both from greater factor returns (e.g. higher value land, benefits from increased capitalization, and the greater productivity of better-trained labour) and higher sales as a result of access to the urban centres' larger and better organized produce markets. In turn, higher sales volumes feed back to enable the farmer to further his capital intensification and pay higher wages for more qualified labour; the two combining to ensure the self-sustenance of rural development.

This hypothesis was tested by Nicholls (1961) and the results confirmed its validity. In detail, he set about establishing the correlation between various indicators of

the efficiency of local labour and capital markets and the degree of urban-industrial development in different counties of South Carolina, Georgia and Tennessee. Data embracing the entire period of 1860 to 1950 consistently threw up results which confirmed expected associations. Moreover, both labour and capital markets were found on the basis of the statistical evidence to be more efficient in urban-industrial counties, and the indicators suggested that agriculture was more productive and rural incomes higher in areas near to urban-industrial development. Furthermore, at the individual factor level, other studies have suggested that farm labour supply is closely related to urban manpower markets (e.g. Smit, 1979). Gregor (1979) also concluded that the degree of farm capitalization is a function of urban orientation.

The original Schultz concept assumed that urban strength stemmed from the concentration of industrial activities in the centres. This proposition has become the centrepiece of the IUH in the sense that industrial-urbanism is advocated as the main agent fostering not only the static efficiency of agriculture, but also such diverse dynamic factors as the rate of innovation diffusion and the progress in a qualitatively developmental sense which follows from rises in the level of rural education (Katzman, 1974). Lately, the servicing function of the urban centres has also been formally grafted into the IUH hypothesis (Taurianen and Young, 1976), rendering the concept

radically different from that of the growth centre where development basically originates from the so-called 'propulsive industries' and pays no heed to the servicing function at all. This oversight on the part of growth centre theory appears to be at odds with reality. For example, Gottmann (1974) insisted that the dynamism of large urban growth at present is mainly attributable to the growth of the 'quaternary' occupations, not secondary ones. Todd and Hsueh (1988) in their study of Taiwan's economic development confirmed this conclusion. As a result, while the smaller urban centres without significant industries cannot be regarded as growth centres; they, nevertheless, can be conceived as possible leading agents in rural development in the IUH concept. For instance, such urban areas can offer non-agricultural employment, including industrial and service jobs, to some rural dwellers and increase the income per household in rural areas in consequence.

In sum, the IUH concept basically assumes the positive impacts of urban places on rural areas; impacts which decrease in accordance with a distance-decay effect. In a sense, prosperity in urban areas and prosperity in rural areas have more of a complementary relationship with each other than a competitive one. While debate continues on the validity of the detailed manifestation of these urban spill-overs, there appears to be little doubt that rural districts are in some way beneficiaries of urban development. As Rondinelli (1983, p.379) has put it;"... towns

and small cities have helped to transform the economies of rural areas by providing access to services, facilities, and non-agricultural employment opportunities and by providing incentives for the commercialization of agriculture. When adequate linkages have been forged between towns and small cities and their hinterlands, these centres have been able to articulate the settlement systems in these regions and to help integrate them into the economy of the country. The towns and small cities serve as centres for marketing, services, commerce, processing, transportation, distribution, and communications and as centres for small-scale manufacturing, for the diffusion of innovation, and for social interaction."

Clearly, even small urban centres with only a modicum of spill-over potential need not be dismissed as agents in promoting development. Conceivably, the scope for development impulses rises in proportion to the size of urban centre. Along these lines Rondinelli (1983, p.395) suggested that " the effects of cities on villages and rural population decline with increased distance. Because of this relationship, a system of towns and cities, in which large centres are linked to rural villages and farm settlements, seems necessary to ensure wide diffusion of innovations, stimulation of economic activities in rural areas, and improved access for rural folk to town-based service and facilities." Adding substance to this claim is the work of Bryant and O'Connor (1968). In their study of American

rural farm income levels, these authors concluded that the average income of rural farm people per county depends upon the county's location relative to centres of industrial-urban growth, the sizes of the centres, the characteristics of the county's economy and, finally, the demographic characteristics of the county's rural farm population. Obviously, their study embraced a complex set of factors which supplement the simple consideration of distance from urban-industrial growth centres in stimulating the rural farm income, but through it all the relevance of distance consideration remained sacrosanct.

2.3 Recapitulation : The Merits of IUH and Growth Centre Thinking

In conclusion, it is appropriate to succinctly restate the reasoning behind the selection of growth centre theory and, more particularly, the IUH concept as the foundation for a study of spatial development in southern Taiwan. To put it bluntly, these two theories indicate relationships between urban-industrial growth and rural development which support the expectation that an urban-industrial centre strategy can achieve various regional planning objectives, especially those leading to a more equitable and socially-satisfying form of overall development (Gore, 1984). Furthermore --- and most importantly --- these relationships have for the most part been empirically verified. To be sure, corroboration of these theories is circumscribed by a host of factors relating to the geographical context of the

study region, its stage in the development process, size in the urban system, structure of economic activities, not to say nature of development itself. Qualifications aside, the fact remains that the two theories in question have registered the greatest success of any in both disentangling the constituents of development and outlining the transfer mechanism effecting the redistribution from urban to rural surroundings. As such, their merits need not be laboured here, better by far is to switch attention to the means of operationalizing them. Chapter 4 sets about that task. Prior to embarking upon it, however, one must gain greater familiarity with the study area itself. To this end, the next chapter describes the region's endowments and recent history, providing, in effect, the skeleton upon which the development concepts can be hung.

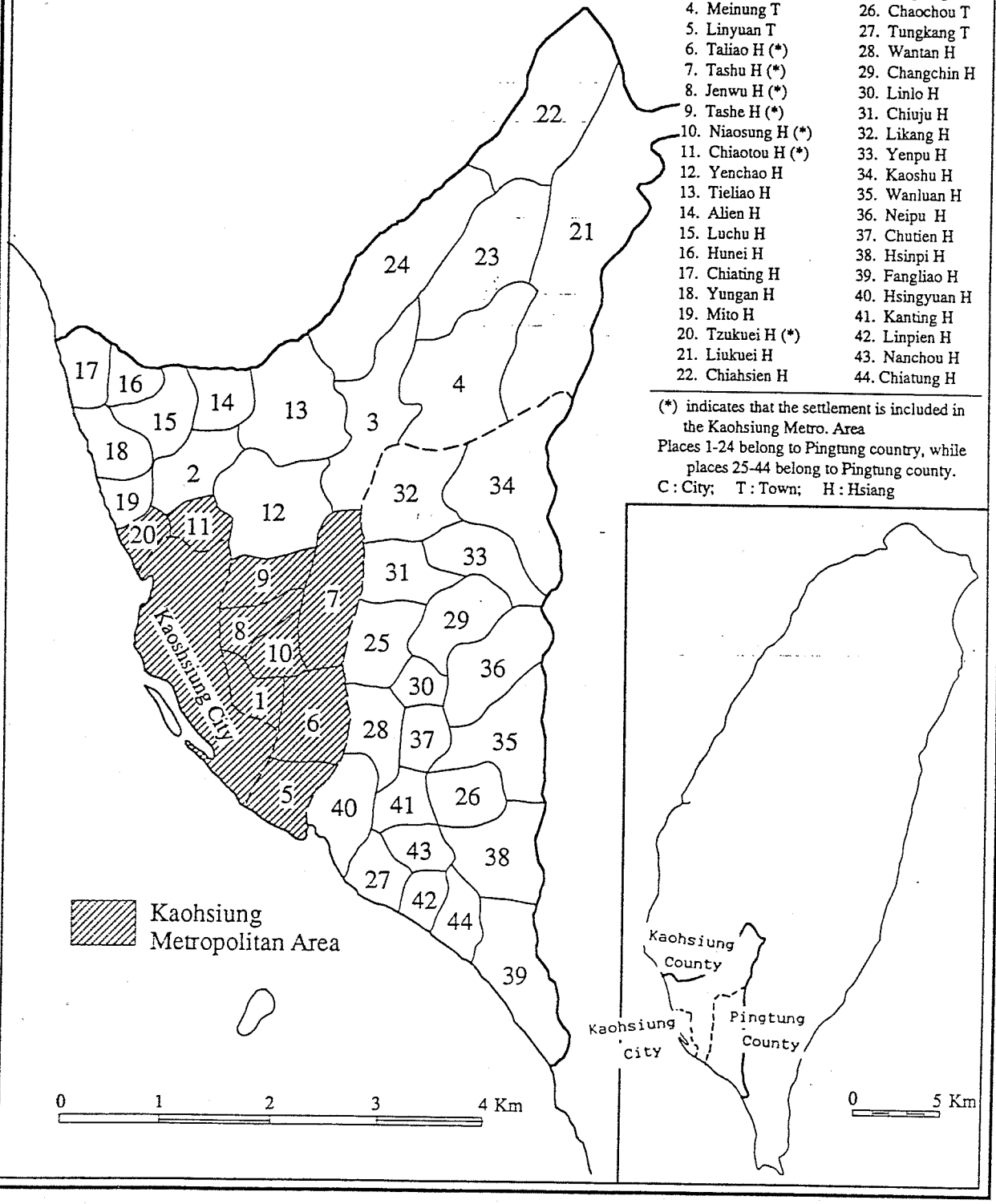
Chapter 3
An Affirmation of the Validity of the Study Region

3.1 Introduction : Location and Physical Setting

The study region boasts a total area of 2,509.86 square kilometres and recorded a total population of 3,219,959 in 1989. Its northern border is delimited by Tainan city and Tainan county (represented by the Er-Jen River); the Central Mountain Range constitutes its eastern frontier; while its other limits are set by the Taiwan Strait in the west and the Taiwan Strait and the Central Mountain Range in the south and southeast. Administratively, the study area consists of the entire area of Kaohsiung city, and the majority both of Kaohsiung and Pingtung counties, excluding the mountainous aborigine reserve rural districts (i.e. hsiangs), which are in general sparsely populated and are economically backward, and the Hengchun Peninsula of the southernmost part of Pingtung county. In other words, besides Kaohsiung Municipality, the study area includes 44 county cities, towns and rural districts (i.e. hsiangs). These are listed in their entirely in Figure 3-1.

Topographically, the study region is basically a flat plain dotted with some small coral limestone hills, such as Takan Shan and Shiao-kan Shan in Kaohsiung county, and Pan-ping Shan, Kuei-shan, Wan-shou Shan and Chie-shan in Kaohsiung city. All of these coral hills fall below 400 metres in elevation. The plain can be divided into two parts by the border river of Kaohsiung county and Pingtung

Fig. 3-1: The Boundary and the Administration Divisions of the Study Area



county; that is to say, the Kaoping River. The plain north of the Kaoping River, which includes Kaohsiung city and the plain part of Kaohsiung county, is sometimes called 'Kaohsiung plain' but in fact is an extension of Chianan plain --- the largest plain of Taiwan; while south of the Kaoping River is found the Pingtung plain. While both are areas of fertile alluvial deposits, the Pingtung location is especially noteworthy as one of the three most fertile plains in Taiwan. Generally speaking, the whole study area is quite low and flat, with a gentle slope down from the piedmont of the Central Mountains in the east towards the Taiwan Strait in the west. In Kaohsiung city proper, for instance, 91 per cent of the area is below 20 metres in altitude, and 89 per cent of the topography has a slope angled between 0 and 5 degrees (Shih, 1975). The littoral of the coast area is sandy, characterized by straight coastline, numerous offshore sandbars and lagoons. Kaohsiung commercial harbour and its naval harbour (located in the Tsoying district of Kaohsiung city) are built along the lagoons.

As to climate, since the whole part of the study area is located south of the Tropic of Cancer, it may be characterised as tropical, burdened with high temperature and heavy moisture. Usually, the annual average temperature is around 24 degrees C, with a slightly higher average in the Pingtung Plain. For its part, the annual average precipitation is between 1,500 and 2,000 mm in the Kaohsiung area

and between 2,000 and 2,400 mm in the Pingtung Plain, with a high degree of concentration in the summer months and a prominent dry season in winter. Except for the typhoon season, the wind velocity is not strong, registering an average of 2.6 m/sec during the southwest monsoon season in summer and 3.6 m/sec during the northeast monsoon season in winter (Kaohsiung City Government, 1984).

Granted this physical setting, it is obvious that the majority of the study area is eminently suitable for agricultural development. As a matter of fact, parts of the Pingtung Plain are held up as among the most productive land for agriculture in Taiwan. This can be judged from the fact that this zone is the only area in Taiwan which achieves three harvests of rice per year; as compared with the two crops in other parts of Taiwan and the one crop in temperate areas of Monsoon Asia. Apart from the physical setting, the study area is also an ideal place to examine urban and industrial developments, not least those generated by the development of a massive port complex.

3.2 Historical Perspectives

As a result of access to Tainan city, the capital city of Taiwan during the Dutch colonial stage and the Koxinga dynasty (Cheng dynasty), the study area was developed very early. From the historical perspective, the evolution of development of the study area can be roughly divided into the following three stages.

(A) The initial stage of development; that is, the pre-Japanese occupation period (1563-1894) --- As early as 1563 Chinese immigrants from the mainland had already established their fishing villages along the coastal area of today's Kaohsiung city in an area then called 'Ta-Kaou' (literally meaning 'biting dog'). During the period of Dutch occupation (1624-1661), the whole area of Taiwan was carved up into five divisions; the north, the south, Tam-sui, Ilan, and Penan (Wu, 1988). The south included the area between the Er-jen River (today's border river between Tainan city/county and Kaohsiung county) and Hengchun (the southernmost part of Pingtung county). It approximately coincides with the study area of this dissertation. At the same time, the Dutch also colonized the island of Java. Because of the advantage of geographical location --- access to Java --- Kaohsiung port was selected as a communication point between Java and Taiwan (Tsai, 1987).

During Koxinga's (Cheng) dynasty, and later the Ching dynasty, Chinese immigrants were encouraged to penetrate into the deep part of the plains of Kaohsiung and Pingtung. Administratively, Fengshan county was set up, which included the bulk of today's Kaohsiung and Pingtung plains. Irrigation dams and ditches were built in the area in order to develop agriculture. Consequently, the Kaohsiung and Pingtung plains together became one of the most significant agricultural areas in Taiwan at that period of time. What is more important is that the agricultural development of

the Kaohsiung and Pingtung areas provided Kaohsiung port with a potential hinterland which was definitely helpful to the prosperity of the city of Kaohsiung. The development of Kaohsiung harbour, in turn, promoted through trade a market for the agricultural products of the hinterland. In fact, during this period, Kaohsiung became a significant trade centre in the southwest coastal area of Taiwan, second only to Tainan. After 1856 and the signing of the Sino-British Tien-jing Treaty, some Western trade companies, such as the British Jardine Matheson & Co. and Mac-Phail & Co., the German Lessler & Co., and the American Robinet & Co., elected to set up their offices in Kaohsiung in effect from 1869. The British government even opened a consulate on the western slope of Choushan, facing the entrance to Kaohsiung harbour. By 1879 there was a total of 399 ships inbound and outbound of Kaohsiung harbour, carrying a total cargo of 126,609 tons. The shipping lanes extended not only to the significant ports on the Chinese mainland, such as Canton, Amoy, Shanghai, and Tien-jing, but also to other parts of Asia, e.g. Singapore, the Philippines and Japan. A service was even instituted to London in 1870 (Wang, 1984). The main export products from Kaohsiung harbour then were cane sugar, rice and camphor, while the main import products were cotton, flour, iron instruments, and other metal products. Therefore, the development of Kaohsiung harbour and the increasing amount of trade served to induce the further development of agri-

culture in the hinterland from which most export products came. On the other hand, the further development of the hinterland attracted more immigrants either from mainland China or from other parts of Taiwan, resulting in a more prosperous agricultural economy within the tributary zone of Kaohsiung city. This, in turn, was helpful to the further development of Kaohsiung city.

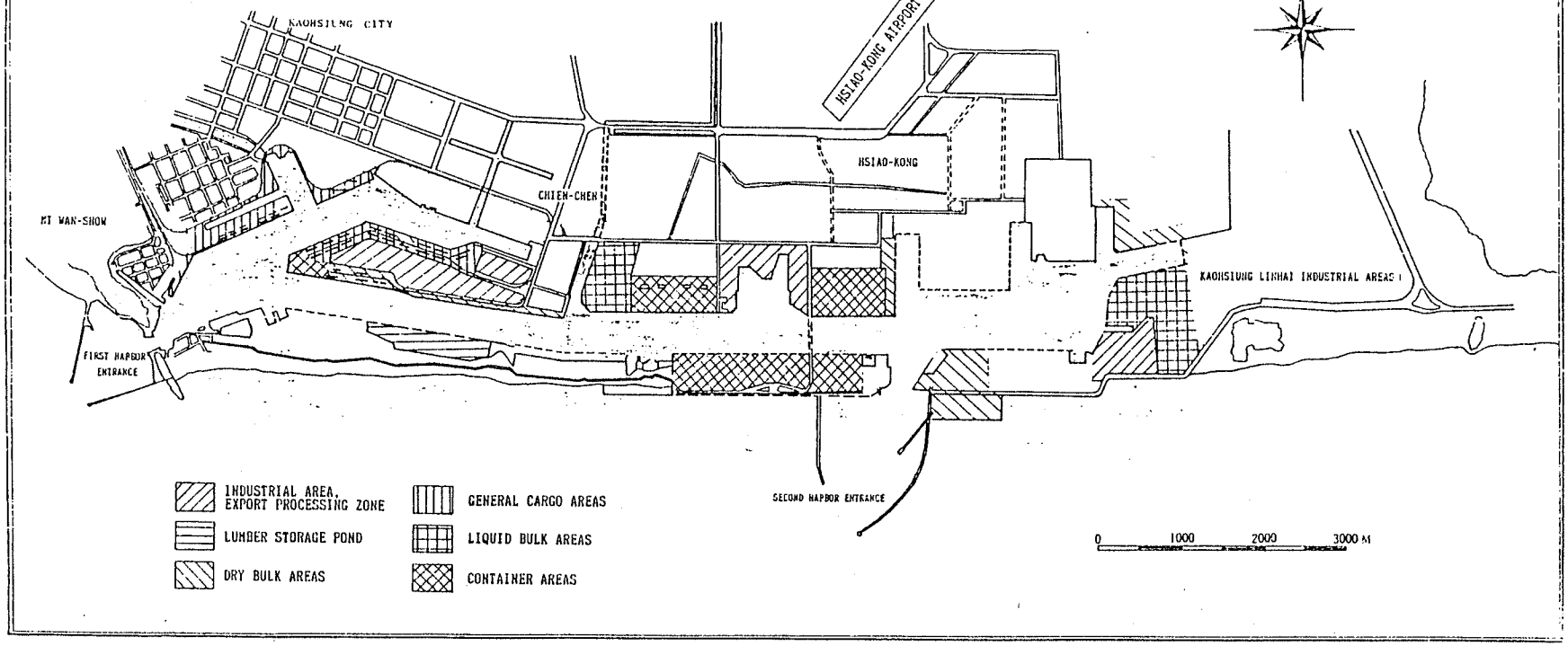
In sum, during the early stage of development, the economy of the study area was based on agriculture and fishing. This was partly a natural result of the physical endowments of the area. However, another significant factor which worked to greatly stimulate the further development of the area was the emergence of Kaohsiung harbour as a significant trading centre. Owing to its excellent location, Kaohsiung harbour emerged as an important communications point between what is now Indonesia and Taiwan, linking these elements of the Dutch empire. The harbour function was further emphasized during the period of the Koxinga dynasty and the Ching dynasty, in large part because of the demand by foreigners for camphor, sugar, and some other agricultural products. Another reason accounting for this rising importance may be that most major harbours then along the western coast of Taiwan --- Anping (i.e. Tainan), Peikang and Lukang --- were suffering from problems of silting; a problem fortunately absent from Kaohsiung harbour because of its location along a huge lagoon. Consequently, the relationship between the develop-

ment of Kaohsiung city, with its harbour, and the hinterlands surrounding conformed more to a benign one than a vicious one.

(B) The period of the Japanese occupation (1895-1945). The occupation of Taiwan by the Japanese in 1895 started a new era both for the development of Kaohsiung city and its hinterland. First of all, the Japanese began to build a new harbour on the same site as the old one. It was equipped, however, with modern harbour facilities, including a storehouse and a railway station, as well as dock space enough to accommodate six 8,000-ton ships at one time (Yuao, 1970). Basically, the harbour was built in a long lagoon running east and west between two sand bars (see Fig. 3-2). The bottom consists of sand, which is good holding ground for ships' anchors. It is easy to deepen and presents no silting problem. During World War II, the Japanese built a supplementary harbour in another lagoon at Tsoying north of Soushan and made Kaohsiung an important naval base, ranking with such important ports in Japan proper as Osaka, Kobe and Nagasaki. The Japanese even planned to reconstruct the harbour within twenty-five years to allow the port to accommodate 150 ships of 10,000 tons --- a total capacity of 1,500,000 tons --- at the same time. It was only because of their deteriorating war situation that the plan was dropped.

Additional to its harbour and commercial functions, the Japanese also planned to develop Kaohsiung as the most

Fig. 3-2: Port of Kaohsiung



Source: Kaohsiung Harbour Bureau (1986)

significant industrial centre in Taiwan. As a result, a range of industries were introduced into Kaohsiung. These included oil refining, salt, food, chemical, petroleum, limestone, alkali, cement, aluminum, fertilizer, and ship-building manufactures. Most of these manufacturing activities concentrated within today's Kaohsiung city proper. Accompanying the development of harbour functions and manufacturing and commercial activities in Kaohsiung there was a programmeto improve the city's infrastructure, particularly in such fields as transportation (e.g. railway and highway), electricity and water-supply.

With all of these developments working in conjunction, the rapid increase of employment opportunities attracted a huge in-flow of immigrants from the hinterland and other parts of Taiwan. Consequently, in 1944, the population of Kaohsiung city amounted to 200,000, surpassing Tainan city and ranking as the largest city in southwestern Taiwan and the second largest city in Taiwan, next only to Taipei. However, most of the developments of commercial and manufacturing activities were concentrated in Kaohsiung city proper, leaving the vast hinterland still a rural-agricultural scene. Thus, the dichotomous characteristics of economy prevailed, with the Japanese bequeathing to their successors a city touched by industrialization serving a hinterland devoted to the export of such tropical agricultural products as cane sugar, rice, bananas, pineapples and camphor.

3.3 Modern Trends

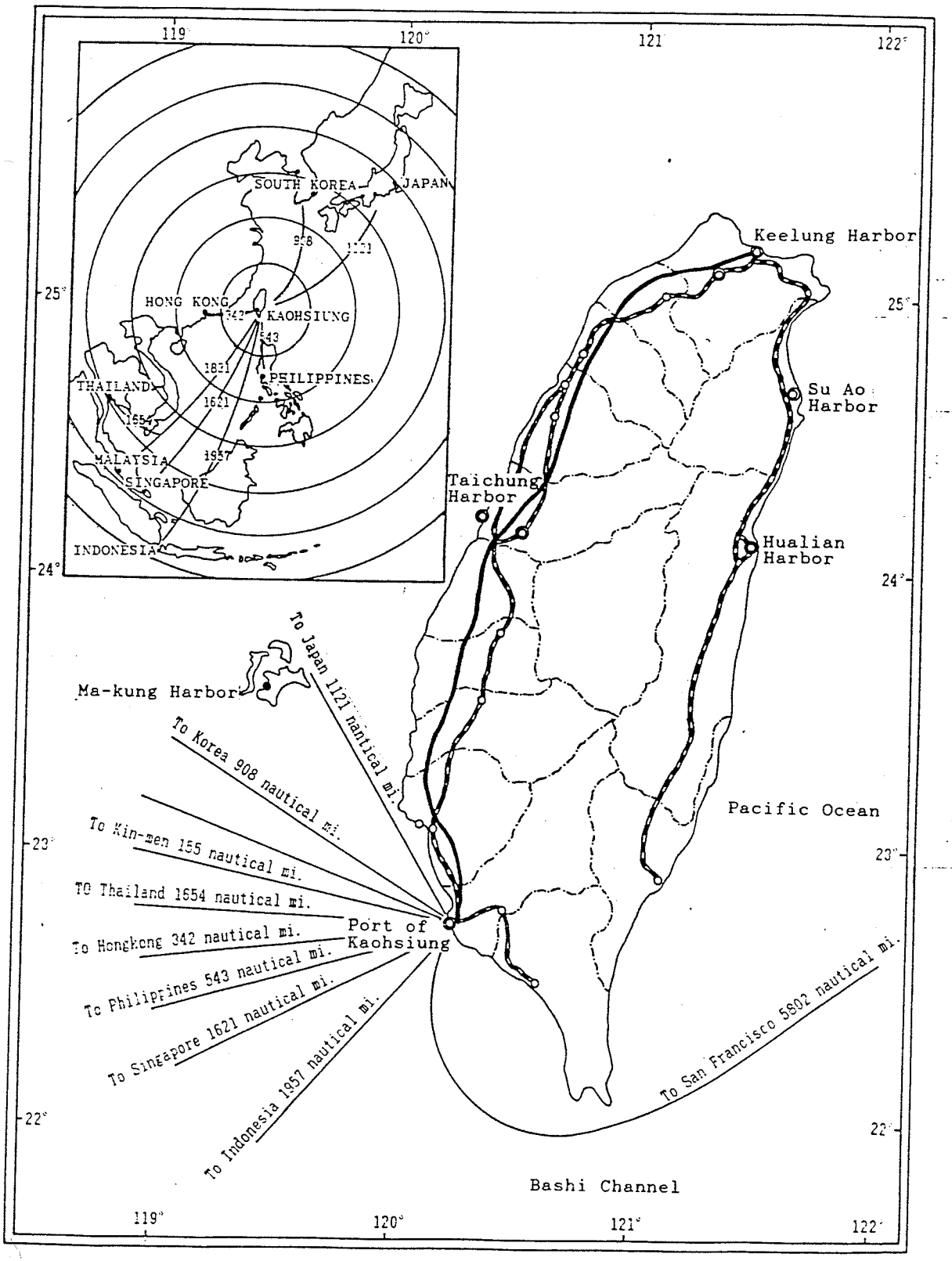
Taiwan was retroceded to China in 1945 and rehabilitation work commenced immediately. Owing to its excellent physical conditions --- a huge lagoon for the enlargement of its harbour, the vast plain for urban and industrial development, the excellent geographical location, and an extensive hinterland with prosperous agriculture --- Kaohsiung city grew very fast. Based on the fundamentals built by the Japanese prior to World War II, the government of the ROC started to rehabilitate the harbour facilities damaged by the U.S. air forces during the war. By 1949 the port was restored to its pre-war condition. The 12-year Harbour Extensions Project, running from 1958 to 1970, dramatically changed Kaohsiung harbour by expanding the water area four times (from the original 3.3 square kilometres to 12.7 square kilometres) and reclaiming 544 hectares of new land. This, in turn, permitted additional development, exemplified by such projects as the Chungtao Commercial Harbour Area, Kaohsiung Export Processing Zone, Chienchen Fishing Harbour, Linhai Industrial Zone, the integrated steel mill of China Steel Corporation, a major shipyard of China Shipbuilding Corporation, Container Terminals 1, 2, and 3, and the second harbour entrance. With the completion of the last of these facilities, the district of Chichin became an island. Construction of a four-lane, across-harbour tunnel under the main channel has been formulated and steps have been taken to develop the proposed Chunghsing Commercial

Harbour Area in Chichin into Container Terminal No. 4. In addition, a transshipment centre was established to develop container and bulk cargo transshipment business in 1983. Besides, two additional container terminals are scheduled to be built (Kaohsiung Harbour Bureau, 1986) (see Figures 3-2 and 3-3).

According to the estimates proffered by the Kaohsiung Harbour Bureau, when all of these projects are completed, the total annual volume of cargo handling of the port will be 150 million tons; a substantial increase over the 100 million tons of cargo recorded in 1986 (Kaohsiung Harbour Bureau, 1986). Kaohsiung is expected to become one of the top international seaports in the world in terms of freight handled and physical size in the near future. As a matter of fact, Kaohsiung Harbour now is already among the top five largest container transshipment centres in the world, and will soon become the leading bulk commodities transshipment centre in Asia (Kaohsiung City Government, 1984).

Besides building on inherited port installations the government also put much emphasis on the expansion of the existing industrial fabric. For instance, during the first Four-year Economic plan implemented in 1953, Kaohsiung city was classified as the centre of state-induced economic development. In pace with the enlargement projects of Kaohsiung harbour and the rapidly increasing trade with foreign countries following from the export production strategy enacted after the 1960s, industrial investments

Fig. 3-3: Location of Port of Kaohsiung and Affiliate Harbours



Source: Kaohsiung Harbour Bureau (1986)

increased at a fast rate, especially in respect of the petro-chemical, heavy, and export-oriented light industries. Since Taiwan basically lacks the raw material for petro-chemical and heavy industries, a number of wet and dry bulk materials (e.g. petroleum, iron ore, and coal) for the most part are imported. As a result, a place (or city) with excellent harbour facilities has usually an excellent locational advantage for the development of those industries. It is therefore not altogether surprising that Kaohsiung has become the largest industrial centre --- especially for heavy and petro-chemical industries --- in Taiwan. Unlike the situation applying during the Japanese occupation, industrial developments in Kaohsiung city after World War II are not limited to Kaohsiung city proper, but have reached far beyond it to the neighbouring towns and hsiangs in Kaohsiung county; i.e. to the so-called 'Kaohsiung Metropolitan Area' as designated by some researchers. This district includes Kaohsiung city, Fengshan city, Niaosung hsiang, Jenwu hsiang, Tashe hsiang, Chiaotou hsiang, Linyuan hsiang, Taliao hsiang, Tzukuan hsiang, and Tashu hsiang (e.g. the Committee of Transportation, Ministry of Communication, 1984; Lai and Chen, 1986; and Wu, 1988). To take industrial districts, which are definitely a significant index for industrial development, as an example, there are 12 major industrial districts within the Kaohsiung Metropolitan Area. These are: Kaohsiung Export Processing Zone, Nantze Export Processing Zone, Kaohsiung

Linhai Industrial District (including four phases of development), Fengshan Motorcar Repairs Industrial District, Linyuan Petro-chemical Industrial District, Tafa Industrial District, Jenwu Petro-chemical Industrial District, Tashe Petro-chemical Industrial District, Tashe Expansion Petro-chemical Industrial District, and Yungan Industrial District. Moreover, two additional industrial districts have also been set up in Pingtung county, beyond the limit of the Kaohsiung Metropolitan Area; namely, Pingtung Industrial District and Neipu Industrial District (see Table 3-1).

