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INTERNATIONAL TELECOMMUNICATIONS AND ECONOMIC DEVELOPMENT:
THE CASE OF SINGAPORE

By

Peng Hwa Ang

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ABSTRACT

INTERNATIONAL TELECOMMUNICATIONS AND ECONOMIC DEVELOPMENT:
THE CASE OF SINGAPORE

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Peng Hwa Ang

This study analyzes the causal relationship between International Telecommunications and economic development. It builds upon previous research that has shown that investment in telecommunications causes economic development, or GDP (gross domestic product) growth.

Using Granger causality, it analyzes data from Singapore at a national aggregate level as well as at the subsectoral levels of trade and tourism. At the national aggregate level, the study found that, generally, it was economic growth that causes International Telecommunications growth. Commerce, Manufacturing, Construction and GDP were found to cause economic growth. Because the measures of economic activity are measures of wealth, this is called the "wealth effect."

At the aggregate level, Transport and Communications, the sector that includes telecommunications, was found to cause economic growth. The result suggests that previous findings may have been the result of double counting in that investment in telecommunications is part of the GDP.

At the subsectoral level, Trade, as an aggregate, and Imports were found to cause International Telecommunications growth. This is consistent with the wealth effect. International Telecommunications, however, was found to cause Re-Exports. This is the subsector that measures entrepot trade: goods are imported, processed for export, and then exported. In such a context, the same goods may require twice the amount of telecommunications, as it were, thereby enhancing the importance of International Telecommunications.

At the level of international flows, no clear pattern of causal relationships was found. It was noted that Imports caused International Telecommunications for West Germany, Japan and Hong Kong, major trading countries of the world and Asia. The United States is conspicuously absent. The absence of findings suggests that there may be patterns of telephone use peculiar to each country.

Some evidence for this comes from India and the Philippines. In India, International Telecommunications traffic to the country grew 200 percent in 1983 because of the opening of a new international gateway. In the Philippines, there is some evidence of a substitution effect during the crisis leading to the fall of Marcos.

The study concludes with a discussion of policy implications and research recommendations.

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CHAPTER ONE

STATEMENT OF PROBLEM AND JUSTIFICATION FOR RESEARCH

Introduction

The contribution of the telephone to economic development has been well documented. Studies in the mid-1970s and early 1980s have theorized and demonstrated that the telephone facilitates economic development, that the payback on investment was several fold and that underinvestment would retard economic development (Hardy and Hudson 1981; Parker 1981; Berry 1981).

The common thread running through these studies is that investment in telecommunications pays off in the form of general economic growth. These studies suggest that telecommunications authorities therefore should not focus only on direct monetary payback to determine if they should invest in a system.

A 1983 synthesis of earlier studies concluded that "telecommunications confers benefits on society which are over and above the private benefits represented or captured by the price system" (Pierce, W. and N. Jequier 1983, 34). Although the all-encompassing word "telecommunications" is used, it refers to *domestic* telecommunications.

This study builds upon such research by analyzing international telecommunications.

Statement of Problem

Since those studies, international telecommunication

has been growing in importance. Countries have become more aware of the need to be part of the world's economy. Singapore, by virtue of its small market, adopted a deliberate outward-orientation in all economic spheres, including telecommunications.

Few studies have been done, however, on the contribution of international telecommunication to the economic development of a country. Just how dependent the economic development of a country is on international telecommunications has yet to be determined. The questions this dissertation proposes to study are:

1. Does a country's international telecommunication have an impact on its economic development?

2. If so, what are the magnitude and direction of this impact?

3. How is the impact manifested?

4. To what extent are the policies of a telecommunications entity responsible for such impacts?

In this study, the term "telecommunications" is synonymous with "telephone" and is used interchangeably unless otherwise indicated. The words "International Telecommunications" refer specifically to the variable under study. Depending on the context, it will refer either to total outbound telephone traffic or to outbound traffic to specific countries.

Justification for Research

This study will add the international dimension to the body of research conducted on the telephone and economic development.