Based on the data published by the Industrial Development Bureau (1986), there are 72 industrial districts which have been already developed in Taiwan. Of that number, 62 are public investments and 10 private investments (note: the different phase of the same industrial site is counted here as a distinct 'district'). In terms of the percentage of the total number of industrial districts, Kaohsiung area does not possess a very significant proportion ---only 22.58 per cent of the total number of the public-invested industrial districts and 19.44 per cent of the total industrial districts. However, in terms of the percentage of the total area, Kaohsiung area plays a very significant role in the spatial distribution of industrial districts. It embraces 36.15 per cent and 33.76 per cent of the total area of the public-invested industrial districts and that of the total industrial districts respec-

Table 3-1 The Industrial Districts Surrounding Kaohsiung City

Name of Districts	Location	Area(ha)	Nature	Period of Development
(1) Kaohsiung Linhai I.D. Phase 1	Kaohsiung city	149	general	Jun. 1963-Jan. 1965
(2) Kaohsiung Linhai I.D. Phase 2	Kaohsiung city	208	general	Mar. 1968-Jan. 1972
(3) Kaohsiung Linhai I.D. Phase 3 & 4	Kaohsiung city	1,648	general	Jun. 1972-Det. 1977
(4) Kaohsiung EPZ	Kaohsiung city	66.30	general	Jun. 1963-Jun. 1965
(5) Nantze EPZ	Kaohsiung city	88.05	general	July. 1972-Aug. 1973
(6) Jenwu I.D.	Kaohsiung county	21	petrochemical	Aug. 1970-Jun. 1971
(7) Tashe I.D.	Kaohsiung county	61	petrochemical	Jun. 1970-Jan. 1971
(8) Tashe I.D.	Kaohsiung county	54	petrochemical	Jun. 1974-Dec. 1975
(9) Fengshan I.D.	Kaohsiung county	11	auto. repairs	Apr. 1973-Jun. 1974
(10)Yungan I.D.	Kaohsiung county	73	general	Sep. 1973-Dec. 1975
(11)Linyuan I.D.	Kaohsiung county	388	petrochemical	Oct. 1973-Dec. 1975
(12)Tafa I.D.	Kaohsiung county	391	general	Oct. 1975-Jun. 1978
(13)Pingtung I.D.	Pingtung county	156	paper & general	Nov. 1973-Dec. 1975
(14)Neipu I.D.	Pingtung county	99	general	Nov. 1980-Feb. 1984

(Source; Industrial Development Bureau, Ministry of Economic Affairs (1986): The Development of Industrial Districts in Taiwan, ROC.)

tively. In other words, over one-third of the total industrial districts in Taiwan are concentrated in the area surrounding Kaohsiung city, especially in the Kaohsiung Metropolitan Area. Another characteristic of the industrial districts in Kaohsiung area is their large scale. For instance, Kaohsiung Linhai Industrial District, which has a total area of 2,005 ha (149 ha, 208 ha, and 1,648 ha for phase 1, phase 2, and phases 3 and 4 respectively), is the largest in Taiwan; more than four times greater than the second largest, the Northern Special Area Industrial District in Taoyuan county, which has a total area of only 478 ha. Finally, the nature of the industrial districts in Kaohsiung area is also very special. Generally speaking, most of the activities in the area consist of petro-chemical and heavy industries. Of the six petro-chemical industrial districts in Taiwan, no less than four are to be found in the Kaohsiung area. Besides, there exists at Nantze, Kaohsiung city, the largest oil-refinery owned by the state monopoly, the Chinese Petroleum Corporation. Equally impressive, Kaohsiung Linhai Industrial District is the largest heavy industrial centre in Taiwan; and the majority of the most significant heavy industry corporations in Taiwan are located there, including the China Steel Corporation, China Shipbuilding Corporation, Taiwan Machinery Manufacturing Corporation, Taiwan Alkali Corporation, and the Taiwan Aluminum Corporation. In terms of number of factories, the combined machinery, metal, iron & steel,

electricity and electronic, and chemical industries comprise 53.3 percent of the total manufactures in Kaohsiung metropolitan area (Wu, 1987). This accords the city a unique place in the island's industrial fabric. For instance, of the total manufacturing activities in Taiwan in 1966, the light and heavy industries constituted 58 percent and 42 percent respectively; but in Kaohsiung city the equivalent ratios were 12.7 percent and 87.3 percent . The situation shifted to a more balanced one later. Nevertheless, even in 1981, the heavy industries still comprised 69.6 percent of the total manufacturing in Kaohsiung city (Lee, 1985; Wu, 1987).

With the rapid development of manufacturing activities and the expansion of harbour facilities and trade, Kaohsiung city has become a centre of gravity for employment opportunities and has attracted a strong in-flow of migrants from all parts of Taiwan, especially southern Taiwan and the Pescadoes (or Penghu county, a group of about 64 small islands located in the Taiwan Strait southwest of the main island of Taiwan). As a result, Kaohsiung city has undergone a rapid urban growth in the past two or three decades. In 1961 the population of Kaohsiung city did not exceed 500,000, but 28 years later, i.e. in 1979, the population had surpassed one million, making the city the second municipality in Taiwan. From Table 3-2 it is evident that during the period of 1966-1976 the average annual growth rate of Kaohsiung city proper was the most vibrant;

in fact, about two to three times that of the Taiwan area as a whole. In the succeeding period of 1972-1976, the average annual growth rate of Kaohsiung city proper slowed down and was surpassed by that of its metropolitan area. Obviously, this occurrence was occasioned by the sprawl of urban growth from the city proper to the further suburban or outlying areas. After 1977, the average annual growth rate of population diminished both for Kaohsiung city proper and the metropolitan area, but especially for the former. In fact, during the 1981-1985 period, the average annual growth rate of Kaohsiung city proper was less than that of the Taiwan area as a whole. This is probably because, first, Kaohsiung city proper and, to a lesser extent, the Kaohsiung Metropolitan Area, have been saturated and have little room left for more immigrants; an outcome producing more stronger push factors than pull factors for the migration process. Second, with improved transportation, the people living in the surrounding rural areas are not compelled to move to Kaohsiung city just to work there. They can easily commute between their working places in Kaohsiung city or metropolitan area and their residences in the more distant hometowns. Wu's (1982) study of Kaohsiung and Nantze Export Processing Zones revealed that their labour supply mostly came from the surrounding Kaohsiung county, Pingtung county, and, to a lesser extent, Tainan county, with a fairly high proportion of commuting workers. Third, the decentralization of industries from Kaohsiung city and

metropolitan area to the further outlying rural areas has provided the local population with employment opportunities other than agriculture.

In sum, the most significant developments in the Kaohsiung area after World War II are: (1) the enlargement and improvement of harbour facilities and the rapid developments of manufacturing and commercial activities; (2) the rapid urban sprawl of the city which has led to the metropolitanization of Kaohsiung; and (3) the structural changes of industries and the redistribution of population resulting from the development of rapid urbanization and industrialization. All of these developments are not only limited to Kaohsiung city and its metropolitan area, but also have significant impacts on the immediately surrounding hinterland; that is to say, Kaohsiung and Pingtung counties. These will be discussed in more detail, as follows.

3.4 Detailed Changes in the Hinterland

From Table 3-3, it is clear that from 1978 --- the year when Shiaokang area of Kaohsiung county was incorporated into Kaohsiung city and the latter became a municipality administratively belonging to the Executive Yuan of the central government --- to 1988, the Kaohsiung Metropolitan Area had the fastest growth rate of population. If the Kaohsiung city proper is excluded, the remaining Kaohsiung Metropolitan Area experienced an even higher growth rate of

Table 3-2 The Annual Increase Rates of Population unit : percentage

Years	Taiwan Area	Southern Region	Kaohsiung Metro.	Kaohsiung city
1967	2.62	2.14	5.02	5.44
1968	2.39	2.43	5.54	6.14
1969	3.02	4.94	6.44	6.83
1970	2.90	2.03	6.12	6.43
1971	2.27	1.78	4.85	5.31
1972	2.07	1.39	4.41	4.55
1973	1.88	1.23	4.18	3.83
1974	3.24	1.35	6.22	5.35
1875	1.40	1.34	3.44	2.83
1976	2.22	1.48	2.41	2.31
1877	1.85	1.13	2.78	2.35
1878	1.92	1.16	3.04	2.47
1979	2.01	1.49	4.06	3.50
1980	1.86	1.25	3.17	2.48
1981	1.86	1.14	2.36	2.11
1982	2.01	1.20	2.30	1.69
1983	1.17	1.00	1.78	1.09
1984	1.49	0.89	1.75	1.85
1985	1.29	0.68	1.50	1.38
Ave. Growth Rate				
1966-1971	2.79	2.80	6.35	7.12
1972-1976	2.26	1.38	4.31	3.77
1977-1980	1.97	1.32	3.54	2.90
1981-1985	1.55	0.95	1.88	1.54

(Source: Calculated based on the data from Taiwan-Fukien Demographic Fact Book, ROC, published by Ministry of the Interior, ROC)

population; i.e. some 24.36 per cent. It is quite logical to surmise that, as mentioned above, the development of Kaohsiung city proper was becoming saturated at this time and not much room remained for residential uses. Furthermore, the economic growth and the rising of living standards demanded much more space for commercial and public land-uses in Kaohsiung city which, owing to its excellent central-place location, offered a great potential market encompassing the city proper as well as the enlarged surrounding hinterland. Therefore, some residential land-uses

were transformed into commercial land-uses in the city proper. All of these forces effected the dispersal of the residential zones from Kaohsiung city to the immediate surrounding hinterland.

The trend was reinforced through the spreading of industrial estates in the metropolitan area. As alluded to above, over half of the industrial districts in Kaohsiung area are located outside the Kaohsiung city proper and mostly in the Kaohsiung Metropolitan Area. The sites in question are the Jenwu, Tashe, Linyuan, Tafa, Fengshan, Yungan, Pingtung and Neipu Industrial Districts. On the one hand, industrial development in the surrounding areas of Kaohsiung city provided the local people with job opportunities while sufficing, on the other, to attract more immigrants from remoter parts of the study area and other parts of Taiwan. If look at the industrial-urban and rural settlements of the study area, the situation is clearer. In Kaohsiung county, the settlements which are included as a part of the Kaohsiung Metropolitan Area had in general the fastest population growth rate --- all over 10 per cent. Places outside the metropolitan area which shared high growth rates, such as Kangshan town, Yenchao hsiang, Alien hsiang, and Luchu hsiang, are mostly located along or near the corridor between Kaohsiung city and Tainan city. At the other extreme, the places recording high negative population the rate of change, such as Liukuei hsiang, Chiahien hsiang, Shanlin hsiang and Neimen hsiang, are all located

in mountainous territory at the remote periphery of the study area. One special case concerns both Chishan town and Meinung town which were in fact losing population during the period of 1979 to 1988 (recording high negative rates of -10.45 per cent and -9.46 per cent respectively). This situation stems from the fact that both towns are located near the piedmont area far from Kaohsiung city, which is basically an agricultural area famous for fruit plantations,especially those growing bananas. They basked in a golden time when the export of bananas to Japan was buoyant during the 1960s and 1970s. However, since then, the export of bananas to Japan has decreased greatly for a variety of reasons, and this outcome has definitely been detrimental to the economic development of the Chishan and Meinung areas. Although the growing of bananas is gradually being replaced by that of tobacco in the Meinung area, the situation has scarcely improved and the district remains impaired by its somewhat remote location from the main urban area. The place registering the largest negative rate of population change is Tienliao hsiang (-23.61), a zone falling largely into topography of the 'badland' category, unsuitable for agricultural and other landuses.

As to the Pingtung plain, its population growth rate during the 1979-1988 period was in general quite low; certainly not comparable to that of the Kaohsiung Metropolitan Area and the Kaohsiung county part of the study area.

Table 3-3 The Number and Growth Rate of Population of the Study Area (1979-1988)

Places	No. of Population (1) 1979	(2) 1988	No. of Increase (3)=(2)-(1)	Growth Rates (3)/(1) %
(1) Fengshan c(*)	204,865	282,352	77,487	37.82
(2) Kangshan T	76,524	82,429	5,905	7.71
(3) Chishan T	52,915	47,388	-5,527	-10.45
(4) Meinung T	56,072	50,768	-5,304	-9.46
(5) Linyuan H (*)	52,787	59,725	6,938	13.14
(6) Taliao H (*)	78,838	88,528	9,690	12.29
(7) Tashu H (*)	41,234	43,090	1,856	4.50
(8) Jenwu H (*)	25,892	34,109	8,217	31.74
(9) Tashe H (*)	19,358	24,391	5,033	26.00
(10)Niaosung H (*)	19,729	26,782	7,053	35.75
(11)Chiatou H (*)	31,809	35,759	3,950	12.42
(12)Yenchao H	29,014	31,691	2,677	9.23
(13)Tienliao H	13,748	10,502	-3,246	-23.61
(14)Alien H	25,883	28,970	3,087	11.93
(15)Luchu H	46,017	50,293	4,276	9.29
(16)Hunei H	24,326	25,483	1,157	4.76
(17)Chiating H	32,336	33.040	705	2.18
(18)Yungan H	10,425	11.031	606	5.81
(19)Mito H	21,307	21,289	-18	-0.08
(20)Tzukuan H (*)	33,563	37,119	3,556	10.60
(21)Liukuei H	21,273	18,687	-2,586	-12.16
(22)Chiahsien H	10,466	9,473	-993	-9.49
(23)Shanlin H	17,061	14,298	-2,763	-16.19
(24)Neimen H	21,293	18,798	-2,495	-11.72
(25)Pingtung C	185,142	206,991	21,849	11.80
(26)Chaochou T	52,010	54,549	2,539	4.88
(27)Tungkang T	43,807	47,039	3,232	7.38
(28)Wantan H	47,764	49,077	1,313	2.75
(29)Changchih H	27,702	27,106	-596	-2.15
(30)Linlo H	11,142	10,860	-282	-2.53
(31)Chiuju H	21,046	21,062	16	0.08
(32)Likang H	26,453	26,318	-135	-0.51
(33)Yenpu H	27,295	27,510	215	0.79
(34)Kaoshu H	35,451	30,900	-4,551	-12.84
(35)Wanluan H	27,167	25,202	-1,965	-7.23
(36)Neipu H	59,243	62,666	3,423	5.78
(37)Chutien H	20,827	19,260	-1,567	-7.52
(38)Hsinpi H	14,454	12,937	-1,517	-10.50
(39)Fangliao H	33,722	31,853	-1,869	-5.54
(40)Hsingyuan H	39,467	41,737	2,270	5.75
(41)Kanting H	14,356	13,787	-569	-4.00
(42)Linpien H	22,910	23,466	556	2.43
(43)Nanchou H	15,154	14,237	917	-6.05
(44)Chiatung H	26,912	25,391	-1,521	-5.65
Kaohsiung city (*)	1,172,977	1,362,086	189,109	16.12
Kaohsiung county	966,734	1,085,995	119,261	12.34
Pingtung county	752,024	771,888	19,864	2.64
Kaohsiung Metro.	1,681,052	1,993,941	312,889	18.61
Kaohsiung Metro. excluding Kaohsiung city	508,075	631,855	123,780	24.36

Source : Compiled and calculated from "The Statistical Abstracts of Kaohsiung Municipality, Kaohsiung county, and Pingtung county", published by Bureau of Budget, Accounting and Statistics (of Kaohsiung city government, Kaohsiung county government and Pingtung county government).

P.S. : (1) The values for Kaohsiung and Pingtung counties are just for the study area, excluding the aborigine reserve hsiangs and the Hengchun Peninsula.
(2) (*) indicates that the settlement is included in the Kaohsiung Metropolitan Area.
(3) The figures for growth rates are rounded.

As a rule, the places with high growth rates are those which are located near the Kaohsiung Metropolitan Area, such as Pingtung city, Chaochou town, Tungkang town, Neipu hsiang and Hsingyuan hsiang. Among them, Pingtung city, Chaochou town and Tungkang town are urban places, and Hsingyuan hsiang is an immediate neighbour of Linyuan which belongs to the Kaohsiung Metropolitan Area. As to Neipu hsiang, though it is not so close to the Kaohsiung Metropolitan Area as Hsingyuan hsiang, there is an industrial district within its borders. With the exception of these places, the settlements of Pingtung county experienced either negligible or negative rates.

The structural changes of industries in the study area during the 1977-1988 period showed a somewhat similar pattern to the changes in population growth rates. Some significant points may be elicited from Table 3-4. First of all, the percentage shares of the total employment for primary industry for each settlement during the period of 1979-1988 were in general all decreasing, while those for secondary industry were increasing. Second, the increase rates applying to the secondary industry were the fastest within the Kaohsiung Metropolitan Area, although 'outliers' occurred in Linyuan hsiang, Tashe hsiang and Fengshan city, followed by Alien hsiang, Hunei hsiang, Chiating hsiang and Wanluan hsiang. Of these, Alien, Hunei and Chiating are all located close to the city of Tainan, while Wanluan is near the Kaohsiung Metropolitan Area. Third, almost all

the places which are remote from either Kaohsiung city or Tainan city revealed the lowest rates of increase. Liukuei and Chiahsien stand out in this respect. Fourth, generally speaking, the settlements occupying Pingtung area had much lower rates of increases for the secondary industry than those falling in the Kaohsiung area. In a word, the distance to Kaohsiung city has seemingly played a significant role in the structural changes of the settlements in the study area. Of course, there are some exceptions. For example, Yenchao and Tienliao are not too far removed from either Kaohsiung city or Tainan city, but both registered very low rates of increase. Similarly, Linyuan and Linpien (Pingtung county), despite being very close to the Kaohsiung Metropolitan Area, exhibited fairly low values. These may result from factors other than the distance from Kaohsiung city, such as, unfavourable topography, inadequate transportation, and other social or historical factors. If look at the distribution of the manufacturing activities alone, the situation is quite similar to that of the secondary industries.

Since manufacturing activities constitute the absolute majority of the percentage share of the secondary industries, this finding is not unexpected. As shown in Table 3-5, in terms of the percentage share of total employment in manufacturing for 1979 and 1987, the settlements of Kaohsiung county, in general, displayed much higher values than those found in Pingtung county. Again, the occupants

Table 3-4 The Industrial Distribution of the Study Area unit : percentage

Places	Primary Industry			Secondary Industry			Tertiary Industry		
	(1)1979	(2)1987	(2)-(1)	(3)1979	(4)1987	(4)-(3)	(5)1979	(6)1987	(6)-(5)
(1)Fengshan C(•)	6.4	7.9	1.5	34.1	36.6	2.5	59.5	55.5	-4.0
(2)Kangshan T	21.8	19.4	-2.4	26.2	33.6	7.4	52.0	47.0	-5.0
(3)Chishan T	43.4	42.6	-0.8	19.7	18.0	-1.7	36.9	39.3	2.4
(4)Meinung T	64.5	49.9	-14.6	12.4	23.6	11.2	23.1	26.5	3.4
(5)Linyuan H(•)	31.0	22.0	-9.0	26.6	25.5	-1.1	42.4	52.5	10.1
(6)Taliao H(•)	30.3	21.1	-9.2	31.1	43.0	11.9	38.5	35.9	-2.6
(7)Tashu H(•)	46.4	41.9	-4.5	21.5	22.2	0.7	32.1	35.9	3.8
(8)Jenwu H(•)	22.7	14.9	-7.8	41.0	53.9	12.9	36.2	31.2	-5.0
(9)Tashe H(•)	40.6	33.1	-7.5	27.5	31.0	3.5	31.9	35.9	3.8
(10)Niaosung H(•)	41.3	26.5	-14.8	27.1	35.0	7.9	31.6	38.3	6.7
(11)Chiaotou H(•)	20.6	17.3	-3.3	30.0	50.1	20.1	49.4	32.6	-16.8
(12)Yenchao H	50.8	47.8	-3.0	26.1	26.2	0.1	23.1	26.0	2.9
(13)Tienliao H	75.2	75.0	-0.2	11.5	11.6	0.1	13.3	13.3	0.0
(14)Alien H	56.2	32.3	-23.9	20.8	40.0	19.2	23.0	27.6	4.6
(15)Luchu H	43.8	36.0	-7.8	24.2	26.0	1.8	32.0	38.0	6.0
(16)Hunei H	31.3	19.1	-12.2	24.4	42.6	18.2	44.2	30.2	-6.0
(17)Chiating H	42.3	26.0	-16.3	20.1	45.0	24.9	37.5	29.0	-8.5
(18)Yungan H	32.4	38.7	6.3	32.4	38.0	5.6	35.2	23.3	-11.9
(19)Mito H	47.2	34.0	-13.2	28.0	36.8	8.8	24.7	29.2	4.5
(20)Tzukuan H(•)	28.6	21.0	-7.6	38.9	45.7	6.8	32.5	33.3	0.8
(21)Liukuei H	53.8	52.1	-1.7	21.7	14.3	-7.6	24.5	33.7	9.2
(22)Chiahsien H	62.8	58.0	-4.8	12.5	12.8	0.3	24.6	29.2	4.6
(23)Shanlin H	60.6	44.5	-16.1	18.2	23.9	5.7	21.2	31.6	10.4
(24)Neimen H	77.0	68.8	-8.2	7.8	13.3	5.5	15.1	17.9	2.8
(25)Pingtung C	17.8	16.5	-1.3	26.7	31.6	4.9	55.4	51.9	-3.5
(26)Chaochou T	42.1	39.2	-2.9	18.1	20.0	1.9	39.8	40.7	0.9
(27)Tungkang T	39.7	38.1	-1.6	19.8	22.2	2.4	40.5	39.7	-0.8
(28)Wantan H	64.3	52.5	-11.8	14.3	23.3	9.0	21.4	24.2	2.8
(29)Changchih H	61.7	46.1	-15.6	15.6	25.6	10.0	22.7	28.3	5.6
(30)Linlo H	64.1	59.6	-4.5	13.6	15.9	2.3	22.3	24.6	2.3
(31)Chiuju H	74.0	69.0	-5.0	10.2	13.2	3.0	15.8	17.7	1.9
(32)Likang H	63.2	63.0	-0.2	9.4	9.2	-0.2	27.3	27.8	0.5
(33)Yenpu H	76.5	60.7	-15.8	9.3	19.1	9.8	14.2	20.2	6.0
(34)Kaoshu H	79.1	75.0	-4.1	4.6	7.0	2.4	16.2	18.0	1.8
(35)Wanluan H	59.7	45.8	-13.9	13.4	23.8	10.4	26.9	30.4	3.5
(36)Neipu H	55.4	51.8	-3.6	19.0	22.8	3.8	25.6	25.4	-0.2
(37)Chutien H	50.6	44.7	-5.9	25.9	28.6	2.7	23.5	26.7	3.2
(38)Hsinpi H	71.2	54.7	-16.5	12.3	26.8	14.5	16.5	18.5	2.0
(39)Fangliao H	57.1	40.0	-17.1	13.2	24.1	10.9	29.7	35.9	6.4
(40)Hsingyuan H	55.2	47.6	-7.6	25.9	24.9	-1.0	18.9	27.5	8.6
(41)Kanting H	67.8	56.6	-11.2	13.7	21.3	7.6	18.5	22.1	3.6
(42)Linpien H	49.6	41.0	-8.6	15.8	17.8	2.0	34.6	41.2	6.6
(43)Nanchou H	50.7	45.6	-5.1	20.8	21.5	0.7	28.5	32.9	4.4
(44)Chiatung H	55.5	54.3	-1.2	19.0	18.1	-0.9	25.5	27.0	1.5

Source : 1979 and 1987 Taiwan)Fukien Demographic Fact Book, ROC., published by the Ministry of Interior Affairs.
P.S. : (•) indicates that th settlement is included in the Kaohsiung metropolitan area.

of the Kaohsiung Metropolitan Area recorded the highest values, while some other places with fairly high values, such as Luchu, Hunei and Chiating, are either located along the development corridor between Kaohsiung city and Tainan city, or positioned close to Tainan city.

One thing which must be emphasized here is that the high values for the secondary industries and manufacturing may have arisen from two diverse situations. In the first place, it may result from the successful implementation of rural industrialization; that is to say, from effecting a policy of 'work-to-workers'. On the whole, the infrastructure available in Taiwan's rural areas is quite excellent; better overall than that of other developing countries. It is therefore not overly difficult for the government to implement a 'rural industrialization' policy, especially for those rural areas close to urban places. This policy was helpful in stabilizing the population of the rural areas. Luchu hsiang is a case in point. Secondly, the high values may arise from the commuting of workers to factories in other places. With improved transportation and, particularly, the increasing ownership of motorcycles and motorcars by the rural population, commuting becomes easier on account of the shorter time-distance. Hunei and Chiating hsiangs are two spectacular examples of this sort. Both places are very close to Tainan city and serve as bases for easy commutation to Tainan. Therefore, while the

Table 3-5 The Percentage of the Total Employment Engaged in the Manufactures for the Study Area. unit : %

Places	(1)Fengshan C(•)	(2)Kangshan T	(3)Chishan T	(4)Meinung T	(5)Linyuan H(•)	(6)Taliao H(•)
1979	27.6	22.6	16.3	10.1	21.4	26.0
1987	30.0	30.3	15.0	20.1	21.7	35.8
% Increase	2.4	7.7	-1.3	10.0	0.3	9.8

Places	(7)Tashu H(•)	(8)Jenwu H(•)	(9)Tashe H(•)	(10)Niaosung H(•)	(11)Chiaotou H(•)	(12)Yenchao H
1979	17.7	35.4	23.8	21.1	25.6	20.8
1987	19.1	47.3	27.1	29.8	41.3	22.1
% Increase	1.4	11.9	3.3	8.7	15.7	1.3

Places	(13)Tienliao H	(14)Alien H	(15)Luchu H	(16)Hunei H	(17)Chiating H	(18)Yungan H
1979	10.5	17.1	21.2	21.3	17.8	24.4
1987	10.5	32.9	22.4	36.5	41.4	29.7
% Increase	0.0	15.8	1.2	15.2	23.6	5.3

Places	(19)Mito H	(20)Tzukuan H(•)	(21)Liukuei H	(22)Chiahsien H	(23)Shanlin H	(24)Neimen H
1979	17.2	31.5	17.0	11.0	15.3	6.6
1987	27.1	37.0	11.9	11.0	18.8	11.3
% Increase	9.9	5.5	-5.1	0.0	3.5	4.7

Places	(25)Pingtung C	(26)Chaochou T	(27)Tungkang T	(28)Wantan H	(29)Changchih H	(30)Linlo H
1979	19.6	13.1	15.5	10.6	12.2	11.8
1987	24.7	15.4	18.0	17.0	21.5	14.3
% Increase	5.1	2.3	2.5	6.4	9.3	2.5

Places	(31)Chiuju H	(32)Likang H	(33)Yenpu H	(34)Kaoshu H	(35)Wanluan H	(36)Neipu H
1979	8.0	6.7	7.4	3.6	11.4	15.9
1987	9.6	6.7	14.8	5.7	19.8	20.0
% Increase	1.6	0.0	7.4	2.1	8.4	4.1

Places	(37)Chutien H	(38)Hsinpi H	(39)Fangliao H	(40)Hsingyuan H	(41)Kanting H	(42)Linpien H
1979	22.0	9.4	8.5	18.7	9.9	10.2
1987	24.0	23.6	17.8	17.9	15.7	12.0
% Increase	2.0	14.2	9.3	-0.8	5.8	1.8

Places	(43)Nanchou H	(44)Chiatung H
1979	15.8	15.3
1987	16.5	14.0
% Increase	0.7	-1.3

Source : 1979 and 1987 Taiwan)Fukien Demographic Fact Book, ROC. published by the Ministry of Interior Affairs.
P.S. : (•) indicates that the settlement is included in the Kaohsiung metropolitan area.

number of factories hardly increased in both places, they each enjoyed fairly high percentage shares of employment in manufacturing. Nevertheless, it should be stressed that sometimes the high increase rate of employment in secondary industries or manufacturing failed to guarantee the stabilizing of population from outmigration. After all, many factors other than job opportunities, for example, urban amenities and education quality, may motivate rural residents to forsake their homes for the larger urban centres.

3.5 Summary

In summary, by virtue of its harbour, its excellent location, its suitable geographical environment for urban and industrial development, and its historical development, Kaohsiung city has grown to become one of the two most significant urban-industrial bases in Taiwan. Compared with Keelung harbour, another significant port in the north, Kaohsiung harbour has enjoyed much more potential for development. Although Keelung harbour, which was built in the graben of a fault, is an excellent natural harbour, the water acreage of the port is too small to fully accommodate expansion. Moreover, the area surrounding Keelung city is mountainous with steep slopes and devoid of flat land for urban and industrial developments. Unlike the hinterland of Kaohsiung city, which is a productive agri-

cultural area, the hinterland of Keelung city consists in the main of sparsely populated mountain villages living off relatively poor agricultural products. Although some places are endowed with minerals, the deposits of the minerals are so poor both in quality and quantity as to render the majority of the mines redundant. The survivors are poorly managed under the government's protection. Finally, due to the influences of landform and geographical location, the distribution of rainfall in the Keelung area is constant throughout the year, without any dry season. In fact, the rainfall in the area is so plentiful that Keelung harbour was appointed the nickname of 'raining harbour'. What is worse, during the northeast monsoon season in winter, the wind is in general much stronger than in Kaohsiung. Evidently, the climate of the Keelung area is not so suitable to port operations, and the urban and industrial developments that stem from them, as is that obtaining in Kaohsiung. Furthermore, until recently, the hinterland surrounding Kaohsiung Municipality was basically a homogeneous area; that is, a flat plain turned over to agricultural production. It is therefore an ideal place to test the development concepts resting on the IUH and growth centre theories, and it is to that purpose that the remainder of the thesis is dedicated.

Chapter 4
Appropriate Methodologies for Discerning the Patterns of Development

4.1 Introduction

Generally speaking, all 'core-periphery' models, no matter whether they owe their genesis to the IUH or to the growth centre theory, have a unifying characteristic; that is, they are based on a common assumption that development will be a function of distance from the core. Under this basic assumption, the results of 'positive' and 'negative' impacts will create, in the vicinity of the core, a variety of development surfaces involving a formation of clusters and/or peaks of development and the attendant gradation of development away from them. Elaborate configurations have been concocted out of this basic expectation. According to Friedmann (1966), for example, the development surface will be roughly divided into a dynamic centre and a stagnating periphery. He further proposed four regions surrounding the centre. Core regions, which are concentrated metropolitan economies with a high capacity for innovation and change, constitute the first type. They exist as nested hierarchies from the national metropolitan centre down to the hamlet. Usually they have the characteristics of dominance writ large. Upward-transitional regions, meanwhile, are immediately peripheral to the core, and suitable

for resource exploitation and development. In other words, they are settled areas with growth potential and, like core regions, have net immigration and increasing capitalization of agriculture. A special type of upward- transitional region is the development corridor which exists between two major cities. For their part, resource-frontier regions are peripheral areas of new settlement. They usually display a great potential in either agricultural or in mineral working associated with immigration and small new towns. Finally, downward-transitional regions are stagnating or declining areas. They tend to be located in areas remote from the core. These divisions are notoriously difficult to establish on the ground, in part because of the difficulty of settling the geographical scale question and partly on account of the problems attendant on measuring development. In respect of the latter, there are four fundamental dimensions to contemplate: socio-cultural patterns, location of economic establishments, information diffusion and political patterns (de Souza and Foust, 1979, p.582).

It is against this backdrop that the present study examines theories relating to the spatial form and extent of the impact of Kaohsiung municipality, demonstrably an industrial-urban centre in southern Taiwan. On synthesiz-

ing all the 'core-periphery' models mentioned previously, it is possible to envisage a variety of development configurations lodged within the grand hypothesis that suggests declining levels of development as distance from Kaohsiung city increases. These are expressly stated as four aberrant patterns.

(1) A development corridor may exist between Kaohsiung municipality and Tainan city to the north of Kaohsiung, the two largest cities in southern Taiwan.

(2) It may be conceivable that a development surface occurs which is entirely unrelated to the distance from Kaohsiung city. In other words, the development of places in the study region may be related to factors other than those influenced by accessibility to Kaohsiung city.

(3) Equally, there may emerge surfaces with a variety of different forms which show development levels to be rising away from Kaohsiung municipality. Such configurations would show that development is inversely associated with proximity to the centre and would contradict the normal assumptions underlying the core-periphery concept.

(4) Finally, a number of small peaks in the development surface may exist in the study area, even in the zones remote from Kaohsiung city. This reflects the fact that some smaller urban centres may have their own local impact

on the surrounding areas and these small peaks are the spatial manifestations of these (reminiscent, indeed, of Thunen's view of secondary markets distorting the concentric-ring model of agricultural land-uses).

In essence, these four alternative patterns combine to act as the foil to the fundamental relationship that would anticipate. Plainly put, the research hypothesis merely claims that development --- however measured --- should lessen in intensity at a linear (monotonic) rate with distance from the city. This deceptively simple assertion can be conceived as a statistical hypothesis with the contrary possibilities together constituting the null hypothesis. Grafting a statistical element to the thesis, of course, necessitates a discourse on appropriate statistical methods. The rationale for the choice of methods is outlined forthwith.

4.2 Statistical Tools

The methodologies which will be used to analyze the developmental surface of the study area are factor analysis, linear regression, and the coefficient of variation. The first is chosen as the methodology for analyzing the broad functional relationships between variables. The purpose of factor analysis is to interpret the structure within the variance-covariance matrix of a multivariate data collec-

tion. Its primary concern is to simplify and organize large amounts of data in order to clarify the relationships between the measured characteristics, to eliminate redundant variables, and to determine the nature and order of importance of basic dimensions of the data matrix. Because of these useful characteristics factor analysis has become one of the most widely used techniques in geography. Rummel even emphasized that "factor analysis and the complementary multiple regression model are initiating a scientific revolution in the social sciences as profound and far-reaching as that developed by the calculus in physics" (Yeates, 1974, p.207). For the most part, in social science one-to-one causal relationship are rare. In fact, most geographical investigations are of a multivariate nature in that they seek to analyze many attributes measured for different areas. For instance, an attempt to understand the economic development of a region may involve investigation of a series of causally-related variables. This can be done by the stepwise method, that is, 'one-atfer-another' manner, if the number of variables is small. However, in the instance of a large number or cases, the stepwise process will turn out to be tedious, impractical and prone to errors of interpretation. Should this arise, factor analysis capable of considering the multiple varia-

bles simultaneously would be resorted to. As a consequence, factor analysis, along with the other multivariate analyses, "may be applied individually or sequentially to problems concerned with the relationships between geographical characteristics (variables) measured in different areas. They can also be applied to test the validity of regional boundaries, so long as within each region numerical values can be assigned to the attributes of interest" (Mather and Doornkamp, 1970, p.163).

Furthermore, with the progressive acceptance of sophisticated statistical techniques in research, geographers have also become increasingly aware of the inherent difficulties and limitations of some techniques in their application in geography. For instance, the linear multiple regression methodology, which is so popular in social science, is based on a set of premises stipulating that "the variables utilized approximate normality, that they are independent, and that they are fixed" (Romsa et al, 1969, p.344). Unfortunately, most geographical data fail to conform to these assumptions. Although some of the problems of 'normality' and 'independence' of the variables can be overcomed by using logarithmic (or square root) transformations and partial correlations respectively, the problem of multicollinearity, or lack of independence

between variables, still remains as an Achilles' heel of the linear multiple regression model when it is applied in social science and this constraint, by and large, rules out its use in this thesis.

Factor analysis is free of many of the limitations of assumptions mentioned above. This is because factor analysis can automatically overcome these problems during the analytical process. For example, the problem of multicollinearity can be overcome in factor analysis by extracting m orthogonal dimensions from a given set of n variables (where m n). The m dimensions generally represent the majority of the original variance among the n variables. Besides, the problem of 'normality' can be solved during the analysis because the factor scores so generated are normally distributed and may be processed in subsequent analyses as any other normally-distributed data input (Romsa et al., 1969).

These two prominent characteristics of factor analysis enable the technique to be applied to any geographical problem involving many measured properties for each of many units. One obvious scope of the technique, germane to our interests, lies in demarcating the spread of development effects. For instance, Gilbert (1975) used factor analysis to examine one aspect of a growth centre's supposed plan-

ning role; namely, its ability to induce development in surrounding areas, with the case study of the Antioquio region in Colombia. The object of the analysis was to examine the nature of the development-response surface in Antioquio and to establish the existence of the trickle-down effect postulated by growth centre theory.

In sum, it is obvious that the ways in which factor analysis has been applied in geography are mostly based on descriptive ends, but as Gilbert's study demonstrates, the factor analysis may also be used for hypothesis testing. Given such a precedent, factor analysis was selected in this study for the purpose of compiling composite factors from the original variables. As a rule, the factors with eigenvalues greater than one (the conventional criterion for determining the significance of any component) will be chosen as an index of development. As a consequence, each settlement (i.e. hsiang, town and county city) of the study area is accorded values of factor scores for the selected factors. Once this preliminary is accomplished, a preliminary which serves to eradicate multicollinearity as well as deduce composite variables, the object switches to specific hypothesis testing. The linear relationships between 'the distance from each settlement to Kaohsiung city' (measured on the map as the straight line between the CBD of Kaoh-

siung city and the central point of each settlement) and 'the factor scores of the selected factors for each settlement', which are used as the indices of development, are fed into a simple linear regression model. The critical hypothesis can be represented as the following equation:

$$Y = a + bX$$

Where, Y : the set of factor scores for certain settlements.
X : the set of distances from those settlements to Kaohsiung city.
a, b : constants.

Because only a single independent variable is involved, the problems of collinearity plaguing the multiple X model is safely overcome in the relationship. Finally, in order to examine further the spatial inequality of development, the standard coefficient of variation (adjusted to accommodate spatial data) of each variable for all settlements is calculated. The formula is:

$$\text{Coefficient of Variation (Cv)} = \frac{\text{(Standard Deviation)}}{\text{Mean}} * 100$$

Cv provides a ready means of comparison between variables representing different units of measurement.

4.3 Data Compilation and Organization

Before the collection of data, one has to face the

problem of the validity of variables. Any effort to define 'development' will fall prey to a host of difficulties. First of all, that old chestnut returns to haunt us; namely, what is the definition of development? Second, there is little agreement as to specific indicators by means of which development should be measured, although most authors tend to agree that some kind of composite measure is preferable to a single indicator. Third, even when the composites of development have been decided, there is still a question as to how their constituents should be weighted. For instance, should all the variables be treated equally? If not, then, how should the weights be apportioned? Fourth, the problem thrown up by spatial autocorrelation of data is another difficulty which seems endemic to geographical data. For example, the distribution of population is areally contiguous. However, in order to satisfy statistical assumptions, the data for population are always regarded as independent units. The problem is, as Clark et al. (1974, p.267) have pointed out, that "with an arbitrary set of areal units such as enumeration districts, there can be no guarantee that adjacent areas will be independent of each other."

Besides, the availability of data is another challenging problem to most researchers. Even in developed countries

the shortage of data for some kinds of useful information is not uncommon, and this difficulty is obviously compounded in less-developed countries. Furthermore, in most countries, even compiled data banks are not always accessible to the researcher because of confidentiality clauses. In many other cases, data we need are only available for some parts of the study area, or only for some periods of time. To give but one example: in this study, per capita income and average family income, which are supposed to be two significant indices of development in economic terms, are both absent at the hsiang (i.e. rural district) level and available only at the county level. On the other hand, some valuable variables representing the living standards of farm households are available at the hsiang level in the 1969 and 1980 censuses, but not in the 1987 census. Indeed, these same variables of the 1987 census are only available for the county level and not for the hsiang level.

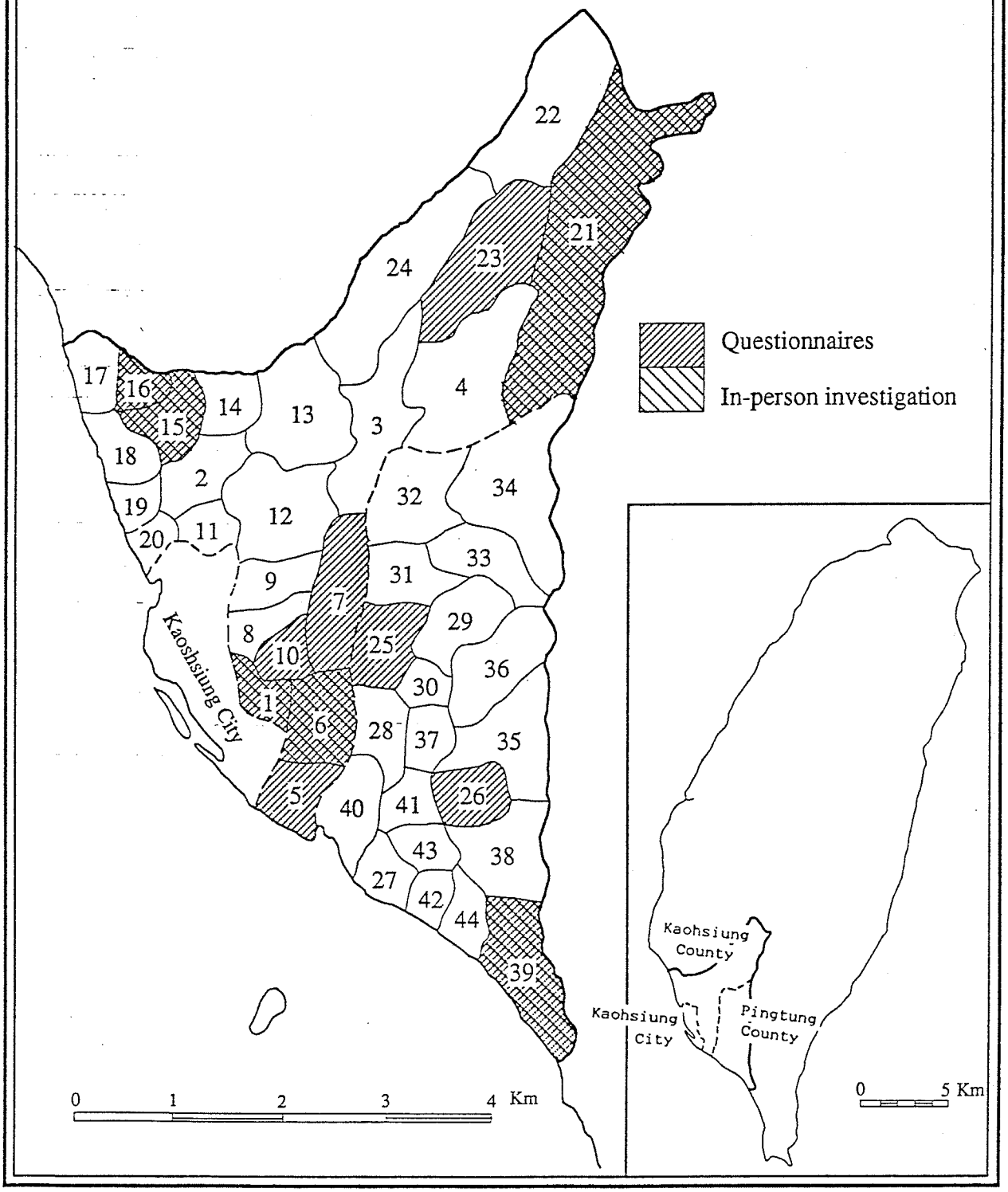
Because of these difficulties, the choice of the variables as indications of development cannot abide by the ideal basis of what consider development ought to embrace. In fact, a serious consideration must be given to reality, in the sense that choices must be to a great extent based on surrogates of what development actually does embrace

rather than real indicators of well-being. In brief, owing to problems of availability, adequacy and reliability, the variables used in this study are necessarily limited in number. For the most part, the data come from two sources --- primary and secondary --- in the manner outlined below.

(1) Primary sources

Data derived from primary sources used in this study had two origins; that is, in-person investigations and questionnaires. Both are based on the family unit, not the person. There were 120 in-person interviews conducted in eight places; namely, Fengshan city, Taliao hsiang, Liukuei hsiang, Luchu hsiang, Hunei hsiang, Fangliao hsiang, Linyuan hsiang and Chaochou town. Among these 120 interviews, some 105 are effective: a response rate of 87.5 per cent. The questionnaires were accomplished with the help of the teachers of the primary and secondary schools in 12 selected places, i.e., Fengshan city, Niaosung hsiang, Tashu hsiang, Taliao hsiang, Luchu hsiang, Linyuan hsiang, Hunei hsiang, Shanlin hsiang, Liukuei hsiang, Fengliao hsiang, Pingtung city and Chaochou town (see Fig 4-1). A total of 1,000 questionnaires were distributed and 785 were returned, with the returning rate equaling 78.5 per cent. Among these 785 returned questionnaires, 740 proved effective. The questionnaires were distributed to the teachers.

Fig. 4-1: The Distribution of the Questionnaires and In-person Investigations



The teachers, for their part, asked the students to take home these questionnaires for their parents' attention before returning them to school. Finally, the teachers forwarded them to me. The questionnaire survey was undertaken during September-October of 1989, while the in-person investigations occurred in August of 1989 (i.e. during the summer vacation, accomplished with the help of 10 university students.

The data obtained from these 845 interviews and questionnaires were reorganized and produced a series of tables, which in combination can be used as a supplementary tool to interpret the developmental patterns of the study area. Basically, the data reorganized from the questionnaires and interviews can be roughly divided into three categories: (1) the data pertaining to the commuting to work, attending high school, and shopping and social activities; (2) the material monitoring out-migration patterns of the places in the study area, and (3) information stressing the circumstances affecting agricultural development, such as the sources of income of the household and the changes in crops and farmland uses.

(2) Secondary sources

Secondary sources can also be divided into two parts: a set of general variables representing population struc-

ture as well as social and economic developments on the one hand, and a set representing the living standard of the farm household on the other. Data for the first group were obtained from the government censuses; namely, Taiwan-Fukien Demographic Censuses, published by the Ministry of Interior Affairs, and the Abstracts of the Statistical Facts of Kaohsiung city, Kaohsiung county and Pingtung county, each published by the Kaohsiung city government, Kaohsiung county government and Pingtung county government. Twelve variables were selected, applying to the years 1971 and 1987. The reason for selecting these two years is that they represent respectively eight years before and after 1979, the year when Kaohsiung city was promoted from provincial city to municipality (i.e. effectively transferring it to the Executive Yuan of the Central Government). It forms a convenient divide (mid-point) between the 1987 census --- the latest available --- and 1971; a year representative of the burgeoning of Kaohsiung's industrialization programmes. These 12 variables encompass:

(1) size of population;

(2) crude birth rate;

(3) percentage of population aged 0-14;

(4) percentage of population aged 15-64;

(5) percentage of population aged over 65;

(6) dependency rate of population;

(7) percentage of the employment force in secondary industry;

(8) percentage of the employment force in secondary industry;

(9) percentage of the employment force in tertiary industry;

(10) in-migration rate,

(11) out-migration rate;

(12)net-migration rate.

In respect of the second group, the living standard of the farm household, there are six variables in all: namely, (1) percentage of the farm households owning a TV set, (2) percentage of the farm households owning a washing machine, (3) percentage of the farm households owning a refrigerator, (4) percentage of the farm households owning a telephone, (5) percentage of the farm households owning a camera and (6) percentage 6 of the farm households subscribing to a newspaper. Data for these six variables apply to the years 1969 and 1980. The 1969 data were obtained from "The Report of 1969 Agricultural Census of Taiwan-Fukien District of the Republic of China" (Vol.16 and vol. 17), published by the Committee on Agricultural and Fishing Censuses, Executive Yuan, while those of 1980 were

drawn from 'The Report on 1980 Agricultural and Fishery Censuses, Taiwan-Fukien, the Republic of China (vol 19 and vol 20), published by the Directorate-General of Budget, Accounting and Statistics, Executive Yuan.

Unfortunately, some valuable variables dealing with access to air-conditioning appliances, VCRs, motorcycle and cars, which were available for 1980, were absent from the 1969 census. This may have arisen because all these variables were insignificant before 1969. For instance, few farm households owned a motorcar during the 1960s or before. Another problem is that in the more recent censuses, i.e. 1987, the same variables were based on different spatial units; that is to say, on the county level instead of the hsiang level. As a consequence, the set of variables indicative of the living standards of the farms households were restricted to two year's censuses, these of 1969 and 1980.

4.4 Summary

The case has been made in this chapter for adopting a statistical approach to testing the validity of IUH and growth centre theories in the context of southern Taiwan. The beauty of these theories lies in the fact that they can be reduced to a simple proposition which accords prime importance to the distance factor. Converted into a cen-

tral research-cum-statistical hypothesis, that proposition maintains that development should diminish at a regular rate (linear fashion) with increasing hinterland isolation from the city of Kaohsiung. Disarmingly simple, the hypothesis must be verified if two underlying theories are to retain any credence. In truth, some allowance is made for deviations from the expected pattern, deviations which together constitute the statistical null hypothesis. A hard core of standard statistical methods were introduced and justified as relevant to the task in hand. Finally, the assembly of data was discussed and the strengths and limitations of the resultant data sets revealed. One must turn to the next chapter in order to gauge the results of analysis.

Chapter 5
Data Analysis

5.1 Brief preliminary

The data described in the previous chapter were subjected to the battery of statistical techniques as promised therein. All that remains to do in this chapter is to lay out the results of that exercise, bearing in mind that the sets of data were analyzed separately. For the set of 12 general variables, factor analysis was first used to discern the dimensions with eigenvalues greater than one for the years of 1971 and 1987. Subsequently, the simple linear regression model was employed in order to demonstrate the relationships between the values of these factors for 44 places of the study area and the distances from these places to Kaohsiung city. At that juncture, the coefficients of variation and Z-Scores were calculated for the years of 1971 and 1987 to elicit changes in the spatial expression of development. Next, the data representing the living standards of farm households were analyzed by the same processes. Finally, as to the data from the interviews and questionnaires, a series of tables will be produced, based on the reorganization of the original data, which are useful as a supplemental tool to aid in the interpretation of the results derived from the analyses of

the secondary data. This is rendered possible owing to the fact that the samples were selected deliberately according to three different zones: (a) a commuting zone which approximately coincides with the Kaohsiung metropolitan area, (b) a zone comprising the remote areas; and (c) the intermediate zone between these two.

5.2 Results Arising From Analysis of the General Variables

(1) Factor analysis

In this study, factor analysis is used to identify patterns of relationships between variables and to gain an idea of spatial variation in development in the study area. The results of the factor analysis for the general variables are expressed below.

(A) The situation in 1971 :

The correlation matrix, as shown in table 5-1, reveals few high positive coefficients. Indeed, only variables 3 (percentage of population aged 0-14) and 6 (dependency rate of population), 5 (percentage of population aged over 65) and 6, 8 (percentage of the employment base in secondary industry) and 9 (percentage of the employment base in tertiary industry), 10 (in-migration rate) and 12 (net-migration rate) appear to be highly correlated with each other. However, there are some combinations of high negative coefficients; that is, variables 3 (percentage of popula-

tion aged 0-14) and 4 (percentage of population aged 15-64), 4 and 6 (dependency rate of population), 7 (percentage of the employment base in primary industry) and 8 (percentage of the employment base in secondary industry); to say nothing of 7 and 9 (percentage of the employment base in tertiary industry). In general, it is quite logical and easy to interpret these highly correlated variables, both positive and negative. For instance, variable 6 (dependency rate of population) exhibits high positive correlation with variables 3 (percentage of population aged 0-14) and 5 (percentage of population aged over 65) because people aged under 14 or over 65 are usually jobless, being either too young or too old to work. Similarly, the revelation that a high percentage of the employment base in secondary industry (i.e. variable 8) is positively correlated with a high per cent of the employment base in tertiary industry (i.e. variable 9) is hardly surprising. It is common sense to suppose that, in contrast to the primary industry, the secondary industry should have a much stronger 'multiplier effect' in creating job opportunities within the tertiary sector. The high correlation between variables 10 (in-migration rate) and 11 (out-migration rate) simply points to a high degree of mobility demonstrated by the population in some places, usually urban places. By extension, the high

net migration rate (i.e. variable 12) stems from the high in-migration rate (i.e. variable 10). On the contrary, variable 4 (percentage aged 15-64) has highly negative correlations with variables 3 (percentage aged 0-14) and 6 (dependency rate of population). This is a corollary of the out-migration of population. Usually, the places containing abundant job opportunities attract an inflow from the population cohorts of age groups spanning the years 15-64 and, thus, display reduced percentages of those aged from 0-14 together with low dependency rates for their populations. By the same token, the percentages of the employment base in primary industry (i.e. variable 7) is usually negatively correlated with situations both of high per cent of the employment base in secondary industry (variable 8) and tertiary industry (variable 9) owing to the sectoral transition mentioned earlier.

Factor analysis produces three important factors that have eigenvalues of more than 1.0, and in combination they account for 86.29 per cent of the total variance. Of the three, Factor 1 alone explains 51.64 per cent of the total variance with an eigenvalue of 5.4, while Factor 2 accounts for 22.89 per cent of the total variance with an eigenvalue of 2.495, and Factor 3 accounts for 11.76 per cent of the total variance with an eigenvalue of 1.346. As shown in

Table 5-2, Factor 1 loads heavily on variables 4 (percentage of population aged 15-64), 8 (percentage of the employment base in secondary industry), 9(percentage of the employment base in tertiary industry), and, to a lesser extent, on variables 10 (in-migration rate), 11 (out-migration rate), and 1 (size of population). Factor 2 loads, in an insignificant degree, on variable 4 and Factor 3 loads heavily on variable 5 (percentage of population aged over 65).

It is obvious that Factor 1 represents a major proportion of the total variance and appears to some extent to capture at least the interlocking nature of the development represented by the 12 general variables. Therefore, focus of attention is concentrated on the interpretation of this particular factor. From Table 5-2 it can be readily observed that there is wide variation in the factor loadings for Factor 1. As just mentioned , variables 4, 8 and 9 have the highest positive values, followed by variables 10 and 11. Besides, variables 6 (dependency rate of population) and 7 (percentage of the employment base in primary industry) have high negative values. This may indicate an unusually high degree of variation of these variables among the 44 places. The results of the coefficient of variation analyses, discussed later, will further examine this

Table 5-1 Correlation Matrix for 12 General Variables for 1971

Variables	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12
V1	1.00	-0.21	-0.29	0.41	-0.33	-0.40	-0.58	0.28	0.63	0.36	0.25	0.29
V2		1.00	0.38	-0.41	0.03	0.39	-0.12	0.19	0.08	0.12	0.06	0.14
V3			1.00	-0.95	-0.22	0.95	0.45	-0.34	-0.44	-0.18	-0.21	-0.29
V4				1.00	-0.08	-0.99	-0.52	0.36	0.52	0.30	0.29	0.15
V5					1.00	0.63	0.19	-0.03	-0.23	-0.36	-0.26	-0.40
V6						1.00	0.51	-0.37	-0.52	-0.29	-0.28	-0.14
V7							1.00	-0.79	-0.97	-0.58	-0.57	-0.33
V8								1.00	0.65	0.50	0.56	0.27
V9									1.00	0.55	0.53	0.32
V10										1.00	0.82	0.71
V11											1.00	0.44
V12												1.00

Table 5-2 Rotated (Varimax) Factor Loadings for 12 General Variables for 1971

Variables	Factor 1	Factor 2	Factor 3
V1	0.5855	-0.0398	-0.2097
V2	-0.1095	-0.5077	0.3681
V3	-0.6890	-0.7006	-0.0640
V4	0.7878	0.5762	-0.1703
V5	-0.2762	0.4576	0.7037
V6	-0.7809	-0.5839	0.1405
V7	-0.8947	0.1992	-0.2798
V8	0.7137	-0.2309	0.4963
V9	0.8743	-0.1699	0.1811
V10	0.6997	-0.4935	-0.1272
V11	0.6540	-0.3874	0.0189
V12	0.4496	-0.4633	-0.2703

Fig. 5-1: The Factor Scores of Factor 1 for the 44 places of the Study Area (1971). (General Variables)

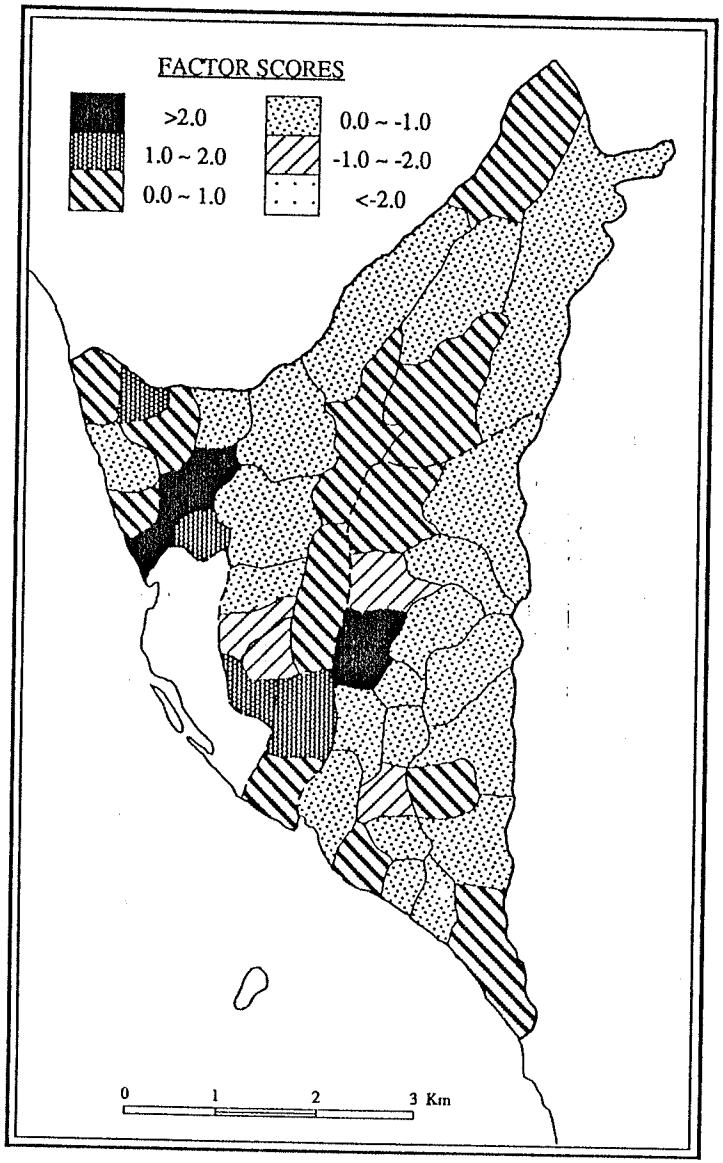
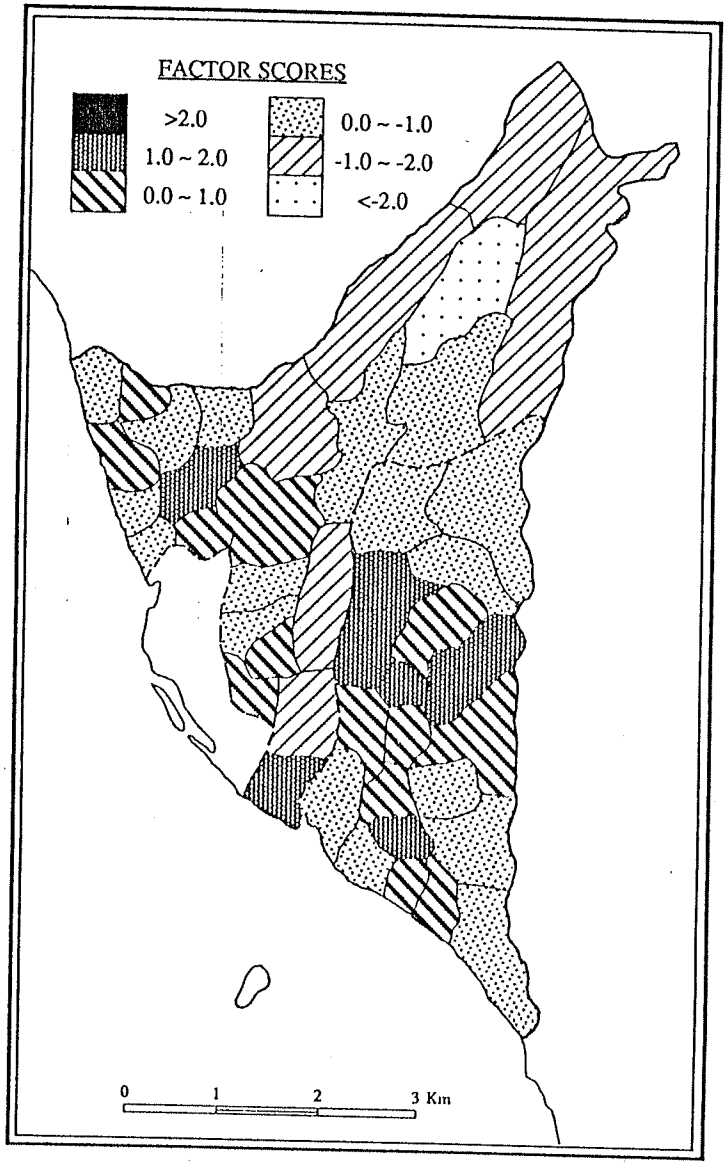


Fig. 5-2: The Factor Scores of Factor 2 for the 44 places of the Study Area (1971). (General Variables)



consideration. However, for the time being, the factor scores on Factor 1, Factor 2, and Factor 3 are computed for the 44 places of the study area in order to gain some idea of the spatial variation of the socio-economic development represented by the 12 general variables (as shown in Table 5-3 and Figures 5-1, 5-2, and 5-3). It can be seen that the places revealing the weightier factor scores on Factor 1 (that is to say, those greater than one) are Fengshan city, Kangshan town, Taliao hsiang, Chiaotou hsiang, Hunei hsiang, Tzukuan hsiang, and Pingtung city. Among these places, Fengshan city, Kangshan town and Pingtung city are urban places close to Kaohsiung city, while Taliao hsiang, Chiaotou hsiang and Tzukuan hsiang are also very close to Kaohsiung city and, in fact, belong to today's Kaohsiung Metropolitan Area. As to Hunei hsiang, it borders Tainan city and is severed from it merely by a narrow river; namely, the Er-Jen River. By way of contrast, the remote places such as Shanlin hsiang (place 23) and Neimen hsiang (place 24) have trivial factor scores, usually of a negative direction. Generally speaking, except for Pingtung city, most places in Pingtung county have either very low or negative values for their factor scores. However, there are some exceptions. For instance, Jenwu hsiang (place 8), Tashe hsiang (place 9) and Niaosung hsiang (place 10), which all belong to the modern Kaohsiung Metropolitan Area, have negative factor scores. This outcome has probably arisen from the fact that, as late as

1970, these places were still wedded to traditional agriculture and the impacts of the industrialization and urbanization from Kaohsiung city were still too weak to affect then unduly. To take but one example in substantiation, the Jenwu and Tashe Petro-chemical Industrial Districts, which indubitably had great impacts on the local economies of Jenwu and Tashe hsiangs, were developed during the period of August 1970-June 1971 (see Table 3-1 of Chapter 3). In other words, the industrial developments initiated and stimulated by these two planned districts in both Jenwu and Tashe hsiangs did not exist before 1970.