As telecommunications entities around the world privatize (see Wellenius, et al 1989), they will face pressures to liberalize and to allow competition in long-distance and international telecommunications. A study on the impact of international telecommunications will therefore help policy-makers in this arena.

Singapore has been chosen for the study because of the author's knowledge and because Singapore represents an extreme case. International telecommunication has always played an important part in the revenues of Singapore telecommunications. Currently, more than half of Singapore Telecom's revenues are derived from the international market (Singapore Telecom). If there are impacts to be found in international telecommunications, they should be manifested in Singapore.

Further, there have been changes in the Singapore economy that should test the robustness of any hypothesis about international telecommunications and development: in the late 1970s, Singapore deliberately set out to be a financial center. In the early 1980s, it set out to reduce the importance of manufacturing in the economy and to replace it with the service sector. The result is shown in Figure 1.1 where manufacturing as a percentage of the

Singapore economy between 1980 and 1986. The service
sector, in contrast, recorded an increase, particularly
between 1983 and 1985. Then the recession in 1985 forced a
rethink of the Singapore government's policy and
manufacturing was once again encouraged. The manufacturing
sector's contribution to the economy has increased between
1986 and 1990. Contrary to conventional wisdom that the
manufacturing sector should decrease in importance as an
economy develops, in Singapore's case the manufacturing
sector's contribution as a percentage of the economy has
fluctuated with changing government policies.

CHAPTER TWO

A Review and Critique of Development Literature

Introduction

The history of modern theories on development shows a pendulumic pattern: swinging back and forth between hope and despair. In the late 1800s, authors such as Max Weber (1930), Karl Marx (1967; 1974; 1976) and Herbert Spencer (1972) cast development in an essentially optimistic light, with human society progressing to increasingly beneficent phases. Weber saw progress through the Protestant work ethic; Marx predicted the building of a workers' paradise through revolution; Spencer expected the Darwinian principle of organic evolution of higher life forms in human society would lead to a better world.

Such optimism, however, failed to predict economic collapse, the rise of totalitarianism and the world wars in the early 1900s. So, a more pessimistic view developed. Huntington (1976) distinguishes between two schools. The first school, typified by Sorokin, Spengler and Toynbee adopted a broad and cyclical view of history looking at patterns of evolution of civilizations from which to generalize the origin, growth, maturity and decline of human society. In general, they concluded that Western civilization was at its peak or had passed it and was on the decline.[1]

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1 More recently, Francis Fukuyama's The End of History and the Last Man (New York: Free Press, 1992) swings the pendulum toward optimism. In the 1989 article on which the

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Spengler (1928), for instance, titled his book: "The decline of the West: Perspectives of World-History." He wrote that "always the splendid mass-cities harbour lamentable poverty and degraded habits, . . . the birth of the City entails its death" (1928:102). For Spengler, the West had passed its maturity or "culture" and was on the descent into "civilization."

In a sense, these theories were not new. Writers and thinkers of yore, such as Diodorus, Q. Metellus, Polybius, Seneca and Machiavelli, had suggested that economic prosperity leads to corruption, demoralization and, finally, to decay.

The second school focused exclusively on Western society, concluding similarly to the first school that the West was now in decline. Proponents argued that Western society, once conducive to human self-fulfillment, now manifested such horrors as Dachau, alienation and anomie, the weakening of religious values, and *the emergence of a mass society*. Blame was pinned on secularization, *industrialization, urbanization and democratization* (emphasis added). These trends were said to have started with The Reformation, the industrial revolution, the French Revolution, among other landmarks (Huntington 1976:33).

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book is based, he predicted that the triumph of consumer-based capitalism and human freedom over Communism will lead the world to a "universal homogenous state" characterized by "liberal democracy in the political sphere combined with easy access to VCRs and stereos in the economic" (Fukuyama 1989:8).

Walter Lippman, for example, argued that 1917 was the
revolutionary year in which governments "began to crack
under the strains of war and upheaval and Western society
began moving toward paralysis, chaos and totalitarianism"
(1955:3-8).