As to Factor 2 and Factor 3, the first evinces a meaningful loading only on variable 3 (percentage of population aged 0-14), with a fairly high negative value, while Factor 3 pivots around the high positive loading for variable 5 (percentage population aged over 65). Both are demographic variables. The places with high factor scores for Factor 2 are Kangshan town (place 2), Linyuan hsiang (place 3), Linlo hsiang (place 30), Chiuju hsiang (place 31), Neipu hsiang (place 36) and Nanchou hsiang (place 43). Correspondingly, high factor scores for Factor 3 are found in such places as Yenchao hsiang (place 12), Tienliao hsiang (place 13), Luchu hsiang (place 15) and Tzukuan hsiang (place 20). Evidently, the majority of the places are rural areas suffering serious outmigration of population; a phenomenon that may be responsible for their demographic characteristics.

Table 5-3 Factor Scores for the 44 Places of the Study Area (1971)
(Factors 1, 2 and 3 of the 12 General Variables)

Places	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
F1	1.627	2.381	0.583	0.424	0.774	1.053	0.285	-1.847	-0.268	-1.546	1.257
F2	0.923	1.094	-0.356	-0.146	1.730	-1.870	-1.219	-0.172	-0.249	0.065	0.672
F3	-1.073	-0.399	0.039	-0.367	-0.594	-0.142	-0.760	-0.697	0.469	-0.260	0.669
Places	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1	-0.906	-0.729	-0.296	0.248	1.202	0.676	-0.624	0.113	2.010	-0.245	0.708
F2	0.339	-1.549	-0.530	-0.186	0.372	-0.393	0.049	-0.364	-0.960	-1.527	-1.851
F3	4.491	1.416	0.904	0.450	1.982	0.769	0.142	0.957	1.245	-0.280	-0.441
Places	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)
F1	-0.407	-0.510	2.375	0.730	0.666	-0.489	-0.709	-0.908	-1.236	0.175	-0.696
F2	-2.019	-1.933	1.017	-0.284	-0.189	0.601	0.884	1.826	1.093	-0.070	-0.440
F3	-1.166	-0.100	-0.596	-0.234	-0.319	-0.404	-0.452	0.203	-1.162	-0.464	-0.975
Places	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)
F1	-0.668	-0.247	-0.204	-0.553	-0.809	0.148	-0.921	-1.250	-0.107	-0.755	-0.506
F2	-0.129	0.715	1.844	0.956	-0.211	-0.049	-0.325	0.653	0.218	1.044	0.928
F3	-0.367	0.577	-0.312	0.062	-0.198	-0.425	0.204	-1.151	-0.250	-0.341	0.350

P.S. : Places (1):Fengshan C, (2):Kangshan T, (3):Chishan T, (4):Meinung T, (5):Linyuan H, (6):Taliao H, (7):Tashu H, (8):Jenwu H, (9):Tashe H, (10):Niaosung H, (11):Chiaotou H, (12):Yenchao H, (13):Tienliao H, (14):Alien H, (15):Luchu H., (16):Hunei H, (17):Chiating H, (18):Yungan H, (19):Mito H, (20):Tzukuan H, (21):Liukuei H, (22):Chiahsien H, (23):shanlin H, (24):Neimen H, (25):Pingtung C, (26):Chaochou T, (27):Tungkang T, (28):Wantan H, (29):Changchih H, (30):Linlo H, (31):Chiuju H, (32):Likang H, (33):Yenpu H, (34):Kaoshu H, (35):Wanluan H, (36)Neipu H, (37):Chutien H, (38):Hsinpi H, (39):Fangliao H, (40):Hsingyuan H, (41):Kanting H, (42):Linpien H, (43):Nanchou H, (44):Chiatung H.

(B) The situation in 1987 :

In order to provide comparative results with the 1971 data, a matrix of correlation coefficients and factor loadings are presented for the same variables but now based on the 1987 data, as shown in Table 5-4 and Table 5-5.

Table 5-4 Correlation Matrix for 12 General Variables for 1987

Variables	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12
V1	1.00	0.36	0.27	-0.13	-0.26	0.12	-0.52	0.23	0.65	0.33	0.05	0.46
V2		1.00	0.28	0.37	-0.01	-0.38	0.50	-0.35	-0.50	-0.26	-0.07	-0.33
V3			1.00	-0.75	-0.65	0.73	-0.67	0.55	0.51	0.27	-0.21	0.71
V4				1.00	-0.19	-0.99	0.49	-0.48	-0.29	-0.19	0.18	-0.55
V5					1.00	0.05	0.45	-0.29	-0.45	-0.19	0.10	-0.44
V6						1.00	0.48	0.48	0.28	0.18	-0.17	0.53
V7							1.00	-0.85	-0.78	-0.47	-0.09	-0.67
V8								1.00	0.35	0.48	0.17	0.57
V9									1.00	2.28	-0.04	0.51
V10										1.00	0.78	0.59
V11											1.00	-0.37
V12												1.00

Table 5-5 Rotate (Varimax) Factor Loadings for 12 General Variables for 1987

Variables	Factor 1	Factor 2	Factor 3	Factor4
V1	-0.4925	0.2315	-0.2418	0.3483
V2	0.4960	-0.0411	-0.1031	-0.3887
V3	-0.8582	-0.3037	-0.1430	-0.3274
V4	0.7201	0.5243	-0.4279	0.0143
V5	0.4661	-0.1481	0.7075	0.4790
V6	-0.7079	-0.5244	0.4492	0.0020
V7	0.9113	-0.1611	0.1186	-0.1540
V8	-0.7626	0.1288	0.1725	-0.1454
V9	-0.7185	0.1444	-0.4113	0.4801
V10	-0.5466	0.7068	0.3466	-0.1704
V11	-0.0352	0.8360	0.4641	-0.0944
V12	-0.8396	0.0494	-0.0456	-0.1539

The correlation matrix in Table 5-4 shows even fewer high and positive correlations than those obtained for 1971. Only variables 3 (percentage of population aged 0-14) and 6 (dependency rate of population), and variables 10 (in-migration rate) and 11 (out-migration rate) display fairly high correlation coefficients. Besides, highly negative correlations also exist between variables 3 and 4 (percentage of population aged 14-65), variables 4 and 6 , variables 7 (percentage of the employment base in primary industry) and 8 (percentage of the employment base in secondary industry), and variables 7 and 9 (percentage of the employment base in tertiary industry). The reasons for these high correlations are quite obvious and generally replicate those of 1971. It is, therefore, tedious to repeat them here. However, analysis of the changes of correlation from 1971 to 1987 reveals some significant implications. Its results are assessed in what follows. (1) The correlation between variables 3 and 4 has decreased in value from-0.95 in 1971 to -0.75 in 1987. This may have arisen from the decrease of the out-migration rate of the adults (aged 15-64) from some places and the rapid reducing of the birth rate for all places following from the success of birth control. (2) The correlation between variables 3 and 6 also erodes, from 0.95 in 1971 to 0.73 in 1987. This occurred in a like manner to (1). These two variables are highly positively correlated, meaning that both of them exist in the rural areas suffering out-migration. Yet, as

in the case of (1), while the value of correlation has decreased from 1971 to 1987, there still exists quite a high correlation between the two variables. (3) Variable 4 remains highly negatively correlated with variable 6 from 1971 to 1987 (both are-0.99). This is a straightforward manifestation of the out-migration which took place in the intervening period. Usually, the majority of the in-migrants are adults leaving their aged parents and, sometimes, their children in their hometowns. As a consequence, the net in-migration areas have a higher percentage share of the population aged 15-64, while the net out-migration areas suffer from a higher population dependency rate. (4) The remarkable change in the value of correlation between variables 3 (percentage of population aged 0-14) and 7 (percentage of the employment base in primary industry), from 0.45 in 1971 to-0.67 in 1987, may be attributed to two reasons: first of all, successful 'family planning' (even in rural areas) has reduced significantly the number of children per family (note, in Taiwan a 'two-children' policy was practised); and, secondly, the rapid decrease of the employment in primary industry (agriculture) was especially telling on the younger generation. These displaced people can easily find a non-farm job in their hometown (owing to rural industrialization) or can commute to work in the nearby towns or cities (as a result of improved transportation). (5) The significant reduction in the correlation between variables 5 (percentage of popula-

tion aged over 65) and 6 (dependency rate of population) from 0.63 in 1971 to 0.05 in 1987 represents, first, the common increase of the aged population in all places occasioned by lengthened life expectancy (today, Taiwan's average life expectancy is 74 years old) and, secondly and more importantly, the rapid decrease of the number of children per family, even in the rural areas, which resulted in the moderating of the population dependency rate. (6) The decrease of the correlation value between variables 7 (percentage of the employment base in primary industry) and 9 (percentage of the employment base in tertiary industry) from -0.97 in 1971 to -0.78 in 1987 simply represents the decline of the percentage of employment in primary industry and the diffusion (or dispersion) of tertiary industries to all places in tandem with the rising of living standards, even in the rural areas. (7) The correlation between variables 10 (in-migration rate) and 12 (net-migration rate) also decreases from 0.71 in 1971 to 0.59 in 1987. This represents the gradual stabilizing of the propensity to migrate.

In sum, by comparing the correlation matrix of 1971 with that of 1987, it is apparent that, in general, the degree of association between variables has decreased. Even the meaningful bivariate associations have, for the most part, decreased significantly their correlation values. One can speculate that this tendency reflects a greater uniformity of development across the study area for the terminal year

as opposed to the beginning one.

Four significant factors with eigenvalues greater than one account for 90.75 per cent of the total variance in the 1987 data set. From Table 5-5, it is clear that Factor 1, which has an eigenvalue of 5.454, loads heavily on variables 4 (percentage aged 15-64) and 7 (percentage of the employment base in primary industry). Factor 2, with an eigenvalue of 2.007, loads heavily on variables 10 (in-migration rate) and 11 (out-migration rate), while Factor 3, with an eigenvalue of 1.561, appears to hinge on variable 5 (percentage of population aged over 65). Factor 4, which has an eigenvalue of 1.160, does not load heavily on any variable. In comparing the factor loadings of 1971 with those of 1987, it is obvious that a significant structural change has occurred. The constituents of that change warrant further discussion.

An analysis based on the interpretation of Factor 1 shows that, as in 1971, there are wide variations in the factor loadings. However, while the loadings on variable 4 retain the same fairly high pattern as of 1971, there are dramatic changes for the loadings on some variables. For instance, the loadings on variables 8 (percentage of the employment base in secondary industry) and 9 (percentage of the employment base in tertiary industry), which have high positive in 1971, have become highly negative in 1987. On the other hand, variable 7 (percentage of the employment base in primary industry) which had a high negative loading

in 1971 has turned out to have the high positive loading in 1987. This might indicate the improvement in the distribution and provision of the secondary and tertiary job opportunities in the study area, a change brought about by either rural industrialization or the improved feasibility of commuting to work. As to the increasing value of loadings on variable 7, it represents the enhanced variation in the spatial distribution of the variable. In other words, economic development in the interim has conspired to reduce the percentage share of the employment in primary industry for the majority of places in the study area. A few exceptions to this pattern persist which, for some reason or other, still display high percentages of employment in primary industry. In a word, the set of factor loadings of Factor 1 for 1987 is approximately the inverse of that for 1971. Factor 2 loads heavily on variables 10 (in-migration rate) and 11 (out-migration rate), representing the migration characteristics of the population, while Factor 3 loads on variables 5 (percentage of population aged over 65) in exactly the same fashion as is the case in 1971, also representing one of the demographic characteristics. As to Factor 4, all the loadings of the variables are pretty low, suggesting that no special characteristics can be indicated by that factor. Therefore, Factor 4 will be excluded from the following discussions of the factor scores and simple linear regressions.

The scores for Factor 1, Factor 2 and Factor 3, based on

the 1987 data, are computed for the 44 places of the study area, as shown in Table 5-6, and Fig. 5-4, Fig. 5-5 and Fig. 5-6. The places which have high factor scores for Factor 1 (i.e. greater than one) are Chishan town (place 3), Meinung town (place 4), Taliao hsiang (place 6), Tien-liao hsiang (place 13), Shanlin hsiang (place 23) and Hsinpi hsiang (place 38). All of these places are rooted in agricultural areas. Although Chishan and Meinung administratively belong to urban places (towns), their economies are still dominated by the agricultural sector, as we have mentioned in Chapter 3. Since the pattern of loadings for Factor 1 for 1987 is approximately the inverse of that for 1971, it may be concluded that a place which had a high positive factor score for Factor 1 in 1971 might probably have a somewhat higher negative factor score for the same factor in 1987. However, with the exception of Tzukuan hsiang (place 20) which has a fairly high negative factor score for Factor 1 for 1987, the places which recorded high positive scores on this factor for 1971 consistently displayed low negative factor scores for 1987. Since the 1971 Factor 1 loads heavily on variables 9 (percentage of the employment base in tertiary industry), 8 (percentage of the employment base in secondary industry) and 4 (percentage of population aged 15-64), the aforementioned results may be ascribed to the more dispersed distribution of these variables. In other words, economic development has been instrumental in spreading employment opportunities in the

secondary and tertiary industries through more places of the study area.

Table 5-6 Factor Scores for the 44 Places of the Study Area (1987)
(Factors 1, 2 and 3 of the 12 General Variables)

Places	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
F1	-0.189	0.159	1.668	1.532	-1.298	1.163	0.630	-0.890	0.071	-0.514	-0.205
F2	1.795	-0.276	0.093	-0.435	-1.161	1.246	-0.624	2.488	0.613	3.549	-0.088
F3	-1.177	0.244	0.537	0.642	-0.646	-0.170	-0.275	-1.031	-0.564	-0.892	0.203
Places	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1	-3.045	1.581	-0.729	-0.816	-0.368	-0.397	-0.090	-1.865	-1.374	0.059	-0.137
F2	1.056	0.323	-0.910	-0.811	-0.053	-1.301	0.486	-0.684	-0.432	0.652	0.091
F3	4.430	1.713	-0.557	-0.612	-0.313	-0.409	-0.084	-0.242	-0.580	0.063	-0.365
Places	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)
F1	2.042	0.658	0.714	0.373	-0.888	-0.671	0.169	0.470	-0.229	0.243	-0.140
F2	-0.432	-0.246	-0.615	-1.904	-0.970	-0.946	0.517	0.470	-0.229	0.243	-0.140
F3	0.640	-0.065	0.227	-0.342	-0.812	-0.720	0.178	-0.014	-0.645	-0.450	-0.812
Places	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)
F1	0.873	0.793	-0.895	0.985	1.277	0.415	-1.506	0.223	-0.330	-0.015	0.767
F2	0.530	-0.585	-0.630	0.299	-0.051	-0.198	-0.471	-0.248	0.012	-0.291	-0.440

*Places: (1)Fengshan C, (2)Kangshan T, (3)Chishan T, (4)Meinung T, (5)Linyuan H, (6)Taliao H, (7)Tashu H, (8)Jenwu H, (9)Tashe H, (10)Niaosung H, (11)Chaotou H, (12)Yenchao H, (13)Tienliao H, (14)Alien H, (15)Luchu H, (16)Hunei H, (17)Chiating H, (18)Yungan H, (19)Mito H, (20)Tzukuan H, (21)Liukuei H, (22)Chiahsien H, (23)Shanlin H, (24)Neimen H, (25) Pingtung C, (26)Chaochou T, (27)Tungkang T, (28)Wantan H, (29)Changchih H, (30)Linlo H, (31)Chiuju H, (32)Likang H, (33)Yenpu H, (34)Kaoshu H, (35)Wanluan H, (36)Neipu H, (37)Chutien H, (38)Hsinpi H, (39)Fangliao H, (40)Hsingyuan H, (41)Kanting H, (42)Linpien H, (43)Nanchou H, (44)chiatung H.

The places standing out with high positive scores for Factor 2 for 1987 are Fengshan city (place 1), Taliao hsiang (place 6), Jenwu hsiang (place 8), Niaosung hsiang (place 10), Yenchao hsiang (place 12) and Linlo hsiang (place 30). Since Factor 2 has high loadings on variables 10 (in-migration rate) and 11 (out-migration rate), all these places have either high in-migration rates or high out-migration rates. Among them, Fengshan city, Taliao

Fig. 5-3: The Factor Scores of Factor 3 for the 44 places of the Study Area (1987). (General Variables)

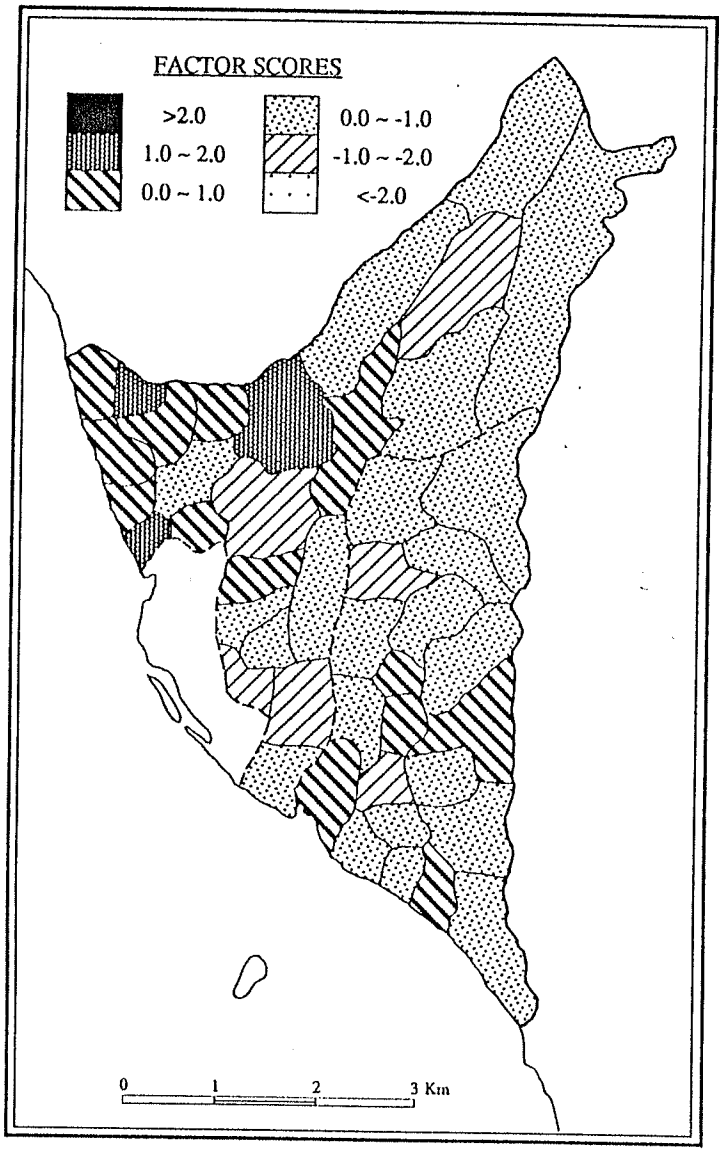


Fig. 5-4: The Factor Scores of Factor 1 for the 44 places of the Study Area (1987). (General Variables)

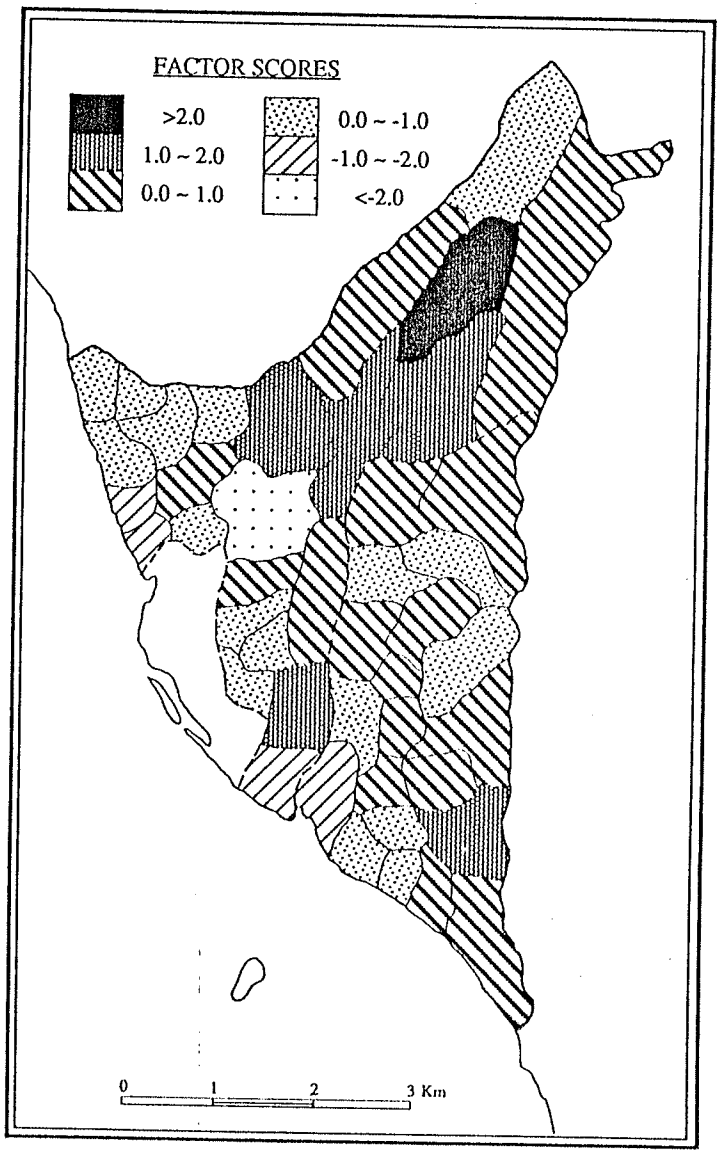


Fig. 5-5: The Factor Scores of Factor 2 for the 44 places of the Study Area (1987).
(General Variables)

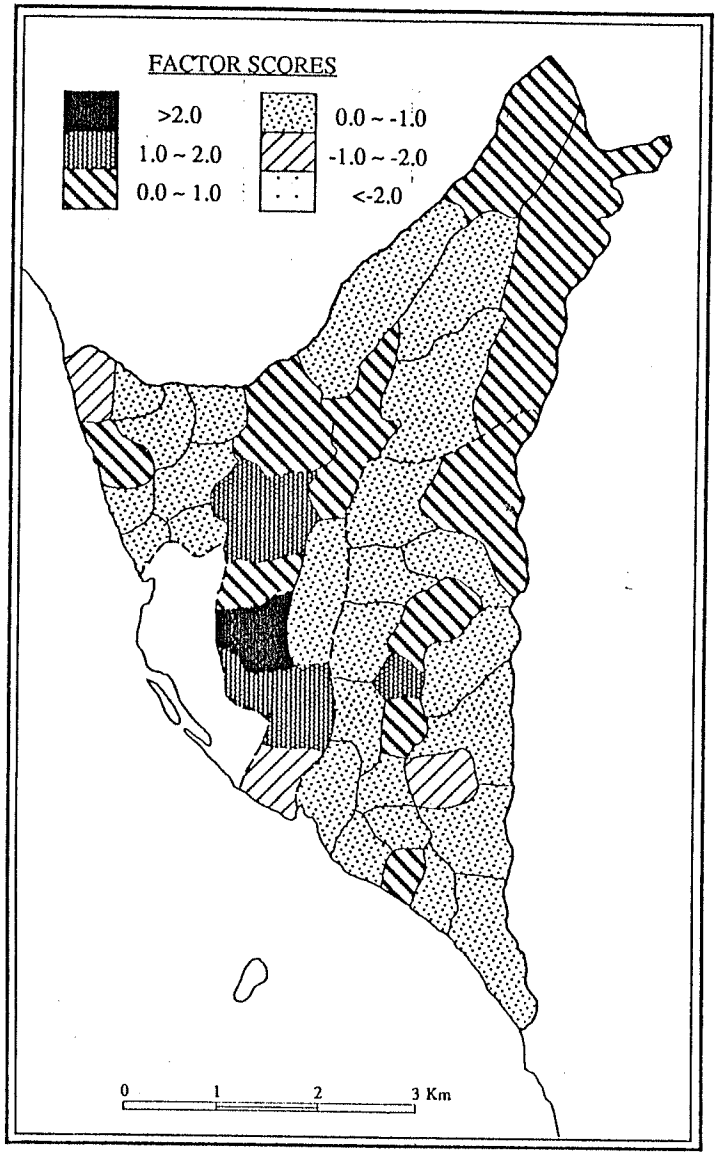
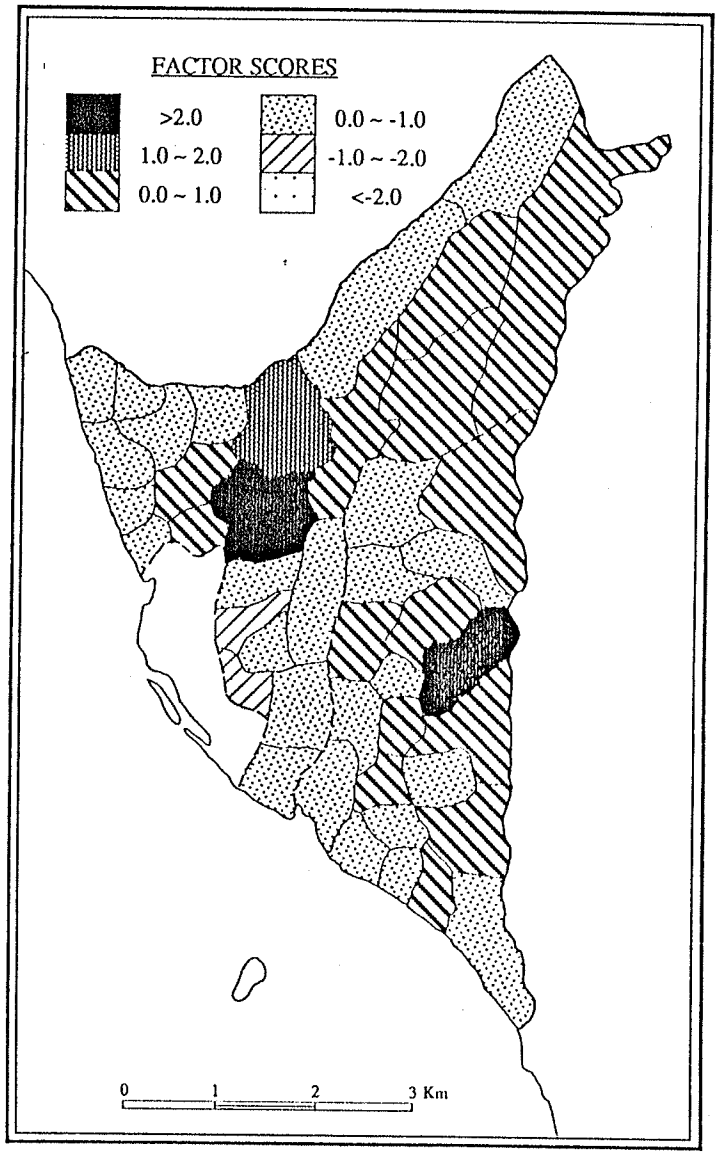


Fig. 5-6: The Factor Scores of Factor 3 for the 44 places of the Study Area (1987).
(General Variables)



hsiang, Jenwu hsiang and Niaosung hsiang, which all belong to Kaohsiung Metropolitan Area, are either highly urbanized or highly industrialized areas and thus have attracted a flow of in-migrants in the last decade or more. In comparison, Yenchao hsiang and Linlo hsiang are places with high out-migration records. Factor 3 for 1987 loads heavily on variables 5 (percentage aged over 65), exactly the same as the Factor 3 for 1971. However, the distributions of factor scores is somewhat different. For 1971, the places with high scores for Factor 3 are Yenchao hsiang (place 12), Tienliao hsiang (place 13), Hunei hsiang (place 16) and Tzukuan hsiang (place 20). For 1987, Yenchao hsiang and Tienliao hsiang continue to display high scores on Factor 3, but the other two places have switched to negative values and are replaced by Neipu hsiang (place 36). In the cases of Yenchao hsiang and Tienliao hsiang, and especially the latter, landform plays a significant role in their development. Although these two places are close to Kangshan town, they are mostly surrounded by badlands neither suitable for agricultural nor industrial land-uses. As a consequence, out-migration has prevailed in these two places in the past one or two decades, resulting in the outcome of high percentages of those aged over 65 in their populations.

(2) Simple Linear Regression

In order to determine if any significant linear relations exist between the values of the factor scores of the

44 places and their distances to Kaohsiung city, the simple linear regression technique was employed. In this case, Y represents the values of the factor scores, and X represents the distance from each place to Kaohsiung city. The first three factors with eigenvalues greater than one are chosen for both 1971 and 1987. As to the distance variable, it represents the straight distance on the map from the centre of each place to the CBD of Kaohsiung city. The results are as follows :

(A) for 1971

Factor 1 : $Y = -1.251 + 0.006 X$
$r^2 = 0.2759$
$F = 16.01$

Factor 2 : $Y = 0.703 - 0.003 X$
$r^2 = 0.0843$
$F = 3.87$

Factor 3 : $Y = -0.142 + 0.001 X$
$r^2 = 0.0035$
$F = 0.15$

(B) for 1987

Factor 1 : $Y = -1.071 + 0.005 X$
$r^2 = 0.1963$
$F = 10.26$

Factor 2 : $Y = 0.777 - 0.004 X$
$r^2 = 0.1048$
$F = 4.92$

Factor 3 : $Y = 0.520 - 0.002 X$
$r^2 = 0.049$
$F = 2.17$

The degrees of freedom (df)=44-1=43. At the 0.05 significance level with 43 degrees of freedom the critical value of F is 2.84. Since the calculated values of F, with the sole exception of Factor 3 (for both 1971 and 1987),

are greater than the critical value, we must reject the null hypothesis and conclude that these equations represent significant functional relationships. In other words, the 'X's earmarked as determinants in the Factor 1 and Factor 2 equations are decidedly meaningful. This situation is not replicated in the Factor 3 equation, however, where the X is shown to be insignificant. Despite these signs, the overall implications of the equations are much less encouraging; as the relatively low coefficients of determination testify. Only Factor 1 for 1971 is forthcoming with a correlation coefficient (r) of slightly greater than 0.5. Yet even for that factor, the coefficient of determination is only 0.276. All the other factors, no matter whether for 1971 or 1987, have more trivial values of both r and r^2. In other words, at its best, as in the case of Factor 1 for 1971, the regression can only explain 27.59 per cent of the total variance. Put otherwise, more than two-thirds of the "explanation" accounting for the spatial development pattern appears to be unaffected by any "distance-decay" considerations.

(3) The coefficient of variation analysis :

The aim of using the coefficient of variation is to assess the scope of relative variations between the 44 places for the years 1971 and 1987. For this purpose, the coefficient of variation was computed for each of the variables on the basis of two measures, the mean and the standard deviation, as shown by the formula presented for

the coefficient of variation mentioned above.

The results of the above analysis would be sufficient to show the general trend of inequalities. However, although this seems valid in broad terms, the coefficient of variation may conceal important differences among the individual places. For example, it is not possible to have an idea of the relative position of individual places within a hierarchy of regional development. Thus a series of standard scores (z-scores) was computed for the variables to provide a means to rank and classify the places in a common scale and to ascertain whether certain of them had experienced declining fortunes while others had improved their relative positions (Footnote 1 at the end of this chapter furnishes the formula used in calculation).

The 1971 data (Table 5-7) show that the variables present fairly high coefficients of variation indicating that spatial inequalities among places were quite conspicuous. Variables 12 (net-migration rate), 1 (size of population) and 10 (in-migration rate) evince the highest coefficients of variation (CV), followed by variables 8 (percentage of the employment base in secondary industry) and 9 (percentage of the employment base in tertiary industry). All these indicate the high inequality of their distribution. Incidentally, except for variables 1 and 12, all other variables also have the higher positive values of factor loadings in factor 1 for 1971, indicating the high degree of variation of these variables between the 44

places. In other words, the results of the coefficient of variation analysis confirm, for the most part, those elicited from factor analysis. On the other hand, some demographic variables such as variables 3 (percentage of population aged 0-14), 4 (percentage of population aged 15-64) and 6 (dependency rate of population) have the least Cv magnitudes, indicating their more even distribution.

The 1987 data (Table 5-8) reveal a more or less similar pattern of spatial inequalities as 1971. Although many indicators point to an improvement in terms of spatial distribution of these variables, the level of inequalities continues to remain fairly high. Variables 1 (size of population) and 12 (net-migration rate) still lead the table, followed by variables 8 (percentage of the employment base in secondary industry), 10 (in-migration rate) and 7 (percentage of the employment base in primary industry). However, changes in the Cvs of variables in 1971 and 1987 (Table 5-9) show that, despite remaining moderately high, there are some variables which have registered a significant decrease in their Cv values. Among them, variables 8 (percentage of the employment base in secondry industry) and 9 (percentage of the employment base in tertiary industry) are particularly prominent both in respect of absolute and relative changes. This indicates the more dispersed distribution of these variables, again, confirming the results of the factor analysis. Moreover, variables 10 (in-migration rate), 4 (percentage of population aged 15-64) and 2

(crude birth rate) also reduce their values of variation in accordance with the findings from the factor analysis. Nevertheless, the other variables demonstrate a range from slight increase to significant increase of the Cv values during the 1971-1987 period. Variables 12 (net-migration rate) and 1 (size of population) provide the most rapid increase of the Cv values, indicating their biased spatial distribution. This relationship was not exposed in the factor analysis. The others, like variables 7 (percentage of the employment base in primary industry) and 5 (percentage of population aged over 65), also show a moderate increase of the CV values, implying an increasing divergence of the spatial distribution of these variables in much the same way as the results from the factor analyses.

The nature of spatial inequalities is related to the multi-dimensional aspect of development. Over one decade of overall economic growth from 1971 to 1987 has indeed led to a decrease in economic inequalities, as represented in this study by variables 8 and 9. To have a clearer picture of the situation it is be appropriate to look at the performance of the individual places (hsiang, towns, and cities). For this purpose, z-scores for the 12 general variables were calculated for the 44 places and, then, were ranked, as shown in Table 5-10. The ranking of individual places can show the relative position of each community in 1971 and 1987 and suggest how each fared in terms of regional development over the intervening period.

Table 5-7 The Coefficient of Variation for the 12 General Variables (1971)

Variables	Mean	Standard Deviation	Coefficient of Variation
V1	33813.04	27291.91	80.71
V2	25.58	2.82	11.02
V3	40.18	1.99	4.96
V4	56.82	1.96	3.45
V5	2.99	0.61	20.50
V6	76.11	6.07	7.98
V7	61.25	18.92	30.89
V8	8.63	5.13	59.45
V9	30.10	15.17	50.39
V10	4.06	2.15	52.91
V11	4.93	1.15	23.28
V12	-0.63	1.52	-240.90

Table 5-8 The Coefficient of Variation for the 12 General Variables (1987)

Variables	Mean	Standard Deviation	Coefficient of Variation
V1	41986.13	47381.37	112.85
V2	15.79	1.30	8.25
V3	27.01	2.93	10.86
V4	66.79	2.23	3.33
V5	6.18	1.92	31.16
V6	49.84	5.08	10.19
V7	42.10	16.72	39.71
V8	26.27	11.34	43.17
V9	31.40	9.36	29.80
V10	5.37	2.10	39.12
V11	6.87	1.69	24.66
V12	-1.48	1.32	-88.93

From Table 5-10, several important features are discernible. First of all, Fengshan city remains first on the rank for both years with scores far ahead of the others. In fact, Fengshan city has become a de facto part of Kaohsiung city --- the extending of the built-up areas of the two cities has blurred the boundary between them.Second, the top ten ranked places are quite stable between the two years, although their ranks have witnessed some changes. For instance, among the leading ten places in 1987, there are

seven belonging to the top ten of 1971. Third, generally speaking, the places of Kaohsiung county constitute the majority of the first half ranked places. In 1971, among the top 22 ranked places only three belong to Pingtung county. Although the situation has improved a little in 1987, the dominance of Kaohsiung county in the first half ranked places is still evident. In that year, only six places of Pingtung county have been listed in the first 22 ranked places. Fourth, all the places (nine in all) of the Kaohsiung Metropolitan Area are included in the fist 22 (i.e. half) ranked places. Besides, a majority of the places located along or near the Kaohsiung-Tainan axis, such as Kangshan town, Luchu hsiang, Yenchao hsiang, Alien hsiang, Hunei hsiang and Chiating hsiang, are also included in the list in 1971. Obviously, there was a strongly north-biased development along the Kaohsiung-Tainan corridor. This situation, although suffering some slippage, still prevailed in 1987.

5.3 Evaluation of the Farm Household Variables

In order to understand the impacts of the development of Kaohsiung on the agricultural economy of the study area, six variables pertaining to the living facilities of farm households are chosen as the indices of farmers' well-being. Based on the farm households of the 44 places of the study area, these six variables are:

(1) percentage of the farm households owning a TV set,

(2) percentage of the farm households owning a washing machine,

(3) percentage of the farm households owning a refrigerator,

(4) percentage of the farm households owning a telephone,

(5) percentage of the farm households owning a camera and

(6) percentage of the farm households subscribing to a newspaper.

As with the procedure adopted for the general variables, factor analysis will be first employed, then, simple linear regression and, finally, the coefficient of variation analysis. The data sets used here refer to 1969 and 1980.

Table 5-9 The Changes of the Coefficient of Variation (CV) of the General Variables

Variables	(1) CV(1971)	(2) CV(1987)	(3)Absolute Change(•) (1971-1987)	(4)Relative Change(••) (1971-1987)
V1 (size of population)	80.71	112.85	32.14	39.82
V2 (rude birth rate)	11.02	8.25	-2.77	-25.14
V3 (% of aged 0-14)	4.96	10.86	5.90	118.95
V4 (% of aged 15-64)	3.45	3.33	-0.12	-3.48
V5 (% of aged over 65)	20.50	31.16	10.66	52.00
V6 (Dependency rate of pop.)	7.98	10.19	2.21	27.69
V7 (% of the employment base in primary industry)	30.89	39.71	8.82	28.55
V8 (% of the employment base in secondary industry)	59.45	43.17	-16.28	-27.38
V9 (% of the employment base in tertiary industry)	50.39	29.80	-20.59	-40.86
V10 (in)migration rate)	52.91	39.12	-13.79	-26.06
V11 (out)migration rate)	23.28	24.66	1.38	5.93
V12 (net)migration rate)	-240.90	-88.93	151.97	63.08

(•):(3) = (2) - (1); (••): (4) =((3)/(1)).100

Table 5-10 Z-Scores of the General Variables of the Study Area

1971			1987		
Ranks	Z-scores	Places	Ranks	Z-scores	Places
1	12.96	(1)Fengshan C	1	10.76	(1)Fengshan C
2	7.66	(8)Jenwu H	2	8.05	(10)Niaosung H
3	4.83	(6)Taliao H	3	6.22	(8)Jenwu H
4	4.36	(25)Pingtung C	4	4.79	(9)Tashe H
5	4.29	(10)Niaosung H	5	4.34	(25)Pingtung C
6	3.24	(9)Tashe H	6	3.75	(18)Yungan H
7	3.01	(26)Chaochou T	7	3.74	(6)Taliao H
8	2.72	(17)Chiating H	8	3.54	(12)Yenchao H
9	2.59	(16)Hunei H	9	2.22	(2)Kangshan T
10	2.10	(14)Alien H	10	1.96	(16)Hunei H
11	1.66	(12)Yenchao H	11	1.03	(29)Changchih H
12	1.44	(20)Tzukuan H	12	0.81	(36)Neipu H
13	1.42	(15)Luchu H	13	0.77	(20)Tzukuan H
14	1.31	(21)Liukuei H	14	0.62	(11)Chiaotou H
15	1.22	(22)Tungkang T	15	0.45	(14)Alien H
16	1.22	(19)Mito H	16	-0.04	(5)Linyuan H
17	1.03	(11)Chiaotou H	17	-0.05	(40)Hsingyuan H
18	0.78	(7)Tashu H	18	-0.22	(27)Tungkang T
19	0.59	(3)Chishan T	19	-0.35	(15)Luchu H
20	0.40	(2)Kangshan T	20	-0.58	(7)Tashu H
21	-0.03	(40)Hsingyuan H	21	-0.95	(21)Liukuei H
22	-0.29	(5)Linyuan H	22	-0.98	(39)Fangliao H
23	-0.30	(38)Hsinpi H	23	-0.99	(37)Chutien H
24	-0.32	(18)Yungan H	24	-1.10	(28)Wantan H
25	-0.36	(23)Shanlin H	25	-1.25	(17)Chiating H
26	-0.81	(22)Chiahsien H	26	-1.39	(33)Yenpu H
27	-1.23	(39)Fangliao H	27	-1.48	(42)Linpien H
28	-1.32	(24)Neimen H	28	-1.67	(24)Neimen H
29	-1.76	(13)Tienliao H	29	-1.76	(44)Chiatung H
30	-1.93	(29)Changchih H	30	-1.80	(30)Linlo H
31	-2.17	(35)Wanluan H	31	-1.86	(31)Chiuju H
32	-2.31	(31)Chuju H	32	-2.15	(43)Nanchou H
33	-2.33	(42)Linpien H	33	-2.40	(41)Kanting H
34	-2.86	(36)Neipu H	34	-2.43	(34)Kaoshu H
35	-3.12	(43)Nanchou H	35	-2.46	(13)Tienliao H
36	-3.13	(28)Wantan H	36	-2.58	(3)Chishan T
37	-3.49	(37)Chutien H	37	-2.72	(4)Meinung T
38	-3.51	(4)Meinung T	38	-2.85	(19)Mito H
39	-3.92	(32)Likang H	39	-2.88	(32)Likang H
40	-4.21	(44)Chiatung H	40	-2.89	(35)Wanluan H
41	-4.22	(33)Yenpu H	41	-3.12	(38)Hsinpi H
42	-4.46	(34)Kaoshu H	42	-3.22	(23)shanlin H
43	-4.83	(41)Kanting H	43	-3.25	(22)Chiahsien H
44	-6.52	(30)Linlo H	44	-3.65	(26)Chaochou T

(1) Factor analysis

(A) The situation in 1969

The correlation matrix in Table 5-11 shows that variables 1 , 2 and 3 are highly correlated with each other. These three facilities are very useful to families in general and farm households are no exception. Watching TV has become the most significant recreation for the farm households in Taiwan. A washing machine can save both labour and time for doing laundry, while a refrigerator can prevent food from rapid spoilage, especially under the hot and humid weather conditions prevailing in Taiwan. As a consequence, as long as the incomes of farm households are being augmented, these three facilities are always listed among the priorities for shopping. Besides, variables 3 and 4 (percentage of the farm households owning a telephone) also have a fairly high correlation. In 1969, industrialization in Taiwan was still at its incipient stage, so that the economic situation, in general, was not affluent enough for farm households to buy those facilities. Generally, only those more affluent farm households close to urban areas could afford to buy those facilities. This situation was particularly apt for telephones because, at that time, lines were available only in those rural areas near urban places. In the light of such circumstances, all four variables were highly correlated to their spatial distribution. As for variables 5 (percentage of the farm households owning a camera) and 6 (percentage of the farm households

subscribing to a newspaper), these are not so necessary to the general well-being of farm households.

Table 5-11 Correlation Matrix for Farm Household Variables for 1969

Variables	V1	V2	V3	V4	V5	V6
V1	1.00	0.73	0.89	0.61	0.58	0.59
V2		1.00	0.78	0.60	0.61	0.50
V3			1.00	0.74	0.68	0.65
V4				1.00	0.59	0.36
V5					1.00	0.60
V6						1.00

The factor analysis renders just one meaningful factor, and that boasts an eigenvalue of 4.201. This factor alone accounts for 94.78 per cent of the total variance. Factor 2, with an eigenvalue of 0.662, accounts for the balance of the total variance.

Table 5-12 shows that Factor 1 loads heavily on almost every variable except number 6. Therefore, Factor 1 is used as the only index worthy to judge the well-being of the farm households for the 44 places of the study area. For that purpose, factor scores for the 44 places are computed (Table 5-13) to gain some idea of the spatial variation in the well-being (or living facilities) of the farm households.

Table 5-12 Rotated (Varimax) Factor Loadings for Farm Household Variables (for 1969)

Variables	V1	V2	V3	V4	V5	V6
Factor 1	0.8805	0.8065	0.9620	0.7337	0.7469	0.6677

From Table 5-13 it is evident that places which have a factor score of greater than one are, with one exception, urban centres. Fengshan city (place 1, with a factor score of 2.108), Chishan town (place 3, 1.551), Chiating hsiang (place 17, 1.918), Pingtung city (place 25, 1.047), Chao-chou town (place 26, 1.993) and Tungkang town (place 27, 1.431) comprise the group and, clearly, Chiating hsiang is the only one which is not an urban place. However, Chiat-ing hsiang borders Tainan city along the Er-Jen River and is decidedly within the commuting distance of its neigh-bour. As to the other places exhibiting positive factor scores, the majority are either close to urban places (especially Kaohsiung city) or are dotted along the Kaoh-siung-Tainan corridor. For instance, Jenwu hsiang (place 8), Tashe hsiang (place 9), Niaosung hsiang (place 10), Chiaotou hsiang (place 11) and Tzukuan hsiang (place 20) all belong to the Kaohsiung metropolitan area, while Kang-shan town (place 2) and Luchu hsiang (place 15) are located along the Kaohsiung-Tainan corridor. Furthermore, Yungan hsiang (place 18), as well as Linpien hsiang (place 42) and Nanchou hsiang (place 43), are near to Kangshan town (the former one) or Kaohsiung city (the latter pair). In marked contrast, the places which have high negative factor scores are mostly located in the remote areas. Notable among them are Shanlin hsiang (place 23), Chiahsien hsiang (place 22), Liukuei hsiang (place 21), Hsinpi hsiang (place 38) and Yenpu hsiang (place 33). In a word, the distribution of

the living facilities of the farm households was quite urban-biased in 1969 (see Fig. 5-7).

(B) The situation in 1980

To provide a basis of comparison for the 1969 data, a matrix of correlation coefficients is computed for the same six variables using 1980 data, as shown in Table 5-14.

Table 5-13 Factor Scores for 44 Places of the Study Area (1969)
(Farm Household Variables)

Places	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
F(1)	2.108	0.451	1.551	-0.757	-0.136	-0.373	-0.145	0.209	0.659	0.406	0.643
Places	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F(1)	-0.583	-0.889	-0.457	0.452	-0.194	1.918	0.477	-0.557	0.043	-0.576	-0.731
Places	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)
F(1)	-0.982	-0.620	1.047	1.993	1.431	-0.144	-0.382	-0.684	-0.426	-0.192	-0.827
Places	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)
F(1)	-0.800	-0.349	-0.558	-0.690	-0.848	-0.389	-0.616	-0.458	-0.997	0.539	-0.553

Places : (1)Fengshan C, (2)Kangshan T, (3)Chishan T, (4)Meinung T, (5)Linyuan H, (6)Taliao H, (7)Tashu H, (8)Jenwu H, (9)Tashe H, (10)Niaosung H, (11)Chiatou H, (12) Yenchao H, (13)Tienliao H, (14)Alien H, (15)Luchu H, (16)Hunei H, (17)Chiating H, (18)Yungan H, (19)Mito H, (20)Tzukuan H, (21)Liukuei H, (22)Chiahsien H, (23)Shanlin H, (24)Neimen H, (25)Pingtung C, (26)Chaochou T, (27)Tungkang T, (28)Wantan H, (29)Changchih H, (30)Linlo H, (31)Chiuju H, (32)LIkang H, (33)Yenpu H, (34)Kaoshu H, (35)Wanluan H, (36)Neipu H, (37)Chutien H, (38)Hsinpi H, (39)Fangliao H, (40)Hsingyuan H, (41)Kanting H, (42)Linpien H, (43)Nanchou H, (44)Chiatung H.

Table 5-14 Correlation Matrix for Farm Household Variables for 1980

Variables	V1	V2	V3	V4	V5	V6
V1	1.00	0.76	0.85	0.61	0.47	0.62
V2		1.00	0.73	0.60	0.54	0.66
V3			1.00	0.51	0.38	0.57
V4				1.00	0.56	0.61
V5					1.00	0.71
V6						1.00

Table 5-15 Rotated (Varimax) Factor Loadings for Farm Household Variables (for 1980)

Variables	V1	V2	V3	V4	V5	V6
Factor Loadings on Factor 1	0.8744	0.8404	0.8166	0.7143	0.6697	0.8015

From that table it can be discerned that the pattern is somewhat similar to that of 1969. Variables 1,2 and 3 are highly positively correlated with one another, reflecting the interrelationship between these variables. However, the correlation coefficient between variables 3 and 4 decreased from 0.74 in 1969 to 0.51 in 1980. This might represent the more dispersed distribution of variable 3 (ownership of refrigerator) which, owing to the development that has occurred in the interim, has been instrumental in enabling farm households even in the remote rural areas to own TVs, washing machines and refrigerators. Nevertheless, the diffusion of telephones was far behind that of the aforementioned three variables, simply because this device is dependent on a huge investment by government to set up the telephone lines before the domestic facility can provided. For the remote rural areas, the erection of the telephone lines is usually both costly (due to longer distance) and inefficient (following from a sparse population). Consequently, despite the fact that the telephone was more widely used in the rural areas in 1980 than in 1969, it is still more urban-oriented than TVs, washing machines or refrigerators. On the other hand. the corre-

lation between variables 5 (percentage of the farm households owning a camera) and 6 (percentage of the farm households subscribing to a newspaper) has increased perceptibly from 0.60 in 1969 to 0.71 in 1980. To the farmers living in the more remote areas, playing with a camera or reading a newspaper are not critical necessities in their lives. To them, these facilities are tantamount to useless. Usually, better-educated people or the residents of the more urbanized areas are more likely to spend money on these items. As a result, with economic growth and, thus, the increasing income of the farm households, these two variables increased more rapidly in those areas closer to urban places rather than in the remote rural areas. Therefore, the two variables become a sightly more correlated with each other in the spatial context, reflecting, as they do, the more urban-biased variables.

The factor analysis produces one factor of consequence, possessing an eigenvalue of greater than one. This factor, with an eigenvalue of 4.075, alone accounts for 88.60 per cent of total variance, while Factor 2, with an eigenvalue of 0.827, accounts for the rest. Therefore, the focus of attention will be concentrated on the first factor. As in 1969, this leading factor loads heavily on almost all variables except 5 (percentage of the farm households owning a camera). The loadings on variables 5 witnessed an erosion from 0.7469 in 1969 to 0.6697 in 1980, possibly the result of a slight increase in the ownership of cameras in

all places, even in the rural areas (Table 5-15).

Factor scores computed on Factor 1 (Table 5-16) to facilitate comparison with 1969 expose some salient features. First of all, the number of the places with high positive scores (say, greater than one) have been reduced from six in 1969 to four in 1980, while the total number of the places with positive factor scores have increased rapidly from 16 in 1969 to 26 in 1980. In other words, quite a few places which recorded negative factor scores in 1969 have turned out to be the ones with positive scores in 1980. Linyuan hsiang (place 5), Taliao hsiang (place 6), Tashu hsiang (place 7), Alien hsiang (place 14), Hunei hsiang (place 16), Mito hsiang (place 19), Wantan hsiang (place 28), Linlo hsiang (place 30), Chutien hsiang (place 37), Hsinpi hsiang (place 38), Fangliao hsiang (place 39), Hsingyuan hsiang (place 40), Linpien hsiang (place 42) and Nanchou hsiang (place 43) are the cases in point. This might represent the more widely dispersed distribution of the living facilities among farm households in the study area. Secondly, despite the more dispersed distribution, the urban-oriented tendency of distribution of the living facilities among the farm households, which prevailed in 1969, was still evident in 1980. The majority of the places with positive factor scores are urban places, or exist near to urban places, some of them occupying the Kaohsiung-Tainan corridor. For instance, all nine places of the Kaohsiung Metropolitan Area, with the exception of

Niaosung hsiang (place 10), have positive factor scores. Moreover, the places located in the Kaohsiung-Tainan corridor, or close to Tainan city, such as Kangshan town (place 2), Alien hsiang (place 14), Luchu hsiang (place 15), Hunei hsiang (place 16) and Chiating hsiang (place 17) all have positive factor scores too. Others like Pingtung city, Chaochou town and Tungkang town, which record positive factor scores, are themselves urban places; while places such as Yungan hsiang, Mito hsiang, Linpien hsiang and Nanchou hsiang are found in close proximity to the urban places of Kaohsiung city, Kangshan town and Pingtung city. Thirdly, remote places, especially those in mountain areas, such as Chiahsien hsiang (place 22), Shanlin hsiang (place 23), Liukuei hsiang (place 21) and Neimen hsiang (place 24) remain, as in 1969, characterized by high negative factor scores. Fourthly, notwithstanding the improvement in the standing of most of the places in Pingtung county, the majority of the places in Kaohsiung county emerge, in general, still better off in terms of the provision of the living facilities to the farm households. Nevertheless, the difference between the best served areas and the worst ones seems to be widening at a greater rate in Kaohsiung county than is the case in Pingtung county (see Figure. 5-8).

(2) Simple Linear Regression :

If the distribution of the living facilities of the farm households is somewhat urban-oriented, as the aforementioned analysis implies, then, there arises an interesting ques-

Fig. 5-7: The Factor Scores of Factor 1 for the 44 places of the Study Area (1969).
(Farm Household Variables)

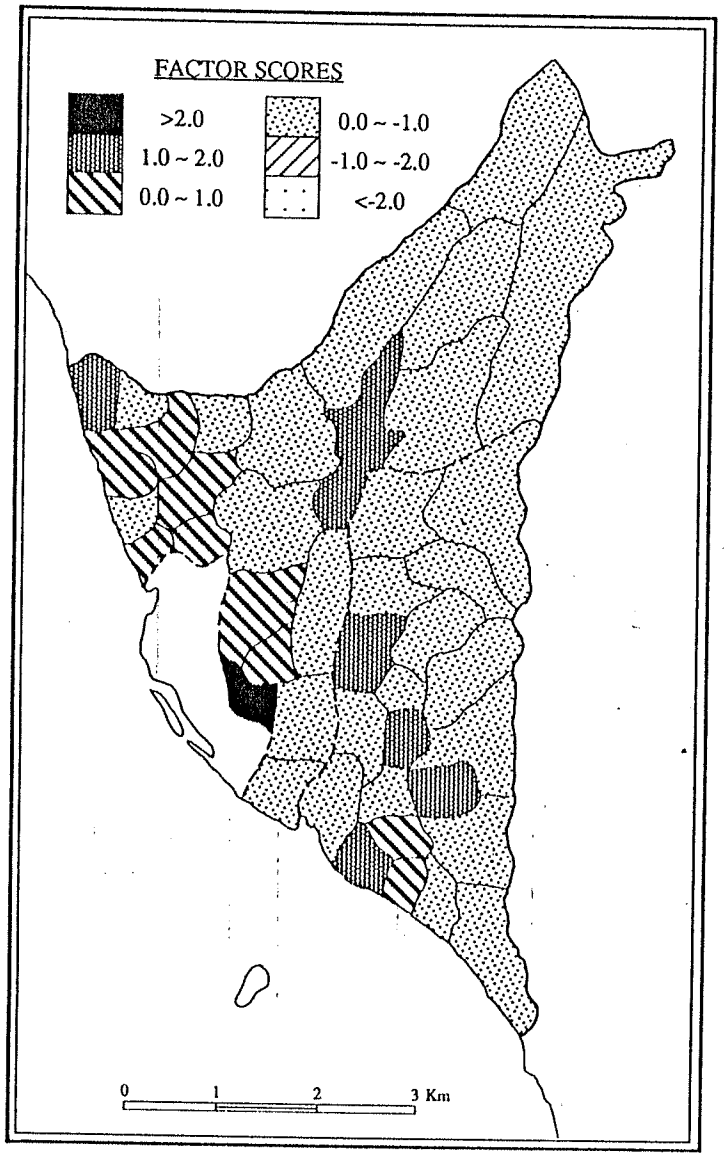
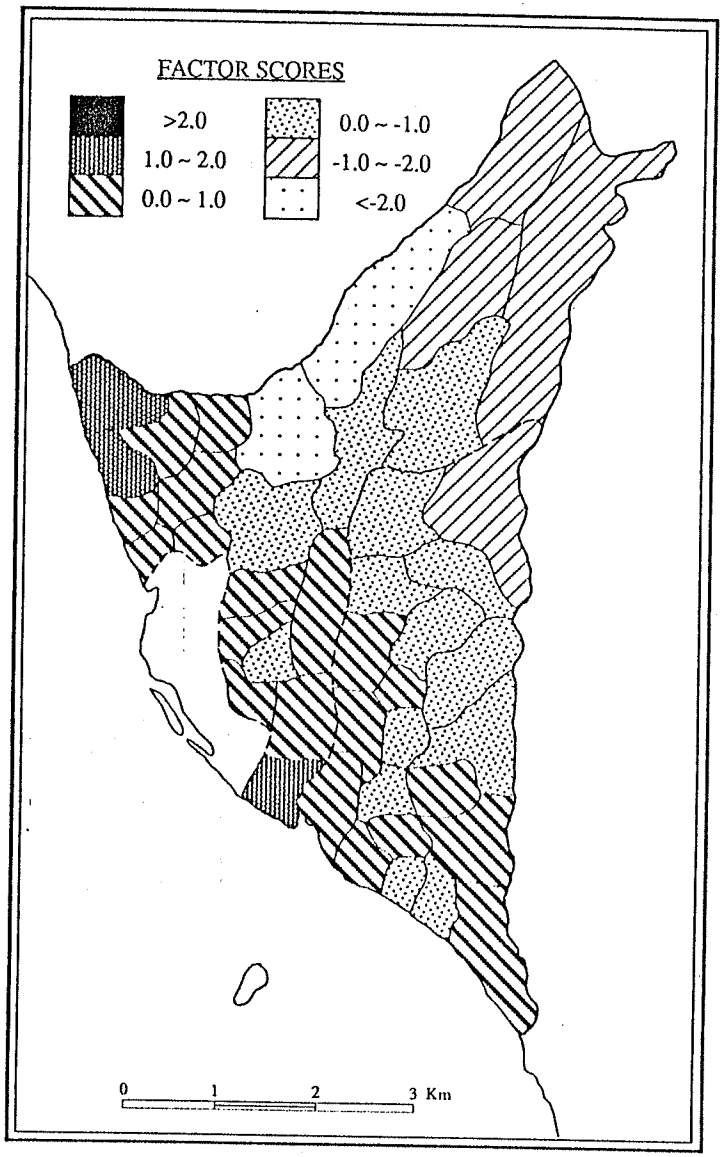


Fig. 5-8: The Factor Scores of Factor 1 for the 44 places of the Study Area (1980).
(Farm Household Variables)



tion; namely, is there a significant linear relationship between those developments evident in the 44 places and their distances to Kaohsiung municipality --- the only metropolis in the study area? In order to answer this question, resort has been made to simple linear regression analysis. Here Y represents the level of the provision of the living facilities to the farm households in each place, while X represents the direct distance from the place in question to Kaohsiung city. Analysis focused on the Factor 1 (Y) of the two years' bases, i.e. 1969 and 1980. The results are as follows :

(A) for 1969

$Y = 1.2504 - 0.0057\ X$
$r2 = 0.3356$
$F = 21.21$

(B) for 1980

$Y = -1.0899 + 0.005\ X$
$r2 = 0.2579$
$F = 14.60$

Table 5-16 Factor Scores for 44 Places of the Study Area (1980)
(Farm Household Variables)

Places	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
F1	0.913	0.719	0.958	0.043	1.115	0.615	0.908	0.816	0.701	0.130	0.646
Places	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
F1	0.256	2.458	0.228	0.366	1.049	1.158	1.096	0.930	0.987	1.954	1.327
Places	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)
F1	1.454	2.360	0.122	0.384	0.413	0.188	0.087	0.358	0.324	0.128	0.235
Places	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)
F1	1.211	0.483	0.437	0.049	0.316	0.011	0.270	0.267	0.319	0.097	0.677

Table 5-17 The Coefficient of Variation for the Farm Household Variables (1969)

Variables	Mean	Standard Deviation	Coefficient of Variation (CV)
V1	19.265	7.097	36.839
V2	1.274	0.868	68.116
V3	6.052	3.317	54.811
V4	1.501	1.160	77.305
V5	0.983	0.701	71.366
V6	12.145	4.633	38.147

Table 5-18 The Coefficient of Variation for the Farm Household Variables (1980)

Variables	Mean	Standard Deviation	Coefficient of Variation (CV)
V1	66.559	13.295	19.974
V2	50.499	16.949	33.562
V3	92.118	5.196	5.641
V4	21.558	14.157	65.669
V5	4.099	2.204	53.761
V6	26.841	11.930	39.978

The degrees of freedom (df)=44-1=43. At the 0.05 significance level with 43 degrees of freedom the critical value of F is 2.84. Since the calculated values of F for both 1969 and 1980 are much greater than the critical value, must reject the null hypothesis and conclude that these two equations represent significant functional relationships. In other words, the X's earmarked as determinants in the equations are certainly relevant. Despite these individual indications, the overall equations are much less encouraging: as the relatively low coefficients of determination testify. These benchmarks are only 0.3356 and 0.2579 for 1969 and 1980 respectively. In other words,

at best, the regression can only explain 33.56 per cent of the total variance (in the case of 1969).

It would be interesting to compare each individual variable to see if the distribution of any variable, when rendered consistent with simple linear regression, conforms to the supposed linear relationship. Since all six variables are measured on the same base, i.e. percentage, and are positively related to the development of the living facilities of the farm households, it is, therefore, reasonable to suppose that the difference of the values of 1969 and 1980 of the same variable for the same place can represent the improvement of that variable for that place from 1969 to 1980. For instance, suppose that the values of variable 1 for place A is 40 for 1969 and 60 for 1980, then, there will be a 20 per cent increase of the farm households owning a TV set for place A during the 1969-1980 period. Since all six variables are positively related to the development of the living facilities of the farm households, the differences of the 1969 and 1980 data sets for each individual variable can be treated as an index of the development of the living standard of the farm households. Using this simple precept, the difference of the 1969 and 1980 data sets for each individual variable were calculated for the 44 places. The resultant differentials are used as 'Y' values for the simple linear regression. The results are as follows:

for variable 1
(percentage of the farm households owning a TV set) :

$Y = 59.702 - 0.057 X$
$r^2 = 0.272$
$F = 15.73$

for variable 2
(percentage of the farm households owning a washing machine) :

$Y = 74.432 - 0.116 X$
$r^2 = 0.3841$
$F = 26.19$

for variable 3
(percentage of the farm households owning a refrigerator) :

$Y = 91.558 - 0.025 X$
$r^2 = 0.230$
$F = 12.53$

for variable 4
(percentage of the farm households owning a telephone) :

$Y = 38.597 - 0.085 X$
$r^2 = 0.305$
$F = 18.40$

for variable 5
(percentage of the farm households owning a camera) :

$Y = 4.752 - 0.076 X$
$r^2 = 0.111$
$F = 5.23$

for variable 6
(percentage of the farm households subscribing to a newspaper) :

$Y = 35.104 - 0.081 X$
$r^2 = 0.4951$
$F = 41.19$

As with the cases of Factor 1 for 1969 and 1980, the calculated values of F for all six equations are much greater than the critical value of F, i.e. 2.84, at the 0.05 significance level with 43 degrees of freedom. Therefore, must reject the null hypothesis and conclude that these six equations represent significant functional relationships;

that is, the X's earmarked as determinants in the equations cannot be dismissed as trivial. Yet, because of their relatively low coefficients of determination, the overall equations are far from being satisfactory. Even for variable 6, which records the highest value of the six equations (0.495), its coefficient of determination is not large enough to command a majority of the 'explanation' in the equation.

(3) The Coefficient of Variation Analysis:

The results of the coefficient of variation analysis applied to the 1969 and 1980 data sets are shown in Table 5-17 and Table 5-18 respectively. The 1969 data (Table 5-17) show that all the variables have in general fairly high CVs, especially in respect of numbers 4 (percentage of the farm household owning a telephone) and 5 (percentage of the farm) households owing a camera). This reflects the highly unequal distribution of these two variables. As have mentioned earlier, dispersion of the telephone facility is not as easily accomplished as, say, the diffusion of TV sets or washing machines. Farm households in the remote rural areas can easily procure a TV set or a washing machine as long as they have money. However, they cannot obtain telephone service even if they can afford it in the absence of telephone-line infrastructure. In other words, diffusion of TV sets, washing machines and refrigerators is relatively straightforward, as suggested by their lower coefficients of variation. Variable 6 (percentage of the

farm households subscribing to a newspaper) also has a low CV value, but in this instance simply because it is cheaper.

If compare the 1980 data (Table 5-18) with the 1969 data, it is apparent that all the variables except number 6 have significantly reduced their CV values. Variable 3 (percentage of the farm households owing a refrigerator) decreased most dramatically, from 54.811 in 1969 to 5.641 in 1980, sufficient to become the least ranking variables in 1980. For its part, variable 1(percentage of the farm households owning a TV set), which had the lowest CV value in 1969, also saw its CV value diminish quite rapidly and became, in consequence, the variable with the second lowest value in 1980. On its heels was variable 2 (percentage of the farm households owing a washing machine). In other words, TV sets, washing machines and refrigerators are gaining in popularity and are widely distributed in all places. In fact, in today's Taiwan, a traveler to a remote mountain village can readily come across TV antennas on the roofs of most farm houses. The reasons for their popularity are twofold: on the one hand, they are very practical facilities indispensable to family life; and, on the other, increasing family incomes of the farm households (stemming from the non-farm jobs created by industrialization) in conjunction with the lowering of the prices of these facilities (as a result of large-scale production by Taiwan's industry, e.g. the Tatung Company) has rapidly increased the purchasing power of the farm households. Some comment

is warranted in the light of the dramatic drop of the CV value of variable 3. In 1969, the refrigerator was still a very expensive proposition for the farm households. Moreover, at that time, the housewives of the farmers' families preferred to patronise traditional fresh-food markets daily, with the result that the refrigerator was not so necessity. However, after a decade's economic development, more women of the farm households go to work and cannot devote the time for daily shopping. Furthermore, with the rising of living standards and the 'demonstration effect' from urban areas, effected either through personal contacts or media such as TV, the younger generation of the farm households has changed their attitude towards life and becomes more materialistic, in a like manner to their counterparts in the urban places. As a consequence, the demand for refrigerators increased very rapidly in the past decade or more.

Table 5-19 Changes in the Coefficient of Variation of Variables between 1969 and 1980 (Farm Household Variables)

Variables	(1)CV(1969)	(2)CV(1980)	(3)Absolute Change(*)	(4)Relative Change(**)
V1	36.839	12.974	-16.865	-45.780
V2	68.116	33.562	-34.554	-50.728
V3	54.811	5.641	-49.170	-89.708
V4	77.305	65.669	-11.636	-15.052
V5	71.366	53.761	-17.605	-24.669
V6	38.147	39.978	1.831	4.800

(*)(3)=(2)-(1); (**)(4)=((3)/(1)).100

Table 5-19 provides us with the changes in the CVs between 1969 and 1980. From it can be elicited the finding that variables 1 (TV sets), 2 (washing machines) and,

especially, 3 (refrigerators) reduced their Cv values most rapidly. As have mentioned, variable 4 (percentage of the farm households owning a telephone) changed the least. In a word, all variables except 6 (percentage of the farm households subscribing to a newspaper) have been undergoing a process of regional convergence in their distributions. Surprisingly, variable 6 registered a slight increase in its Cv value from 1969 to 1980. In short, its distribution is becoming more spatially unequal. This may be attributed partly to the out-migration of population in some rural areas, particularly the more remote ones. The out-migrants are, more often than not, young and educated persons. Therefore, the out-migration of population has resulted in the higher proportions of older people in the rural areas, who are in general poorly educated or illiterate. What is more, with the increase of family income of the farm households in the past decade or more, the farmers can improve their living standards by buying these facilities in a short period of time, but they cannot buy knowledge with money. All this has occasioned the spatial divergence of variable 6. But the actual distribution of variable 6 in 1980, judged by Table 4-18, was still more even, in absolute terms, than that of variable 4 (telephone) and variable 5 (camera).

The ranking of the z-scores (Table 5-20) has revealed some significant features. First of all, the places which have high z-scores have high factor scores (Table 5-16) as

well. To take an example, the first-15 ranked places of the 1980 z-scores all have positive factor scores, except Niaosung hsiang (place 10) and Chiuju hsiang (place 31). Second , on comparing the 1969 z-scores with the 1980 z-scores, the ranking of the places is not so stable as their counterparts of the general variables (see Table 5-10). The ranking of the z-scores of the general variables is quite stable, especially for those with high scores. This finding represents the greater flexibility of the 'farm household' variables relative to that of the general variables in terms of spatial distribution. Third, there is for the most part urban bias in the distribution of the 'farm household' variables. For example, among the first-22 ranked places(i.e. the first half) of the 1980 data, Fengshan city (place 1), Niaosung hsiang (Place 10), Jenwu hsiang (place 8), Tzukuan hsiang (place 20), Chiaotou hsiang (place 11), Tass hsiang (place 7), Taliao hsiang (place 6) and Linyuan hsiang (place 5) are all ensconced within the Kaohsiung Metropolitan Area. In other words, with the exception of Tashe hsiang (place 9), all the places drawn from the Kaohsiung Metropolitan Area are included in the top half of the rankings . In addition, other places which are included in the list of the first 22 ranked places are either located in the Kaohsiung-Tainan corridor (e.g. Hunei hsiang, Luchu hsiang, Kangshan town), or exist close to urban places (e.g. Chiating hsiang, Yungan hsiang, Mito hsiang, Likang hsiang, and Chiuju hsiang), or are them-

selves urban places (e.g. Pingtung city, Chaochou town). However, again, the tendency of the urban-biased distribution is not so strong as that of the general variables. Fourth, the majority of the places which have very low z-scores are located in the remote rural areas or mountain areas, such as Neimen hsiang (place 24), Shanlin hsiang (place 22), and Tienliao hsiang (place 13). In sum, the Z-score analysis conforms by and large to the results of factor analysis. Moreover, the overall pattern of the distribution of the farm household variables is comparable to that of the general variables, although the tendency is not so strong.

5.4 The Questionnaires and Interviews

The total of 845 questionnaires and in-person interviews were distributed among the following 12 places in the numbers specified : (1) Fengshan(180), (2) Niaosung hsiang(93), (3) Tashu hsiang(63), (4) Taliao hsiang(65), (5) Luchu hsiang(66), (6) Linyuan hsiang(55), (7) Hunei hsiang (64), (8) Shanlin Hsiang(45), (9) Liukuei hsiang(46), (10) Fangliao hsiang (50), (11) Pingtung city(66) and (12) Chaochou town(58)(recall Fig.4-1). The selection of the places for questionnaires and in-person interviews is based on two principles: (1)that they fall along the axes of three directions radiating from Kaohsiung city, i.e. northern, southern, and eastern axes, and (2) they are distributed in the three zones from Kaohsiung city, i.e. inner zone (metropolitan area), outer zone (remote area)

Table 5-20 Z-Scores of the Farm Household Variables

1969			1980		
Ranks	Z-Scores	Places	Ranks	Z-Scores	Places
1	13.09	(26)Chaochou T	1	10.63	(1) Fengshan C
2	11.99	(1) Fengshan C	2	10.31	(10)Niaosung H
3	10.66	(25)Pingtung C	3	7.20	(8) Jenwu H
4	9.44	(3) Chishan T	4	6.93	(20)Tzukuan H
5	6.58	(42)Linpien H	5	6.34	(25)Pingtung H
6	5.46	(27)Tungkang T	6	6.27	(30)Linlo H
7	5.17	(11)Chiaotou H	7	6.03	(16)Hunei H
8	5.10	(43)Nanchou H	8	5.45	(11)Chiaotou H
9	4.81	(10)Niaosung H	9	3.89	(17)Chiating H
10	4.2	(17)Chiating H	10	3.61	(26)Chaochou T
11	2.42	(2) Kangshan T	11	3.28	(27)Tungkang T
12	2.11	(30)Linlo H	12	2.77	(2) Kangshan T
13	1.73	(39)Fangliao H	13	1.51	(15)Luchu H
14	1.21	(9) Tashe H	14	1.15	(7) Tashu H
15	1.11	(32)Likang H	15	0.99	(31)Chiuju H
16	0.82	(15)Luchu H	16	0.89	(29)ChangchihH
17	0.10	(38)Hsipu H	17	0.85	(32)Likang H
18	-0.06	(36)Neipu H	18	0.76	(19)Mito H
19	-0.16	(31)Chiuju H	19	0.64	(43)Nanchou H
20	-0.48	(41)Kanting H	20	0.46	(6) Taliao H
21	-0.72	(28)Tzukuan H	21	0.05	(18)Yungan H
22	-0.87	(35)Wanluan H	22	0.04	(5) Linyuan H
23	-0.94	(29)Changchih H	23	0.01	(36)Neipu H
24	-0.95	(16)Hunei H	24	-0.17	(28)Wantan H
25	-1.09	(37)Chutien H	25	-0.33	(37)Chutien H
26	-2.18	(18)Yungan H	26	-0.40	(42)Linpien H
27	-2.19	(8) Jenwu H	27	-0.51	(12)Yenchao H
28	-2.38	(28)Wantan H	28	-0.78	(41)Kanting H
29	-2.52	(6) Taliao H	29	-0.86	(35)Wanluan H
30	-2.61	(5) Linyuan H	30	-0.95	(9) Tashe H
31	-2.64	(22)Chiahsien H	31	-1.94	(40)Hsingyuan H
32	-3.24	(7) Tashu H	32	-2.07	(38)Hsinpi H
33	-3.71	(12)Yenchao H	33	-2.66	(14)Alien H
34	-3.91	(44)Chiating H	34	-2.90	(39)Fangliao H
35	-4.17	(34)Kaoshu H	35	-3.60	(3) Chishan H
36	-4.27	(14)Alien H	36	-3.68	(4) Meinung H
37	-4.78	(19)Mito H	37	-3.84	(33)Yenpu H
38	-4.88	(21)Liukuei H	38	-4.13	(44)Chiatung H
39	-5.02	(40)Hsingyuan H	39	-6.57	(34)Kaoshu H
40	-5.12	(4) Meinung T	40	-6.62	(22)ChiahsienH
41	-5.94	(23)Shanlin H	41	-6.88	(21)Liukuei H
42	-6.33	(33)Yenpu H	42	-9.37	(23)Shanlin H
43	-6.65	(24)Neimen H	43	-10.55	(24)Neimen H
44	-8.20	(13)Tienliao H	44	-11.76	(13)Tienliao H

and intermediate zone. Of course, these two principles were partially influenced and even slightly distorted by the availability of the acquaintances who expressed a willingness to help me in undertaking this questionnaire survey. On the whole, however, this consideration was too inconsequential to annul the two principles justifying the survey.

The results of the survey are used here as a supplement to aid the further interpretation of the results of the aforementioned analyses. What follows are the reorganized outcomes of the questionnaires and in-person interviews.

(1) The distributions of working places, schooling and shopping.

Table 5-21 evinces the distribution of working places associated with residents found within the selected 12 places. It is obvious that the places in the inner zone all have high percentages of workers commuting to Kaohsiung city, such as Fengshan city (40.87 percentage), Niaosung hsiang (21.8 percentage), Tashu hsiang (18.55), Taliao hsiang (27.59 percentage) and Linyuan hsiang (26.17 percentage). In fact, all of these places belong to the Kaohsiung Metropolitan Area. On the other hand, the remote areas, such as Shanlin hsiang (10.13 percentage) and Liukuei hsiang (8.54 percentage), have much lower percentages of workers commuting to Kaohsiung city. As to Luchu hsiang and Hunei hsiang, both of them also have low percentages of workers commuting to Kaohsiung city, and this is so espe-

cially for Hunei hsiang. Since Hunei hsiang belongs to the commuting zone of Tainan city (which is revealed by its relatively high percentage of commuting workers to Tainan, some 22.32 percentage), this outcome is hardly surprising. In a word, distance has obviously played a significant role in moulding commuting patterns to Kaohsiung. This can be further demonstrated by the data from the population census, as shown in Table 5-22. From that table, one can see that the places which have high percentages of workers commuting to Kaohsiung city (say, 15 per cent or more) are all --- with the exception of Chishan town --- immediate neighbours of Kaohsiung city. In particular, they are Fengshan city (42.92 percentage), Linyuan hsiang (30.20), Taliao hsiang (26.61), Tashu hsiang (15.90 percentage), Jenwu hsiang (26.17 percentage), Tashe hsiang (22.17 percentage), Niaosung hsiang (30.73 percentage), Chiaotou hsiang (34.98 percentage), Mito hsiang (21.67 percentage) and Tzukuan hsiang (23.52 percentage). Incidentally, of these ten places, nine belong to the Kaohsiung Metropolitan Area (the exception is Mito hsiang). In Table 4-22, the places with the smallest percentages of workers commuting to Kaohsiung city are Alien hsiang (3.99 percentage), Tienliao hsiang (9.21 percentage), Luchu hsiang (8.13 percentage), Hunei hsiang (3.99 percentage), and Chiating hsiang (4.30 percentage). All of these places are closer to Tainan city and, therefore, host more workers commuting to that city (especially noteworthy in this respect are Hunei

hsiang and Chiating hsiang). As to the more remote places such as Chiahsien hsiang, Shanlin hsiang, Neimen hsiang, Wantan hsiang, Chiuju hsiang, Likang hsiang and Yenpu hsiang, all have relatively low percentages of workers commuting to Kaohsiung city. Those urban places which are somewhat distant from Kaohsiung city, such as Pingtung city, Chaochou town and Tungkang town, are also characterized by relatively low percentages of workers commuting to Kaohsiung city. This is partly the corollary of the greater availability of jobs in these urban places.

One thing we should note is that the percentages of workers gainfully employed in their home localities are in general rather high (see Table 5-21 and Table 5-22). This may represent, at least partly, the dispersion of secondary and tertiary job opportunities to all the places of the study area. This result conforms to those of the factor analyses and the coefficient of variation analyses previously discussed.

In sum, Kaohsiung city has played a key role as a magnetic pole in terms of attracting workers from the places of the study area to work there. Besides, the dispersion of the secondary and the tertiary industries in the study area cannot be divorced from the impact of Kaohsiung city. We will return to this issue later. For the time being, let us turn to the role of Kaohsiung as a centre of the cultural and social activities of the study area.

Table 5-21 The Distribution of Working Places

	(1)Fengshan C		(2)Niaosung H		(3)Tashu H		(4)Taliao H		(5)Luchu H		(6)Linyuan H	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Working Places												
(1)Kaohsiung C	168	40.87	47	21.80	23	18.55	32	27.59	12	11.01	28	26.17
(2)Tainan C	7	1.7	0	0.00	6	4.84	0	0.00	10	9.17	0	0.00
(3)Fengshan C	---	---	15	6.9	2	1.61	5	4.31	0	0.00	3	2.80
(4)Pingtung C	5	1.22	3	1.4	0	0.	1	0.09	0	0.00	0	0.00
(5)Kaohsiung county(*)	70	17.0	37	17.1	12	9.68	4	3.45	9	8.26	8	7.48
(6)Pingtung county(**)	3	0.73	2	0.9	0	0.00	0	0.00	0	0.00	3	2.80
(7)Locality	150	36.50	100	46.3	78	62.90	70	60.34	74	67.89	63	58.88
(8)Others	8	1.95	12	5.6	3	2.42	4	3.45	4	3.67	2	1.87
Total	169	100.00	216	100.00	124	100.00	116	100.00	109	100.00	107	100.00

	(7)Hunei H		(8)Shanlin H		(9)Liukuei H		(10)Fangliao H		(11)Pingtung C		(12)Chaochou H	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Working Places												
(1)Kaohsiung C	4	3.57	8	10.13	7	8.54	9	11.54	10	11.90	8	9.41
(2)Tainan C	25	22.32	3	3.79	4	4.88	0	0.00	0	0.00	0	0.00
(3)Fengshan C	0	0.00	2	2.53	0	0.00	1	1.28	0	0.00	0	0.00
(4)Pingtung C	0	0.00	0	0.00	0	0.00	3	3.85	---	---	9	10.59
(5)Kaohsiung county(*)	11	9.82	10	12.66	5	6.10	5	6.41	6	7.14	1	1.18
(6)Pingtung county(**)	0	0.00	0	0.00	0	0.00	10	12.82	12	14.29	12	14.12
(7)Locality	65	58.06	45	56.96	64	78.05	50	64.10	54	64.28	50	58.82
(8)Others	7	6.25	11	13.92	2	2.44	0	0.00	2	2.38	5	5.88
Total	112	100.00	79	100.00	82	100.00	78	100.00	84	100.00	85	100.00

(*) excluding the number of workers who are working at locality or Fengshan city.

(**) excluding the number of workers who are working at locality or Pingtung city.

Table 5-22 The Percentage Distribution of the Workforces of the Study Area Working at Localities or Commuting to Work in Kaohsiung City

Places	% of the Workforces Work at Localities	% of the Workforces Commuting to Work in Kaohsiung City
(1)Fengshan C	44.32	42.92
(2)Kangshan T	64.85	14.94
(3)Chishan T	64.60	16.07
(4)Meinung T	68.34	12.41
(5)Linyuan H	58.68	30.20
(6)Taliao H	57.99	26.61
(7)Tashu H	67.14	15.90
(8)Jenwu H	63.58	26.17
(9)Tashe H	64.43	22.17
(10)Niaosung H	50.79	30.73
(11)Chiaotou H	49.30	34.98
(12)Yenchao H	68.44	13.71
(13)Tienliao H	57.69	9.21
(14)Alien H	69.62	7.25
(15)Luchu H	74.94	8.13
(16)Hunei H	68.11	3.99
(17)Chiating H	56.15	4.30
(18)Yungan H	64.32	13.20
(19)Mito H	54.43	21.67
(20)Tzukuan H	63.64	23.52
(21)Liukuei H	63.54	10.71
(22)Chiahsien H	63.63	7.50
(23)Shanlin H	66.56	10.66
(24)Neimen H	62.06	11.96
(25)Pingtung C	72.01	9.91
(26)Chaochou T	69.72	7.31
(27)Tungkang T	74.07	8.47
(28)Wantan H	75.81	7.69
(29)Changchih H	61.72	8.79
(30)Linlo H	58.34	12.66
(31)Chiuju H	72.82	7.10
(32)Likang H	75.07	7.81
(33)Yenpu H	77.24	5.13
(34)Kaoshu H	71.07	8.33
(35)Wanluan H	57.66	9.57
(36)Neipu H	61.02	9.71
(37)Chutien H	61.07	12.14
(38)Hsinpi H	56.63	7.43
(39)Fangliao H	65.86	10.21
(40)Hsingyuan H	69.74	7.95
(41)Kanting H	63.90	8.54
(42)Linpien H	62.63	9.34
(43)Nanchou H	65.10	10.82
(44)Chiatung H	59.42	11.69

Source : The 1980 Census of the Population of the Taiwan-Fukien Area, ROC. pp.356-359. (published by Ministry of the Interior Affairs, 1982)

(B) The distribution of high-school attendance in the study area.

In this discussion, the spatial distribution of enrollments in elementary schools (grades 1-6), junior middle schools (grades 7-9), and the tertiary education (colleges of higher education) are completely omitted. In Taiwan, nine years compulsory education (i.e. from grades 1-9, including elementary school and junior middle school) has been practised for over ten years. Therefore, every hsiang has its own elementary and junior middle schools and the students are assigned to the nearest schools as a matter of course. In this case, the catchment areas of the elementary schools and the junior middle schools can hardly be used as indicators of the influences exerted by the bigger urban places. On the other hand, the colleges and universities are mostly concentrated in the big cities; namely, Taipei municipality, Taichung city, Tainan city and Kaohsiung municipality. All students who want to enter the universities must pass the joint entrance examination of college and universities and, then, are assigned to the university according to their choice and marks. In this instance, the outcome cannot reflect the influence of the urban places in a regional context. For instance, a sufstantial number of the students at the Kaohsiung Medical College are from the Taipei area in northern Taiwan. Yet, this fact can hardly be interpreted as suggesting that the influence of Kaoh-

siung city has reached to the Taipei area. Consequently, attendance at high schools can more appropriately represent the influences of the urban places in a local or regional context. In Taiwan, high schools (grades 10-12) entry is conditional on the entrance examination, but the origins of the students are usually regional. In other words, few students in Kaohsiung will go to Taipei or Taichung to attend the famous high schools there. In view of this constraint, high-schools attendance is selected in this study as the index of the cultural impact of Kaohsiung on the places of the study area.

Table 5-23 Catchment Areas for Those Attending High Schools in the Study Area

	Locations of Schools									
	(A)Kaohsiung C		(B)Tainan C		(C)Pingtung C		(D)Others		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Places										
(1)Fengshan C	30	46.15	0	0.00	2	3.08	33	50.77	65	100.00
(2)Niaosung H	10	43.48	0	0.00	0	0.00	13	56.52	23	100.00
(3)Tashu H	7	38.89	3	16.67	0	0.00	8	44.44	18	100.00
(4)Taliao H	12	60.00	0	0.00	0	0.00	8	40.00	20	100.00
(5)Luchu H	6	16.67	10	27.78	0	0.00	20	55.56	36	100.00
(6)Linyuan H	13	50.00	0	0.00	1	3.85	12	46.15	26	100.00
(7)Hunei H	4	13.33	16	53.33	0	0.00	10	33.33	30	100.00
(8)Shanlin H	5	33.33	2	13.33	0	0.00	8	53.33	15	100.00
(9)Liukuei H	6	37.50	3	18.75	0	0.00	7	43.75	16	100.00
(10)Fangliao H	4	28.57	0	0.00	4	28.57	6	42.86	14	100.00
(11)Pingtung C	8	38.10	0	0.00	12	57.14	1	4.76	21	100.00
(12)Chaochou T	5	27.78	0	0.00	7	38.89	6	33.33	18	100.00

It is clear from Table 5-23 that the pattern of high-school catchment areas is somewhat different from that obtaining for working places (see Table 5-21 or Table 5-22). To a much greater extent, Kaohsiung city has exerted

its influence on places of the study area in this aspect of culture. As shown in Table 5-23, most of the selected places have fairly high percentages of students attending high schools in Kaohsiung city, although Luchu hsiang and Hunei hsiang differ in that they have higher percentages of students attending high schools in Tainan city. In order to establish whether the distribution of the commuting to Kaohsiung city is significantly different from high-school attendance in Kaohsiung city (from the 12 places), the Chi-square test (X^2) is employed. Since the test is restricted to nominal (frequency) data and is nonparametric (Ebdon, 1978, p.61), frequencies instead of percentages of the data are used (see Footnote 2 for the means of calculation).

The calculated value of X^2 is 25.64, which is greater than the critical value of X^2 (i.e. 19.68) at 0.05 significance level with 11 degrees of freedom. Therefore, the null hypothesis is rejected in that there is no significant difference between these two distributions at the 0.05 significance level. In short, it can be claimed with 95 per cent confidence that there is a significant difference between these two distributions (i.e. accept the alternative hypothesis).

(C) The distribution of shopping and social activities.

For the sake of simplicity, the distribution of shopping and social activities will be contemplated from the viewpoint of the relationships between Kaohsiung city and the 12 places listed in Table 5-24. It is evident that,

except for Hunei hsiang and Luchu hsiang, the residents of these places opt to undertake a high percentage of their shopping and social activities in Kaohsiung city. Of course, there is a wide variation between different kinds of shopping and social activities. Generally speaking, the higher-class goods or services tend to be procured from outlets in Kaohsiung city. For instance, purchases of pearls, cosmetics and cameras are cases in point. These articles are not only expensive, but also easy to carry. On the other hand, goods like furniture and TV sets are less likely to be bought in Kaohsiung city. This is not only because these goods are heavy, but also because, in the case of TV sets, retail outlets are present in every hsiang and town, boasting goods of identical price and quality. By way of contrast, the largest and most respected general hospitals in the study area (which include the Teaching General Hospital of the Kaohsiung Medical College) are located in Kaohsiung city, resulting in the high concentration of that service in Kaohsiung city. In a word, different kinds of goods and activities generate different patterns of shopping. To take the shopping patterns of clothes and cameras for instance, the Chi-square test can be used to verify our reasoning. An empirical test statistic is calculated as :

$X^2 = 21.136$

The degrees of freedom (df)=(2-1)(12-1)=11. At the 0.05 significance level with 11 degrees of freedom the critical

value of X^2 is 19.68. Therefore, the null hypothesis is rejected and accept the alternative hypothesis (H), with 95 per cent of confidence, that there is a significant difference between the shopping patterns for clothes and cameras.

(2) Out-migration patterns in the study area.

The distribution of out-migration avers (in Table 5-25) that, as expected, Kaohsiung city is the most significant magnetic pole of the migration field in the study area.

Quite high proportions of the outmigration occurring in the places of the study area terminate in Kaohsiung city. Even Hunei hsiang which, as other indicators show (e.g. shopping in Table 5-22) is supposed to be located within the commuting range of Tainan city, has a fairly high precentage of its outmigration population moving to Kaohsiung city. Indeed, the proportion is 64.71 per centage in contrast to the 17.65 per cent choosing Tainan city. Obviously, for the majority of emigrants, Kaohsiung city is a place replete with more opportunities. On the other hand, places like Taliao and Tashu, which are both within the Kaohsiung Metropolitan Area, also record very high rates of out-migration to Kaohsiung city notwithstanding its close proximity. Therefore, economic motivation is not the only significant reason for migrants to move to Kaohsiung city. In order to gain greater insight into this problem, the questionnaire was designed to provide four possible answers:

Table 5-24 Shopping Rooted in Kaohsiung City

	Goods and Services									
	(1)specialized books		(2)clothes		(3)pearl & cosmetics		(4)furniture		(5)camera	
	no.	%	no.	%	no.	%	no.	%	no.	%
Places										
(1)Fengshan C	108	60	52	28.9	65	36.1	31	17.2	95	52.8
(2)Niaosung H	63	67.7	15	16.1	53	56.9	22	23.7	65	69.9
(3)Tashu H	36	57.1	8	12.7	28	44.4	20	31.7	35	55.6
(4)Taliao H	52	80.0	25	38.5	35	53.8	23	35.4	48	73.8
(5)Luchu H	25	41.7	12	20.0	28	46.7	8	13.3	32	53.3
(6)Linyuan H	45	81.8	25	45.5	35	63.6	20	36.4	40	72.7
(7)Hunei H	3	4.6	0	0.0	2	3.1	0	0.0	4	6.3
(8)Shanlin H	25	55.5	8	17.8	15	33.3	0	0.0	30	66.7
(9)Liukuei H	26	56.5	5	10.9	18	39.1	0	0.0	20	43.5
(10)Fangliao H	30	60.0	8	16.0	16	32.0	1	2.0	21	42.0
(11)Pingtung C	20	30.3	7	10.6	25	37.9	2	3.0	26	39.4
(12)ChaochouT	18	31.0	5	8.6	28	48.3	4	6.9	28	48.3

	Goods and Services										
	(6)TV sets		(7)general hospital		(8)movie		(9)opera & dancing		(10)social activitie		Total
	no.	%	no.	%	no.	%	no.	%	no.	%	no.(*)
Places											
(1)Fengshan C	12	0.7	86	47.8	78	43.3	120	66.7	43	23.9	180
(2)Niaosung H	10	10.8	75	80.6	35	37.6	45	48.4	25	26.9	93
(3)Tashu H	16	25.4	56	88.9	27	42.9	32	50.8	20	31.7	63
(4)Taliao H	18	27.7	60	92.3	35	53.8	37	56.9	28	43.1	65
(5)Luchu H	10	16.7	21	35.0	13	21.7	15	25.0	9	15.0	60
(6)Linyuan H	13	23.6	48	87.3	42	76.4	46	83.6	30	54.5	55
(7)Hunei H	0	0.0	5	7.8	0	0.0	6	9.4	8	12.5	64
(8)Shanlin H	5	11.1	28	62.2	9	20.0	10	22.2	7	15.5	45
(9)Liukuei H	3	6.5	26	56.5	12	26.1	14	30.4	6	13.0	46
(10)Fangliao H	4	8.0	20	40.0	9	18.0	12	24.0	5	10.0	50
(11)Pingtung C	1	1.5	28	42.4	23	34.8	33	50.0	24	36.4	66
(12)Chaochou T	0	0.0	32	55.1	25	43.1	30	51.7	15	25.9	58

(*) The number indicates the total number of questionnaires and interviews.

(1) access to the working place; (2) access to children's schooling; (3) preferences for or against the standards of living of the place; and (4) concern for other interests. The possibility of a number of choices was allowed. The outcome (as shown in Table 5-26) is that 'children's education' is an even more significant factor than the economic reason (jobs) in deciding migrants to relocate to Kaohsiung city. Influenced by the Confucian idea of emphasizing education and the long tradition held by society that education is the best way for the people, especially those that are poor, to upgrade their social position, the parents in Taiwan put much weight on children's education in order to improve their child's chances of passing the entrance examination for higher education. Moreover, the government's economic development and 'low-tuition' policies combine to render the competition for higher education more intense, because even the poor can aspire to allow their children to enter instifutions of higher education. As elsewhere in the world, the bigger cities often provide better elementary and secondary schooling. This, in turn, becomes a significant pull factor for the big cities, enabling them to attract immigrants.

A related matter is remittances and their incidence in study area. Based on the questionnaire findings (as inferred from Table 5-27), only 33.5 percentage of the out-migrants sent back monies to their families. This

Table 5-25 The Distribution of Out-Migration in the Study Area

	To:	(1)Kaohsiung C	(2)Tainan C	(3)Pingtung C	(4)Taipei C	(5)Others	(6)Total
From:							
(1)Fengshan	no.	7	4	6	7	26	50
	%	14.00	8.00	12.00	14.00	52.00	100.00
(2)Niaosung H	no.	8	3	1	3	12	27
	%	29.63	11.11	3.70	11.11	44.45	100.00
(3)Tashu H	no.	9	1	0	2	3	15
	%	60.00	6.66	0.00	13.33	2.00	100.00
(4)Taliao H	no.	13	0	1	1	2	17
	%	76.47	0.00	5.88	5.88	11.76	100.00
(5)Luchu H	no.	6	2	0	4	6	18
	%	33.33	11.11	0.00	22.22	33.33	100.00
(6)Linyuan H	no	7	0	1	3	5	16
	%	43.75	0.00	6.25	18.75	31.25	100.00
(7)Hunei H	no.	11	3	0	1	2	17
	%	64.71	17.65	0.00	5.88	11.76	100.00
(8)Shanlin H	no.	17	4	0	3	11	35
	%	48.57	11.43	0.00	8.57	31.43	100.00
(9)Liukuei H	no.	25	1	5	7	15	53
	%	47.17	1.89	9.43	13.21	28.30	100.00
(10)Fangliao H	no.	26	4	8	7	20	65
	%	40.00	6.15	12.31	10.77	30.77	100.00
(11)Pingtung T	no.	4	1	9	7	6	27
	%	29.63	3.17	33.33	25.93	22.22	100.00
(12)Chaochou T	no.	12	1	4	7	10	34
	%	35.29	2.94	11.76	20.59	29.41	100.00

Table 5-26 The Reasons for Out-migration

		Reasons				
		(1)acess to work	(2)kids' schooling	(3)environment of the place	(4)others	total
Places						
(1)Fengshan C	no.	18	21	2	16	57
	%	31.58	36.84	3.51	28.07	100.00
(2)Niaosung H	no.	8	15	2	5	30
	%	26.67	50.00	6.67	16.67	100.00
(3)Tashu H	no.	7	14	0	16	37
	%	18.92	37.84	0.00	43.24	100.00
(4)Taliao H	no.	9	18	1	10	38
	%	23.68	47.37	2.63	26.32	100.00
(5)Luchu H	no.	10	8	2	12	32
	%	31.25	15.00	6.25	37.50	100.00
(6)Linyuan H	no.	5	16	4	8	33
	%	15.15	48.48	12.12	24.24	100.00
(7)Hunei H	no.	10	14	2	6	32
	%	31.25	43.75	6.25	18.75	100.00
(8)Shanlin H	no.	22	14	0	6	42
	%	52.38	33.33	0.00	14.29	100.00
(9)Liukuei H	no.	10	14	4	10	38
	%	26.32	36.84	10.53	26.32	100.00
(10)Fangliao H	no.	12	15	3	5	35
	%	34.29	42.86	8.57	14.29	100.00
(11)Pingtung C	no.	6	17	5	10	38
	%	15.79	44.74	13.16	26.32	100.00
(12)Chaochou T	no.	18	14	2	5	39
	%	46.15	35.90	5.13	12.82	100.00
Total	no.	135	180	98	109	522
	%	25.86(•)	34.48	18.77	20.88	100.00

(•) (135/522).100 = 25.86 (%)

percentage is not overly high and may be due to the prevalence of the nuclear family, even in rural areas. Among those families that receive remittances, 44.62 per cent considered them to be an important source of their family income. It is evidently a vital form of income injection to many communities and should not be overlooked.

Table 5-27 The Distribution of Remittances Sent by the Out-migrants

Places		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	Total no.	Total %
Remittance	No	23	15	10	12	4	14	8	7	8	19	8	9	137	66.56(*)
	Yes	6	8	4	4	2	2	2	12	9	9	1	8	69	33.50
Is the Remittance Important?	No	3	6	4	2	2	0	0	5	3	4	1	6	36	55.38(**)
	Yes	3	2	0	2	0	2	2	7	5	5	0	1	29	44.62

(*) (137/(137+69)).100 = 66.56 (%); (**) (36/(36+29)).100 = 55.38 (%).
Places : (1)Fengshan C, (2)Niaosung H, (3)Tashu H, (4)Taliao H, (5)Luchu H, (6)Linyuan H, (7)Hunei H, (8)Shanlin H, (9)Liukuei H, (10)Fangliao H, (11)Pingtung C, (12)Chaochou T.

Table 5-28 The Distribution of the Families Engaging in Agriculture

Places		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	Total no.	Total %
No. of Families Engaging in Agri.		11	19	11	8	15	20	9	26	24	16	15	24	198	
Constitutents of the Family Incomes from Agriculture	1	1	3	0	0	5	2	1	2	4	5	2	5	31	15.66
	1/2	1	2	3	0	3	3	2	8	3	6	4	7	42	21.21
	1/4	2	5	5	4	2	6	4	12	5	1	4	6	56	28.28
	1/4	7	9	3	4	5	9	2	4	12	4	5	6	70	35.35

(3) The situation of agricultural development

From the questionnaires, it is apparent that the percentage of families engaging in agriculture is in general quite low (see Table 5-28). As a rule, it is the more

remote areas, such as Shanlin hsiang, Liukuei hsiang and Fangliao hsiang, which have relatively high values. However, places such as Niaosung hsiang and Chaochou town, constituents of the Kaohsiung Metropolitan Area or legitimate urban place (Chaochou town), register relatively high values too. Among these agriculturally-oriented families, only 15.66 per cent of them rely on agriculture for their main income source, and over half of the farm households (i.e. 63.63 percentage) obtained a quarter or less of their income from agriculture (see Table 5-28). Obviously, incomes from non-farm jobs has become a principal source of family income for the farm household.

The changes in cropping patterns and other farm land uses are also important topics which are helpful to the understanding of the impact of urbanization and industrialization on the agricultural economy. The questionnaire survey reveals that crop changes, as shown in Table 5-29, occurred more often in those places close to the urban areas, such as Pingtung city, Chaochou town, Luchu hsiang, Taliao hsiang and Niaosung hsiang. However, in remote places, such as Liukuei hsiang and Fangliao hsiang, changes are equally evident. In a word, the differences between those places close to urban areas and those more remote are not very significant, although they do exist. This convergence may be the result of improvements in transportation and the rapid diffusion of information. In conjunction, they mean that even farmers in the relatively remote areas

can rapidly respond to the demands of the market and change their crops. Compared with crop changes, the situation of changing farmlanduses is more varied among the places (see Table 5-30). Generally speaking, the changes in farmlanduses are slightly more urbanbiased. Places close to the urban areas have higher percentage of farmers who have changed their farm land into non-farm landuses than is the case elsewhere. For instance, Fengshan city, Niaosung hsiang, Taliao hsiang and Pingtung city all contain a relatively high percentage of farmers who changed their landuses patterns. On the contrary, remote areas, such Liukuei hsiang and Shanlin hsiang have low values on this score.

Tables 5-29 and 5-30 suggest that increasing income and shortage of labour account for the most significant reasons for the changes in crop patterns (with the values of 36.71 per cent and 32.91 per cent for 'increasing income' and 'shortage of labour' respectively), while residential and industrial landuses are the two most important factors accounting for changes in farmlanduses (with 54.76 per cent and 21.43 per cent for the residential and industrial landuses respectively). This last, without doubt, is a consequence of the mushrooming urban and industrial developments under way in the study area. The implications of these disparate findings form the substance of the next chapter.

Table 5-29 The Situation of Changing Crops in the Study Area

Places	No. of Farmers Changed Their Corps		Reasons for Changing					
	No.	%	(A)shortage of labour	(B)increasing incomes	(C)Demand of market	(D)Encourged by government	(E)others	Total
(1)Fengshan C	3	27.30(*)	0	1	1	1	2	
(2)Niaosung H	5	26.32	1	2	1	0	2	
(3)Tashu H	2	18.18	1	2	0	0	0	
(4)Taliao H	2	25.0	2	2	0	0	0	
(5)Luchu H	6	40.0	3	2	0	2	0	
(6)Linyuan H	6	30.0	2	1	0	1	0	
(7)Hunei H	3	33.3	2	2	0	0	0	
(8)Shanlin H	3	11.4	2	1	0	1	0	
(9)Liukuei H	9	39.1	4	4	0	1	2	
(10)Fangliao H	5	31.2	2	3	2	1	1	
(11)Pingtung C	9	60.0	5	2	0	3	1	
(12)Chaochou T	10	41.7	2	7	0	0	2	
Total			26(32.91%)**	29(36.71%)	4 (5.06%)	10 (12.66%)	10(12.66%)	79

(*) : % of the total number of families engaging in agriculture for each place (see Table 5-28), e.g. for place 1, the value is (3/11).100 = 27.3 (%)

(**) : The % value represents the % of the choice of that reason, e.g. the % of chosing reason (A) is (26/79).100 = 32.91 (%).

Table 5-30 The Situation of Changes in Farm Landuses in the Study Area

Places	No. of Farmers Changed Their Farm Landuses		Reasons for Changing						
	No.	%	(A)residental uses	(B)industrial uses	(C)recreation uses	(D)public uses	(E)commercial uses	(F)other uses	Total
(1)Fengshan C	4	36.36(*)	3	1	0	0	0	0	
(2)Niaosung H	5	26.32	3	1	0	1	0	0	
(3)Tashu H	2	18.18	2	0	0	0	0	0	
(4)Taliao H	3	37.50	2	1	0	0	0	0	
(5)Luchu H	4	26.70	1	2	0	0	0	1	
(6)Linyuan H	6	30.00	2	1	0	1	1	1	
(7)Hunei H	2	22.22	1	1	0	0	0	0	
(8)Shanlin H	0	0.00	0	0	0	0	0	0	
(9)Linkuei H	4	16.67	2	0	1	0	0	2	
(10)Fangliao H	3	18.75	2	0	0	0	1	0	
(11)Pingtung C	5	33.33	3	1	1	0	0	0	
(12)Chaochou T	3	12.5	2	1	0	0	0	0	
Total			23 (54.76%)**	9 (21.43%)	2 (4.76%)	2 (4.76%)	2 (4.76%)	4(8.69%)	42

(*) : % of the total number of families engaging in agriculture for each place (see Table 5-28), e.g. for place 1, the value is (4/11).100 = 36.36 (%).

** : The value represents the % of the choice of that reason, e.g. the % of chosing reason A is (23/42).100 = 54.76 (%).

Footnotes:

(1) The formula for calculating the z-scores in this study is :

$$Zi = \frac{Xi - X}{S}$$

Where, Zi : the standardized score for the ith observation.
Xi : the original raw data.
X : the mean for all values of X.
S : the standard deviation.

(2) The formula for calculating X2 is :

$$X2 = \frac{d}{e}$$

where, d : the difference between the observed and the expected frequency for each category.
e : the expected frequency for each category.

From Table 5-23 and Table 5-21 the observed frequencies and the except frequencies are obtained, as follows Observed frequencies:

	Place (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	Total
(A) Attending high school in Kaohsiung city	30	10	7	12	6	13	4	5	6	4	8	5	110
(B) Commuting to Kaohsiung city	168	47	23	32	12	28	4	8	7	9	10	8	356
Total	198	57	30	44	18	41	8	13	13	13	18	13	466

	Place											
Expected Frequencies:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(A) Attending high school in Kaohsiung city	46.7(*)	13.5	7.4	10.4	4.4	9.4	1.9	3.1	3.1	3.1	4.4	3.1
(B) Commuting to Kaohsiung city	151.3	43.5	22.9	33.6	13.8	31.3	6.1	9.9	9.9	9.9	13.8	9.9

(*) : the value = (total of column)(total of row)/(total of column and row). For example, the expected frequence of place (1) for (A) is equal to : (198)(110)/466 = 46.7

Place : (1) Fengshan C, (2) Niaosung H, (3) Tashu H, (4) Taliao H, (5) Luchu H, (6) Linyuan H, (7) Hunei H, (8) Shanlish H, (9) Liukuei H, (10) Fangliao H, (11) Pingtung C, (12) Chaochou T.

Chapter 6
Implications of the Analysis

6.1 The Results Condensed

By synthesizing the results of the analyses completed in Chapter 5, several conclusions pertaining to the pattern of development experienced by the study area can be made. These, in turn, can be contrasted with the theoretical assertions which were proffered to justify the thesis in the first place. For the sake of succinctness they are addressed in point form.

(1) From the factor analyses and the coefficient of variation analyses of the 12 general variables, it is obvious that such variables as number 2 (crude birth rate), 4 (percentage of population aged 15-64), 8 (percentage of the employment base in secondary industry), 9 (percentage of the employment base in tertiary industry) and 10 (in-migration rate) have experienced spatial convergence in their distributions, in the sense that these variables are more widely dispersed in 1987 than in 1971. On the other hand, there are other variables such as number 1 (size of population), 3 (percentage of population aged 0-14), 7 (percentage of the employment base in primary industry), 11 (out-migration rate) and 12 (net-migration rate) which have undergone a tendency towards spatial divergence. In other words, these variables have in the past decade and more become more concentrated in terms of relative spatial distribution.

These results contain some significant implications: in the first instance, they point to the success of family planning; a practice which resulted in the overall reduction of birth rates in all communities, rural areas as well as urban areas. Second, they underscore the serious migration of population which occurred in the study area during the period of 1971-1987: a phenomenon resulting in the unbalanced age-distribution of population between different places of the study area. As a rule, out-migration is particularly prominent in places epitomized as poorly developed and lacking in job opportunities. These generally remote rural areas lose people to the places that are economically more developed and thus rejoicing in more job opportunities, such as urban areas. Consequently, such rural-to-urban migration is, in a sense, an adaptation to the process of workers-to-work rather than an adjustment to that of work-to-workers. Since economic development in Taiwan in general, and in the Kaohsiung area in particular, has occurred at a fast pace, the provision of jobs in the urban areas does not constitute a problem, unlike other parts of the Third World. As a matter of fact, continuous economic growth and the successful implementation of family planning in the past one or two decades have together resulted in labour shortages, especially for the blue-collar workers in the manufacturing sectors. This constraint has been exacerbated by shifts in the labour forces from the secondary sectors, mainly manufacturing, to the

tertiary sectors (i.e. service sectors); shifts which, to young people, mean easier work and, in many cases, more income. What is more, since the service sectors are usually characterized by high 'income elasticity of demand' --- i.e. the demand of the service sectors increases in accord to the increase of income --- economic development to a certain extent will produce a snowballeffect in creating yet more jobs within the service sector. This, in turn, results in the incidence of stronger pull factors in the urban areas with the effect of encouraging more migration to them from rural areas. This kind of 'cause-and-effect' cycle has resulted in the concentration of population in some places, as suggested by the rapid increase of the values of the coefficient of variation of variable 1 (size of population) during the 1971-1987 period. Moreover, the process of population migration is essentially selective in that the outmigrants are mostly members of the age group of 15-64 years. As a result, the migration pattern in the study area during the past one-to-two decades has resulted in an imbalanced age composition of population among its places, and nowhere more so than in a few remote 'enclaves' (an observation reinforced by the divergences of the distribution of variables 3, 5 and 6). By way of contrast, the distribution of variable 4 (percentage of population aged 15-64) has proportionately increased its dispersed pattern in conjunction with the more widely dispersed pattern of the secondary and tertiary industries. Third,

there is a strong tendency of spatial convergence as far as the distribution of employment in secondary and tertiary industries is concerned, judged by the rapid decrease of the values of the coefficients of variation for variables 8 and 9 from 1971 to 1987. As indicated earlier, this might result from either rural industrialization or enhanced commuting to work in other places (e.g. urban places). Both cases have worked to effect an increase in the incomes of the families and increased their purchasing power which, in turn, has eventually created, through the multiplier effect, augmented demand for the service sectors. The spread of manufacturing plants in the study area over the past one or two decades was evident from the appearance of large industrial districts comprising many small factories; an occurrence noted in Chapter 3. These dispersed plants, on the one hand, provided the people of localities and nearby areas with job opportunities, but, on the other hand, deprived agriculture of much of its labour force. This may be attributed, at least partly, to the difficulties confronting agricultural development, especially in the more urbanized or more industrialized areas. In these areas, the relationships between agricultural activities, and manufacturing and service activities are essentially competitive and mutually exclusive: the various activities compete with each other for land and labour. An immediate outcome of this development in the study area is the diminished role played by agriculture in economic development

and, in spatial terms, its retreat to the more remote rural areas where food production still plays a fairly important role in the local economy, as judged by the percentage of the employment base in agriculture. In a word, there is an all-too-evident polarization in terms of the spatial distribution of agricultural activities in the study area.

(2) The results from the factor and the coefficient of variation analyses of the farm household variables representing the living standards and activities of the farm households are more or less identical. All of the variables, save number 6 (percentage of the farm households subscribing to a newspaper), were distributed more evenly in 1980 than in 1969. Among them, the ownership of the TV sets (variable 1), washing mechines (variable 2) and refrigerators (variable 3) are the most prominent in their degree of dispersion. The results from the questionnaire survey confirm this conclusion. In fact, those aspects of this survey addressing the issue of living standards was forthcoming with results so comparable across the entire study area as to be deemed without any spatial merit and, accordingly, omitted from the thesis.

Consider this striking fact : the well-being of the farm households has been improved to such an extent that no significant differences exist between the distribution of the majority of the convenience facilities among the farm households in the study area. Of course, there still exist discernible disparities in the distribution of some other

facilities such as telephone provision and ownership of cameras. However, even for these somewhat less vital facilities, the disparities in terms of their spatial distributions were steadily eroding from 1969 to 1980. This conclusion seems to be inconsistent with that just presented bearing on agricultural development in the study area. However, one should note that the incomes of the farm households were obtained mostly from non-farm jobs. The results of the questionnaire survey support this viewpoint. In that survey, over 60 percentage of the farm households obtained less than a quarter of their family income from the agricultural sector.

(3) Judged by the factor scores and z-scores for both the general variables and the farm households variables, along with the rationales furnished above, the overall patterns of development of the study area can be summarized under two themes.

(A) Basically, the developmental surfaces tend to be urban-oriented, in the sense that urban places or places close to urban areas are in general better developed than those found in the remote rural areas. Both the analyses of the general variables and the farm households variables demonstrated this characteristic of the developmental surface in the study area, although, to be sure, the farm household variables did not evince as marked a tendency of urban-biased development as did the general variables. In the main, places close to Kaohsiung municipality have

developed better than the areas far away from it. For instance, it is obvious from our analyses that places within the Kaohsiung Metropolitan Area are generally developed best. At the other extreme, the remote places, especially those in the marginal mountain places of the study area, such as Shanlin hsiang (place 23), Liukuei hsiang (place 21) and Neimen hsiang (place 24), have the least degree of development. In short, development basically conforms to the theoretical hypothesis that in the study area there exists a discernible linear trend in its incidence, a trend declining with distance from Kaohsiung Municipality --- the 'spontaneous' growth centre for the study area.

(B) Next, development displays another characteristic in terms of spatial distribution; that is to say, a tendency to gravitate towards the north. Put otherwise, development occurring along the three different directions of axes --- the north, the south and the east --- did not progress evenly. In general, the northward direction, that is, the band embracing places located between Kaohsiung city and Tainan city, such as Kangshan town (place 2), Luchu hsiang (place 15), Alien hsiang (place 14), Yungan hsiang (place 18), Mito hsiang (place 19), Hunei hsiang (place 16) and Chiating hsiang (place 17), was blessed with better development endowments in comparison with other hsiangs outside the Kaohsiung Metropolitan Area. This configuration, again, is not at odds with claims made in the

conceptual part of the thesis, reflecting in all probability a developmental corridor between the two big centres of Kaohsiung and Tainan city.

(4) Notwithstanding the exposure of a discernible trend, the individual analyses of linear regression failed to uncover any strong linear relationships between development affecting the places and the distances of those places from Kaohsiung city.

On first appearance, these findings are surprising in view of theoretical expectations. The reasons why the results of analyses did not show any substantial linear relationship between the development of places and their distances to Kaohsiung city are varied. To begin with, the distance used in this study for measuring the linear regression is the straight-line distance between the centre of each place and the CBD of Kaohsiung city. But, in fact, the connection between two places is often decided by factors other than straight-line distance, such as the situation of the road network, and the feasibility and cost (both pecuniary and time) of transportation. Secondly, rural industrialization may also play a significant role in dispersing development from the core to the peripheral areas, which will definitely distort the gradient of the intensity of development emanating from the core. Thirdly, there are a number of urban places dotted within the study area, each capable of producing its own series of small development surfaces which conspire to coalesce and overlap

with one another. This again will distort the greater development surface of Kaohsiung municipality. Fourthly, with the improvement of transportation, the friction effect of distance may be reduced to such an extent that it no longer proves detrimental to communications between any two places; a possibility extremely likely in small, densely-settled districts such as this study area.

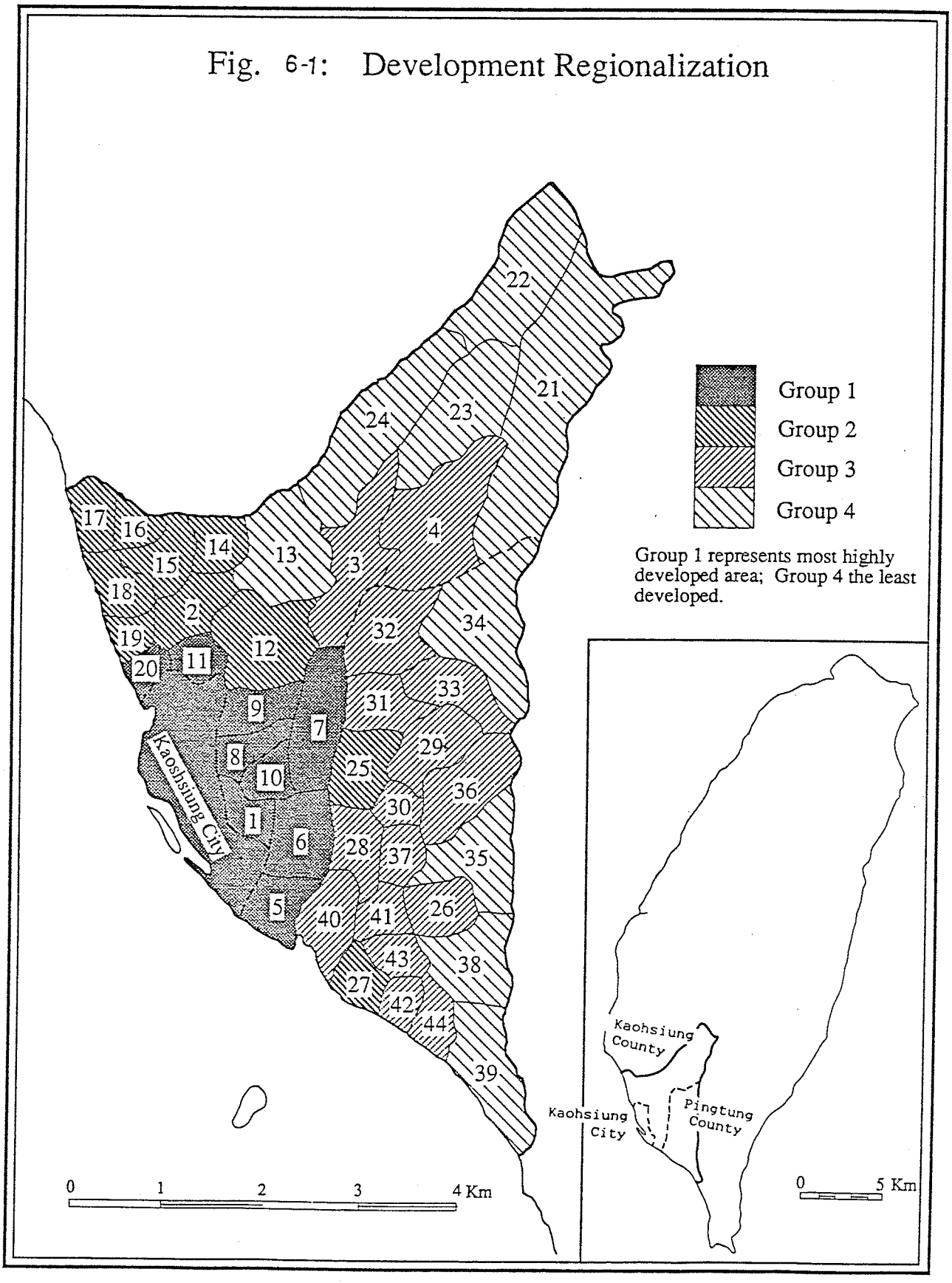
In summary, when the results of the factor analyses, the coefficient of variation analyses, z-score values and the population growth rate from 1979 to 1988 are all taken into account, the study area can be roughly divided into four different zones, according to their characteristics of development (see Figure 6-1). Each of the four zones (denoted as Group 1 to 4) deserves elaboration, beginning with Group 1 : the most sanguine case.

(1) The first group which, as stated, represents the zone promising greatest potential development includes all nine places of the Kaohsiung Metropolitan Area. To be explicit, they are: Fengshan city (place 1), Linyuan hsiang (place 5), Taliao hsiang (place 6), Tashu hsiang (place 7), Jenwu hsiang (place 8), Tashe hsiang (place 9), Niaosung hsiang (place 10), Chiaotou hsiang (place 11) and Tzukuan hsiang (place 20). All these places experienced very high population growth rates from 1977 to 1988; rates consistently greater than 10 per cent. The more dynamic of them, Fengshan city, Jenwu hsiang and Niaohsung hsiang, recorded growth rates of over 30 per cent. What is more, most of

these places enjoyed the highest factor scores and z-scores. If Kaohsiung city is the core area, it follows that these nine places will be equivalent to Friedmann's 'upward-transitional' region. By dint of that status, they were the beneficiaries of much stronger 'spread effects' than 'backwash effects' from the Kaohsiung core area during the period of our study.

(2) The second group represents the zone of moderate to slightly high growth rates of development. Its extent is delimited by the disposition of Kangshan town (place 2), Yenchao hsiang (place 12), Alien hsiang (place 14), Luchu hsiang (place 15), Mito hsiang (place 19), Yungan hsiang (place 18), Hunei hsiang (place 16), Chiating hsiang (place 17), Pingtung city (place 25), and Tungkang town (place 27). In general, all these places registered positive population growth rates from 1979 to 1988; rates which on average were second only to the first group of places. In addition, most of these places displayed moderate to fairly high values for their factor scores and z-scores. With the exceptions of Pingtung city (place 25) and Tungkang town (place 27), which comprise the urban places of Pingtung county, all the rest are located north of Kaohsiung city and, in particular, fall into the axis existing between Kaohsiung city and Tainan city. In essence, they corroborate the prevalence of a Kaohsiung-Tainan Development Corridor. On balance, the places of this second group received more positive (spread) effects than negative ones

Fig. 6-1: Development Regionalization



(backwash) from Kaohsiung city, and, to a lesser extent, the same pattern emanated from Tainan city.

(3) The third group of places represent a transitional zone between groups (1) and (2), and (4) which is the least developed area. Tey are: Chishan Town (place 3), Meinuug Town (place 4), Chaochou Town (place 26), Wantan Hsiang (place 28), Changchin Hsiang (place 29), Linlo Hsiang (place 30), Chiuju Hsiang (place 31), Likang Hsiang (place 32), Yenpu Hsiang (place 33), Neipu Hsiang (place 36) , Chutien Hsiang (place 37), Hsingyuan Hsiang (place 40), Kanting Hsiang (place 41), Linpien Hsiang (place 42), Nanchou Hsiang (place 43), Chiatung Hsiang (place 44). The development situation appertaining to this group is very diverse. For instance, the population growth rates of 1978-1988 range from moderately positive to moderately negative, while the factor scores and z-scores of both the general variables and the farm households are also quite varied, ranging from moderately positive to moderately negative values. In a nutshell, there is much wider variation between the places within this group. On the one hand, there are places which register slightly stronger 'spread effects' than 'backwash effects', while, on the other, there are places exhibiting the exact opposite. For instance, Chaochou town and Linpi-en hsiang (place 42) belong to the former, while Chishan town (place 3) and Likang hsiang (place 32) appear to belong to the latter.

(4) The fourth group embodies the least developed places

of the study area. They are: Tienliao hsiang (place 13), Neimen hsiang (place 24), Chiahsien hsiang (place 2), Shanlin hsiang (place 23), Liukuei hsiang (place 21), Kaoshu hsiang (place 34), Wanluan hsiang (place 35), Hsinpi hsiang (place 38) and Fangliao hsiang (place 38). All these places are located along the border of the study area, occupying either mountain ous areas or the piedmonts of the mountains. They consistently exhibited large negative population growth rates for the period of 1979 to 1988. In addition, most of them vied with each other for the lowest factor scores and z-scores, both in reference to the general variables and the farm households variables. In other words, these are the places with the least development and thus the most serious incidences of population out-migration. On balance, they receive many more 'backwash effects' than 'spread effects' from Kaohsiung city. In aggregate, they are equivalent to Friedmann's 'downward-transitional' zone.

There are some points pertaining to the spatial form of development in the study area which are worthy of emphasis. First of all, in the east and northeast quadrants, there exists a steeply sloping linear surface which reflects the prominent change of the development surface. Basically this line connects Alien hsiang (place 14), Kangshan town (place 2), Yenchao hsiang (place 12) and Tashu hsiang (place 7). This configuration suggests that the 'spread effects' from Kaohsiung city have penetrated to this bound-

ary to the east and northeast directions, but beyond this line are transformed either into 'backwash effects' or into only slightly positive 'spread effects'. Even Chishan town and Meinung town, although they are both urban places, are burdened by negative effects, judging from their high negative growth rates of population, and their very low z-scores and factor scores. Obviously, Chishan town and Meinung town, both surrounded by agricultural districts, injected little in the way of spill-overs into their adjoining areas.

Secondly, there is a pronounced steeply-sloping linear surface extending to the south and southeast direction, albeit one of lesser proportion to the dominant surface projecting to the east and northeast. The boundary of this secondary feature lies basically along the Kao-ping River --- the border river between Kaohsiung county and Pingtung county. Generally speaking, most of the places in Pingtung county, except Pingtung city itself and, to a lesser extent, Tungkang town and Chaochou town, are less developed in comparison with those of Kaohsiung county (save those in remote mountain regions). The relative backwardness of the Pingtung Plain may be attributed to the three following reasons. First, the Kaohsiung Linhai Industrial District --- the largest developed industrial district of heavy industries in Taiwan --- is located at the southern edge of Kaohsiung city which has greatly deterred the continuous development of Kaohsiung city southwards. Secondly, the

Kao-ping River --- the second largest river in Taiwan --- separated the traffic flow between Kaohsiung county and Pingtung county. Before 1970 only one bridge spanned both banks of the river and allowed connections to be effected between Pingtung city and the Kaohsiung area. Subsequently, a new bridge was built along the coastal area, connecting Hsingyuan hsiang and Linyuan hsiang and leading to Kenting National Park. In the past couple of years, a further three bridges were built on the middle reaches of the Kao-ping River. In other words, until the last 10 years or so, traffic between Kaohsiung and Pingtung areas was limited: a restraint which definitely influenced development of the Pingtung Plain in the past. Thirdly, when one has discounted Pingtung city, in the whole of the Pingtung plain and even southwards to the Henchun Peninsula, there is no significant medium-sized city, not to mention large cities. Absence of bigger urban places combined with its remote geographical location have conspired to impose the bonds of isolation upon the entire area.

Finally, the concepts of the positive effects (variously styled 'spread effects' or 'trickling-down effects') and the negative effects ('backwash effects' or 'polarization effects') can be interpreted in different ways. In the first place, the so-called positive or negative effects are relative terms --- relative to different space conceptions and to different time frames. For instance, the difference in unit family incomes per year between Kaohsiung city and,

say, Chishan town was 1,000 US dollars in 1971, but increased to 2,000 US dollars in 1987. This could be construed to mean that the negative effects had prevailed. Now, the problem is what index (or indices) should be used to justify the claim that positive or negative effects have prevailed? In this study, for instance, the economic indices (such as variables 8 --- percentage of the employment base in secondary industries, and variable 9 --- percentage of the employment base in tertiary industries) showed that there was a significant regional convergence in their distributions from 1971 to 1987. If out insists on using these two variables as an index of development --- development in economic terms ---, then the results would tend to fall on the side of stronger positive effects than negative effects. Moreover, the 'spread effects' of Kaohsiung city may be traced as far away as Liukuei hsiang. To complicate matters, however, the positive and negative effects may change with changes incurred through economic development. Yet, influenced by Friedmann's (1966) model of spatial development many people take it for granted that, in direct correspondence with economic development, the incidence of spatial development will progress along a linear path from stage 1 to stage 2, to stage 3 and, finally, to stage 4, like driving along a 'one-way' street. Is this a reasonable approximation of the truth? Let us turn back to address this question by examining our case study, from the official planning perspective.

6.2 The Spatial Ramifications

With the retreat of the ROC government from Mainland China to Taiwan in 1949, the government took to heart the lesson of its failure on the mainland and started a land reform programme in the following year. In a complementary fashion, from 1953 the government implemented a series of 'Four-Year Economic Plans', substituting a 'Six-Year Economic' plan in 1975, followed by a reversion to Four-Year Economic Planning in 1981. All these development policies in combination have produced a great impact on the spatial structure of the study area. The salient features of the impact are worthy of comment.

(1) Before 1966

Taiwan began its industrialization with import-substitution policies and, then, in 1960s, switched to an export-production strategy of industrialization. In order to implement this strategy, the government started to enlarge Kaohsiung harbour in 1958, before going on to build the first Export-Processing Zone (EPZ) in the Kaohsiung harbour area in 1960. With the boom in exports which followed in short order, Kaohsiung city grew at an unprecedented rate and was marked by rapid industrial developments and a huge in-flow of people to man the new activities. At this time, development was still concentrated in Kaohsiung city, as mentioned in Chapter 3. Consequently, Kaohsiung city became a large 'core' in the Kao-Ping area (i.e. our study area), acting as the magnetic pole which served to

absorb the production resources (workers, capital etc.) from the surrounding areas. In short, it abided exactly by the format stipulated by Friedmann for his stage 2 --- incipient industrialization --- model of spatial evolution.

(2) From 1966 to 1980.

During this period of time the industrial development was gradually dispersed to the outlying zones of Kaohsiung city. The suburbanization of development was facilitated through the emergence of large-scale industrial districts in Jenwu hsiang, Tashe hsiang, Linyuan hsiang, Tashu hsiang, Yungan hsiang, Fengshan city, Taliao hsiang, Pingtung city and, eventually, even in the more remote Neipu hsiang of Pingtung county. As to the individual factories, they dispersed even further: smaller plants, in fact, succeeded in penetrating into fairly remote rural areas. This development led not only to a more scattered distribution of industries, but also to a redistribution of the work-forces and, hence, population. This is equivalent to the stage 3 (Transitional Stage) of Friedmann's model. In other words, it marks the beginning of convergence.

(3) The 1980s.

After 1980, in order to upgrade industry, raise the competitive ability of trade, and stimulate further development of the economy, the government proposed the promotion of so-called 'strategy industries', by which it meat to replace gradually the low value-added, labour-intensive industries with the high value-added, technology and capi-

tal-intensive industries. These high technology and capital-intensive activities are usually more urban-biased, gravitating especially towards larger cities. Furthermore, in tandem with economic development, the service sectors grew very fast in Kaohsiung city which attracted more white-collar employees than workers in factories. Besides, better schools, hospitals, libraries, and other public facilities provided other kinds of pull factors to attract more immigrants. Therefore, with the onset of the 1980s, the distribution of population became more concentrated in Kaohsiung city and the Kaohsiung metropolitan area. Although the government continued to build or enlarge the industrial districts even in such remote places as Neipu hsiang (place 36), Fangliao hsiang (place 39) and Chiatung hsiang (place 44), and also set about the building of highways in order to decentralize population, these endeavours were for the most part frustrated by the magnetic pull imposed by Kaohsiung. This upshot flies in the face of the comfortable assumption drawn by Friedmann and others that development will continue to equalize opportunities within the constituent places of a region, and will do so unchecked by obstacles.

6.3 Policy Implications

The hypothesis verified by this empirical case study, in turn, can be used as a reference to mould regional development policy for the Kaohsiung-Pingtung area of South Taiwan. According to the Comprehensive Regional Planning of

the Taiwan Area (Council for Economic Planning and Development, 1978), and the Regional Planning of South Taiwan (Ministry of Interior Affairs, 1984), there are two planning aims which have a direct bearing on spatial development: (1) the implementation of policies which result in a reasonable distribution of population, and (2) the effecting of balanced development between rural areas and urban areas. Judged by the continuous concentration of population revealed in the analyses presented in this case study, it is obvious that these two objectives of regional planning were not fulfilled. Based on the results of this empirical study, the following suggestions are presented as possible courses for remedying the deficient regional development policy in the Kaohsiung-Pingtung area.

(1) In the first place, priority must be given to remote rural places, i.e. the places of group 4, including Tienliao hsiang (place 13), Neimen hsiang (place 24), Shanlin hsiang (place 23), Chiahsien hsiang (place 22), Liukuei hsiang (place 21), Kaoshu hsiang (place 34), Wanluan hsiang (place 35), Hsingpi hsiang (38) and Fangliao hsiang (place 39). Infrastructure must be first provided, especially improved transportation. Of course, industries have to be introduced into these places, but not the large scale, high-tech. modern industries. At the initial stage, considering their conditions and locational advantages, the traditional indigenous industries are deemed a more suitable fit. These indigenous industries, on the one hand, can

provide the local labour (usually unskilled or semi-skilled workers) with jobs consistent with their skills, and, on the other hand, can readily cement backward linkages with the producers of local commodities (e.g. the agricultural products critical to the functioning of food-processing industries). Besides, some of these areas are endowed with scenic landscape or other natural resources which can be developed for tourism. Liukuei hsiang, Chiahsien hsiang, Shanlin hsiang and Kaoshu hsiang come to the fore in this respect. Considering the vast potential of the Taiwan market, the development of these places is very feasible.

(2) The Pingtung Plain, which includes the majority of the places of group 3, promises considerable development potential. It is a flat, fertile plain and boasts the advantage of being close to Kaohsiung city. When the South-linked railway was completed at the end of 1990, it act as a major catalyst for economic development. However, a lesson from the North-linked railway should not be forgotten. In the minds of the planners the completion of the North-linked railway will bring industrial development to Hualien, and stabilize the out-migration of population. Heretofore, however, the North-linked railway has been responsible for perverse effects, encouraging an expanded outflow of population from Hualien rather than the contrary.

(3) As revealed by the questionnaire survey, job opportunity is not the only vital factor influencing the out-migration of people from rural areas to urban areas.

Certain noneconomic factors are also very influential; and no more so than the availability of better schools, libraries, museums and even urban amenities. In point of fact, access to good education in urban areas is undoubtedly the most important factor influencing out-migration. This fact is often neglected by planners and government officials. Therefore, provided that it is serious in its intent to eradicate regional disparities, the government has no choice but to diffuse these facilities to the rural areas, and try to equalize the quality of education between urban and rural areas.

6.4 Summary

In conclusion, Kaohsiung city, as an industrial-urban centre with a strong industrial base and an excellent harbour, has definitely exerted a great impact on its surrounding areas. The nature of this impact may be a blessing or a drawback to the surrounding areas. A positive impact will effect a narrowing in the gap between regions in terms of development, while a negative impact will widen the disparities between regions. The actual impact emanating from Kaohsiung city has formed a development surface in the surrounding area. Generally speaking, the development surface conforms by and large to the theoretical expectation in that there exists an 'upward-transitional' zone embracing the immediate neighbourhood of the Kaohsiung city core, a 'downward-transitional' zone in the

remote rural areas, and a 'development corridor' between Kaohsiung city and Tainan city. Besides, there is also present a steeply-sloping linear surface, trending in both east and northeast directions, in full conformity with the research hypothesis. However, there are also developments inconsistent with that central hypothesis. Above all, there is the absence of a general or 'regional' linear relationship between the developments under way in the places and their distances to Kaohsiung city.

In terms of the distribution of population, there is a decided 'polarization' effect which has resulted in more concentration of population is some areas at the expense of others. However, in terms of other variables, such as the percentage of the employment base in secondary and tertiary industries, or the farm household variables, the distribution is reversed; that is to say, 'spread effects' are triumphant. Regardless of cause, this results in inconsistent but interesting implications embodied within the same development surface. For instance, in our study, development followed a path that promoted 'inter-regional inequality' in terms of the distribution of population but 'inter-personal equality' in terms of income.

Finally, one must pause to consider the question: how can one be sure that the impacts, be they positive or negative, are exerted from the supposed growth centre of Kaohsiung ? To be sure, it is difficult in the statistical sense to unequivocally demonstrate the process because of

the shortage of data. However, logically, the existence of the process is unassailable. One has only to look to concrete developments rooted in Kaohsiung city to find reassurance. For example, the Linyuan petro-chemical industrial district was built there to take advantage of the city's excellent and elaborate harbour functions. Almost equally apparent are the city's impact on society as manifested in commuting patterns. Some people are living, say, in Niaosung hsiang, but journeying to work in Kaohsiung city. Furthermore, as one digs deeper by virtue of the questionnaire survey, it is evident that Kaohsiung city has become the dominant centre of the whole study area, economically, culturally, and socially. Therefore, no place in the study area can conceivably escape from the development influences engendered through Kaohsiung city.

Chapter 7
Conclusions

One of the most fundamental and critical tests of the validity of disequilibrium models in the context of urban-rural relationships is to establish without reservation the existence of urban spill-overs, before continuing to distinguish their intensity and disposition. From the above analyses, it can be confidently stated that, in general, successful development is highly correlated with an extensive degree of urbanization. In other words, places which are close to key urban areas or, in an alternative form of expression, constitute the more urbanized areas, such as the hsiangs included in the Kaohsiung Metropolitan Area, are on average better developed than those which are remote from urban places and compose less-urbanized areas. This result has reinforced the notion that 'spread effects' are fairly severely constrained around the kernels of urban centres, as both the IUH and growth centre theory insist. On the basis of first principles, therefore, the results of this study coincide exactly with other empirical studies applied in both developed and developing countries (e.g. Todd, 1979; Chapman and Wanmali, 1981).

Henceforth, however, a number of salient features mark the results of this study as decidedly different. Todd (1979), for example, found in a study of southern Manitoba that cities, small or large, all disseminated spill-overs throughout rural areas. In marked contradistinction it was discovered in this study that there are some urban

places which exert little, if any, influence on their surrounding rural areas. To take but two examples, Chishan town and Meinung town suffered from the 'backwash effects' of Kaohsiung municipality, notwithstanding their standing as urban places. This unenviable status was made abundantly clear through their being subject to serious out-migration, a phenomenon which resulted in negative population growth rates for the period of 1979 to 1988 --- with values of -10.45 per cent and -9.46 per cent for Chishan and Meinung respectively. As touched on in Chapter 3, Chishan and Meinung towns function as classic central places, organising the distribution of goods and services for their surrounding areas. In parallel, the economies of their tributary zones are still predominantly agricultural. During the 1960s and 1970s when the export of bananas (the most notable product of the zones) to Japan reached its peak, these two places (and especially Chishan town) enjoyed a respectable prosperity. Since the decline of the export of bananas to Japan, however, the economies of these two places have declined in concert. The inevitable result has been outmigration; although, fortunately, the concurrent expansion of industries in the Kaohsiung Metropolitan Area acted as a convenient sponge to absorb the surplus labour. What is more, with the improvement of the transportation infrastructure, including the upgrading and construction of road networks and, more importantly, increasing mobility of the population consequent upon the spread of motorcycle and

car ownership, more people in the surrounding areas, even those hailing from Chishan and Meinung, travel directly to the bigger cities, especially Kaohsiung city, for shopping, working, recreation and social activities. The results of the questionnaire analysis emphatically underscored this radical restructuring of activity patterns. As a consequence, the original central place functions of Chishan and Meinung towns have dwindled to but a shadow of their former glories. By the same token, other urban places in Pingtung county; namely, Chaochou town and Tungkang town, have witnessed comparable, though less severe, erosion of their central-place functions.

The reasons for this development are basically threefold: first of all, these urban places are all located in the somewhat remote areas relative to Kaohsiung city; secondly, they are all devoid of a strong industrial base, and thirdly, the impact of Kaohsiung is too strong and the distances between places and Kaohsiung city are too small to allow local spill overs to rise and resist the overwhelming force issuing from the big city. All in all, then, the situation is quite different from that obtaining in southern Manitoba. For one thing, in comparison with Kaohsiung, Winnipeg is much smaller in population (just half that of Kaohsiung), much weaker in its industrial base, and is bereft of a harbour function. Furthermore, the area of southern Manitoba is much bigger than that of our study area (incidentally, the size of Lake Winnipeg alone is a

little bigger than two-thirds of the area of the whole of Taiwan !). Consequently, small urban places remotely located from Winnipeg more easily exert their influence on local areas, conceding only the more sophisticated functions to the provincial capital.

In a word, this empirical study has demonstrated that small cities in rural areas, when denied an industrial base, can hardly hope to become 'spontaneous growth centres' disseminating their impacts on surrounding areas, especially when they are sited at no great distance from a big metropolis. The stark fact of the matter is that the centra-place functions found in these small urban places are usually too weak to generate sufficient forces capable of exerting any significant impact on rural areas, unlike the case of large metropolises where, as Gottmann (1974) insisted, the tertiary and quaternary sectors have become the most significant factors accounting for the growth of these metropolises. By virtue of the sheer momentum consistent with size, large cities can exert an irresistible influence over their adjoining regions, be it culturally or socially. Even if manufacturing activities were forced by government fiat (or exorbitant land prices) to favour decentralised locations, the spill overs from large cities would remain paramount because most manufacturing enterprises retain their offices and headquarters in the city proper. Furthermore, the workers in dispersed manufacturing establishments will persist in returning to the cities

for shopping, recreation, social activities or other purposes. These create more job opportunities in the cities which, in turn, attract more immigrants to them. On the other hand, standing in contrast to the events occurring in Chishan and Meinung towns, is the record of Neipu hsiang in Pingtung county. A remoter place, Neipu hsiang has experienced a more auspicious development mode than either Chishan or Meinung towns. It registered a slightly positive growth rate in population between 1979 and 1988, and boasted on average higher levels of factor scores and z-scores than the two aforementioned towns. This state of affairs can be ascribed at least partly to the fact that Neipu hsiang has a stronger industrial base than Chishan and Meinung, including the endowment of an industrial district which is absent from both of the other communities. At all events, it is reasonable to maintain that small urban places in remote areas, when denied industrial bases, cannot aspire to assert any significant impact on their surrounding rural zones.

This finding has obvious implications for the theoretical discussions of the disequilibrium models and their applications to regional development strategies in general. It would appear, therefore, immediately obvious that a single growth centre placed in a backward area (e.g. to intentionally create a new town as a growth centre in the remote area) will not flourish, but will either succumb to the regressive elements of the rural background, or will

subsist as an alien graft, effecting no linkage with the existing economic activities within the rural areas. Reality confirms this reasoning. Development policy applied to a wide range of backward areas, which follows the disequilibrium theories, has, more often than not, failed in its objectives. In the theoretical discussions of the vital operational aspects of disequilibrium concepts, growth centre theory and the IUH, it seems to be universally taken for granted that the development of urban places themselves will automatically engender positive development for the surrounding areas, without dwelling on the need to address the conditions of the surrounding rural areas. Events, and not least those connected with this study, have shown such complacency to be misplaced. It is, therefore, better for those charged with formulating development policy to recognize from the outset that they cannot simply rely upon utilizing the urban framework, but must concentrate their efforts on restructuring the rural areas directly. Consequently, the disequilibrium models, be they anchored in the polarization approach or the polarization reversal approach, should explicitly incorporate the conditions that regulate development in the peripheral areas rather than in their supposed cores.

The second finding arising out of this empirical study which has a bearing on the theoretical discussions of the disequilibrium models is associated with the role of distance in the impacts (positive or negative) of the core

areas (i.e. urban places). Theoretically, almost all the classical locational theories such as Thunen's 'Economic Rent' concept regulating agricultural land-uses, Christaller's 'Central Place' theory investing form into service activities, Weber's 'Locational Triangle' model setting out the conditions for industrial location and Isard's 'Locational Equilibrium' model attempting to synthesize them, are incumbent on the assumption of the uniform (or homogeneous) geographical surface. In other words, all these theories were predicated on the existence of a surface that is identical in all physical and human conditions. Therefore, distance, which is always represented by transportation cost, becomes the only telling factor influencing the location of activities. For instance, Thunen argues that the economic rent of a place is decided only by the distance from that place to the central market, since the other factors of yield per unit of land, production cost per unit product, market price per unit product, and transportation rate are all taken as constants. Therefore, the economic rent of a place decreases only with the increase of distance from that place to the central market. Similarly, in Weber's and Isard's schemes, the optimal location of a given industry is the site (location) with the minimum aggregate transportation cost. Following this tradition of emphasizing the role of distance, most of the disequilibrium models also put undue emphasis on the factor of distance. In growth centre theory, for example, the develop-

ment surfaces radiating outwards from the urban core are, as propounded by Friedmann, basically divided into a set of types according to their distances from the growth centre. Likewise, in Schultz's IUH, both the well-being of rural residents and the agricultural development of the rural areas decrease in inverse proportion with the increase in distance from the urban places. In other words, these development theories hold that the intensity of the development of a place is basically a distance-decay effect relative to the centre.

However, this empirical study challenges this comfortable assumption. Indeed, the distance factor , as demonstrated by the simple linear regression analyses, is not strongly related to the intensity of development at the regional level. To be sure, some solace can be taken from the fact that the model works at the meso-level. In short, if attention is confined to the Kaohsiung Metropolitan Area and its immediate neighbourhood, a semblance of a development surface rooted in the 'distance-decay' effect can be inferred. However, the 'explanatory' power of this framework rapidly diminishes once the more remote rural areas are broached. The cases thrown up by Chishan and Meinung towns have already received attention. The reasons for this 'deviation' from theory were expounded in Chapter 6; nevertheless, there are two points pertaining to this problem which warrant further emphasis.

(1) Whether the factor of distance emerges as important

in regional development greatly depends on the size of the region in question. In other words, 'scale' is a significant factor deciding the validity of the frictional effect of distance in the models, but for the most part has been ignored by theorists in the name of generality. In truth, the wither is prepared to concede that distance may play a large part in determining the configurations of development in an area the size of the United States. Transport costs may even become a telling factor in the location of economic activities in such a context. However, in the micro-scale study area, the usual bailiwick of the regional planner, the importance of the distance factor will be greatly reduced, especially when transport infrastructure is abundant and accessibility are not pressing issues.

(2) Usually, in theoretical discussions of both locational and regional development concepts, distance is taken to mean physical distance (Euclidian or geographical distance). However, with the development of transportation, and its resultant impact on place accessibility, other ways of expressing distance, such as time-distance, cost-distance, and even the so-called 'psychological or social distance', are more meaningful than the traditional physical distance in discussing the problems pertaining to spatial interaction. It stands to reason that physical distance is fixed and immutable. For instance, the distance from Taipei to Kaohsiung is about 370 kilometres, and has been so since the founding of those two communities.

But, in terms of time-distance, flux substitutes for constancy. It took more than eight hours to travel by train or car from Taipei to Kaohsiung just a decade ago; however, after the completion of the freeway and the electrification of the railway, the time-distance between these two places has reduced to just a little more than four hours. As a consequence, the rapid improvement of transportation --- in itself a manifestation of development --- which makes people travel the same distance faster and cheaper than before, has rapidly changed the spatial structure. This, in turn, violates the validities of location theories and development theories in their applications. To take an example from the work of Thunen. The cultivation of flowers as a cash crop, a product enjoying high market price, to say nothing of high transportation rates and high damage rates, should by his lights be grown in areas closest to the market, say, in the Taipei area in the case of Taiwan. Yet, with the completion of the freeway in Taiwan in the late 1970s, the growing of flowers moved progressively southwards to Tienwei hsiang in the centre of the island on account of the location there of more suitable natural conditions (climate and soil) for growing flowers. Today, Tienwei hsiang has become the chief producer of flowers in Taiwan, rejoicing in a comparative advantage reinforced by the realisation of scale economies. By the same token, transport improvements will upset Weber's model of the 'Locational Triangle', ensuring that the location with the

minimum aggregate transportation cost will be replaced by the location with the more favourable condition of other variables and, in particular, more competitive labour costs. In a word, the improvement of transportation has reduced to a great extent the frictional effect of distance --- however measured --- and has, in consequence, undermined the presumption that distance is the decisive factor influencing spatial patterns of development, especially in a regional context.

The third implication deriving from this study centres on the definitions of development. Although the scope of development may include many aspects drawn from the economic, social, demographic and other fields, most of the development theories have stressed the economic aspect at the expense of the others. It is an article of faith that economic growth is a very important index of development, and, moreover, easy to measure. However, it is equally true that in many cases the non-economic factors may have more powerful impacts than the economic ones in influencing the development of a place. For instance, migration of population is often regarded by Western regional theorists as the flow of population to 'have' regions from 'have-not' regions --- a typical economically-motivated behaviour. However, in this study, the results from questionnaires revealed that 'better education for the children' is a more important factor accounting for out-migration from what may be termed 'have' and 'have-not' communities alike than

access to jobs. Given this alternative motivation, the outmigration from Taliao hsiang --- a place belonging to the Kaohsiung Metropolitan Area and, of course, within the commuting range of Kaohsiung city --- to Kaohsiung city ceases to be puzzling. In Taiwan, the major cities retain in their grasp the best facilities in terms of schools, shopping, cultural and recreational services. This is why the rich and middle classes prefer to live in the city proper, despite the fact that many of them complain of the disadvantages of the city proper; for example, its congestion, air pollution and high cost of living. This 'behavioural' predilection is quite different from that which has motivated the residents of North American cities in the past few decades, where rapid suburbanization of retail establishments, industries and residences since World War II has actually resulted in the degrading of the downtown areas in the majority of cities. The middle or upper classes have moved to the suburbs or even to outlying rural areas, in parallel with the decentralization of the better schools, better shopping centres and superior recreation facilities.

Moreover, all of these different elements of development can clash with one another to produce contradictory outcomes. For example, this study established that the distribution of population became more concentrated --- reflecting a process of polarization --- while the distributions of household facilities or employment opportunities

in secondary and tertiary sectors grew more dispersed: a process more consistent with 'spread effects'. This characteristic of contradiction is usually ignored by the development theorists. There is an important viewpoint derived from this conclusion which is worth noting. Stated explicitly, it is: the diffusion of the different elements of development, no matter whether they are of an economic, demographic or social stamp, is decided not only by the intensity and nature of these elements, but also by the abilities of rural areas to adopt them. Usually, places have their different heritages of socio-economic structures and are at different stages in their development. Thus, the overall picture of development takes various forms. In like manner, the reaction of spill overs with the levels of development prevailing in the community is forthcoming with a compound of enhanced development which is highly unlikely to be duplicated across the board. A common format, or uniform spatial pattern of development, seldom occurs in practice.

In sum, while the development surfaces of the study area discerned through our analyses roughly coincide with the theoretical hypothesis, there are exposed a sufficiently large number of exceptions to call in to question the basic premises of the disequilibrium models. How to incorporate the revised concepts into the existing theoretical frameworks of these models and make them more applicable in the actual situation is a significant task worthy of additional

study. Further research is needed to formulate a new framework more applicable to the conditions actually obtaining in rural areas. In the final analysis, the problems pertaining to the definition of development, the difficulties surrounding the choice of social-economic variables as indices of development, and those attendant on the re-interpretation of the 'spread effects' and 'backwash effects', need to be resolved in a manner relevant to the region under scrutiny in order to provide researchers and planners with a valid point of departure for their subsequent endeavours. Only when this is accomplished will it be possible to make comparisons between the results of different studies in different geographical contexts.

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Appendix.

Questionnaire form.

This questionnaire was designed to provide information which cannot be found in government statistics or publications but which, nonetheless, is useful to my research. This is just an academic project,financially supported by the National Council for the Development of Science, the ROC. No government official is involved and under no circumstance will your personal opinions be divulged. For the sake of confidentiality, no names or detailed addresses are required. Your help will be greatly appreciated.

-- Yi-Chung Hsueh--

1.Address:
Where is your family living now?_____country (or provincial city), _____ hsiang (or town, county city).

2.Working and Schooling Situations : Please fill the number or insert the sign ( ) for your choice.
(1)Working situation:

Person relationship with the head of family	Places of working (1)	education accepted			commuting to work		Kind of work				
		elementary school	middle school	college or higher	Yes	No	agri,	manuf,	comm, service	civil	others
1											
2											
3											
4											
5											
6											
7											

(1)just indicate the number of the places : (1)Kaohsiung city; (2) Tainan city; (3)Fengshan city (4)Pingtung city; (5)Pingtung county; (6)Kaohsiung county; (7)Localities; (8)others.
p.s.: Kaohsiung county and Pingtung county exclude Fengshan city and Pingtung city respectively.

(2)Schooling Situations :

Persons relationship with the head of family	Places of schooling (1)	levels of school			commuting to school	
		elementary school	middle school	college or higher	Yes	No.
1						
2						
3						
4						
5						
6						
7						

(1)just indicate the number of the places : (1)Kaohsiung city; (2) Tainan city; (3)Fengshan city (4)Pingtung city; (5)Pingtung county; (6)Kaohsiung county; (7)Localities; (8)others.
p.s.: Kaohsiung county and Pingtung county exclude Fengshan city and Pingtung city respectively.

3.Indicate the place for shopping or participating in the following activities, by checking the sign( ) for your choice. (p.s. If you choice is two places or more for one article, please choose the place you visit most frequently).

Places / Items	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.specialized books									
2.clothes									
3.pearl, cosmetics									
4.furniture									
5.camera									
6.TV set									
7.general hospital									
8.movie									
9.opera or dancing show									
10.social activities									

( )(1)Kaohsiung city; (2) Tainan city; (3)Fengshan city; (4)Pingtung city; (5)Kaohsiung town ; (6)Chishan Town; (7)Chaochou Town; (8)Meinung Town; (10)others.

4.Indicate the following goods or services which your family has owned, by inserting the sign ( ) for your choice.
(1)TV set_____, (2)video_____, (3)motorcycle_____, (4)motor car_____,
(5)refrigerator_____, (6)telephone_____; (7)running water_____,
(8)piano_____, (9)gas stove_____, (10)washing machine_____,
(11)water heater_____.

5.Does your family have member who has out-migrated?
(1) No_____.
(2) Yes_____;

Where did they move to ? (A)Kaohsiung city_____ persons: (B) Tainan city _____ persons:
(C)Pingtung city _____ persons; (D) Taipei city _____ persons;
(E) others _____ persons.

Reasons for moving (can be multi-choice): (A) access to the working place___;
(B) for children's education _____ ;
(C) preferring the environment of the place _____;
(D) others _____.

Do the out-migrated persons send back home remittances?
(A) No _____.
(B) Yes ____ ; Does it constitute of an important source of the family income ? Yes ____;No___.

6.Does your family engage in agriculture?
(1) No _____.
(2) Yes _____.

% of the total family income from agriculture (approximately):
(A) total(i.e.1)_____; (B) about 1/2 _____; (C) about 1/4 _____;
(D) less than 1/4 _____.

Kinds of corps (can be multi-choice): (A)rice ____; (B) fruit ____;
(C)cultivation of fish, shrimp, etc._____;
(D) cash crop (e.g. corn, tobacco, etc.) _____;
(E) others _____.

Did you change your main crops in recent years (say, past 5 years)?
No ____.
Yes _____; What is your former crop ?
(A) rice_____; (B) fruit _____;
(C) cultivation of fish, shrimp etc. _____;
(D) cash crops _____; (E) others _____.

The reasons for changing the crops (can be multi-choice):
(A) shortage of labour _____ ; (B) increasing income _____;
(C) demands of market; (D) subsidies & encouragement by government _____;
(E) others _____.

Did you change your farm land into other non-farm uses?

No _____.

Yes _____; for what purposes (can be multi-choice)?

(A) residential uses ____; (B) industrial uses _____;

(C) Commercial uses _____; (D) Recreation uses ____;

(E) public uses _____; (F) others _____.

— The End — Thank you for your cooperation