In the mid 1900s, with the end of World War II, the
formation of the United Nations, and the unshackling of
colonies from their Western masters, modernization theory
swung again toward a more optimistic stance.

The Modernization Paradigm

As noted above, the modernization paradigm of the 1950s
and 1960s was a contrast to the pessimism just a few decades
earlier. Then, depression, genocide and pogroms reinforced
the idea that there was a fundamental crisis in modernity.

Reconstruction after World War II, however, had the
effect of lifting that gloom. Further, decolonization and
nationalism brought fresh hope to developing countries.

The American Marshall Plan for the reconstruction of
Europe (in part a reflection of the belief in more
government intervention after the Depression) had worked
both economically--in raising standards of living--and
politically--in keeping the advancing threat of Communism at
bay. Containment of Communism was a major foreign policy
goal of the US then (Heller 1981:68).

Not unexpectedly, a Marshall Plan of sorts for the then
Third World was tried out, first in Turkey and Greece. These

were countries thought to be vulnerable to the "Red tide."
The announcement of such a plan was made by then President
Harry S. Truman in his inaugural address on January 20,
1949: "We must embark on a bold new program for making the
benefits of our scientific advances and industrial progress
available for the improvement and growth of underdeveloped
areas" (Truman 1956:263). This was Truman's fourth point of
action in his address and it became known as the Point IV
program. Soon after, the World Bank made its first loan to
developing countries--Chile in 1948 and Mexico and Brazil in
1949.[2] The British Commonwealth in 1950 embraced the
Australian-originated Colombo Plan for technical assistance
(Rostow 1990:376).

Truman saw greater production as the key to prosperity
and peace. He added, "What I hoped Point Four would
accomplish was to provide technical assistance so that these
people themselves, with a very small capital investment from
us, would be able to develop their own resources" (1956:268-
269). He saw nothing wrong with foreign investment provided
it was not for exploitation of the undeveloped countries. He
said, "[T]his country was developed by the investment of
foreign capital. . . " (1956:267).

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2 The World Bank, or the International Bank for
Reconstruction and Development as it is known formally, had
been formed at the Bretton Woods Conference in 1944 to
finance development of Third World countries during the
period after World War II. It was headquartered in
Washington, D.C., and began operations in 1946 (The World
Bank 1982).

Just how hopeful Truman was can be gleaned from an informal speech given at a businessmen's forum on October 20, 1949, where he told the audience that "in the Mesopotamian Valley alone there could be a revival of the Garden of Eden that would take care of thirty million people and feed all the Near East if it were properly developed . . . . [T]he Zambezi River Valley in Africa and a similar area in southern Brazil could also be converted into sections comparable to the Tennessee Valley in our own country if the people of those regions only had access to the 'know-how' which we possessed" (*ibid*).

Several social scientists pointed out both the good sense and the underlying fears in a series of lectures that were reproduced in Bert Hoselitz's *The Progress of Underdeveloped Areas* in 1952. Although the scientists were from different disciplines, they shared the common emphasis on internal factors of development--economic, social and cultural--that has marked modernization theory. They recognized that many Third World countries had a background of colonialism although colonialism was not a major factor in the book. They also recognized, even then, that mono-causal theories of social change were inadequate.

In a few years after the program was implemented, with some difficulties it should be noted, Truman could report such progress as improved agricultural yield, reduced

incidence of illnesses and construction of schools in those nations. Truman wrote: "The program in action had the effect of disarming hostile propagandists and in discouraging the advance of both Communism and extreme nationalism" (1956:274).

It is in this context of progress and positive results that the modernization paradigm arose. It was during this period, between 1950 and 1954, that Daniel Lerner conducted his research on the Middle East that has since tied communication to development (Lerner 1958).

Theory and Paradigm

Until modernization, earlier theories of development usually emphasized either a structural or a psychological component. Modernization theory fused the two.

The structural side of modernization saw evolutionary progress in economic, political and social development. Economist W.W. Rostow (1960) expounded it best with his five-stages of economic growth: traditional society, transition to take-off, take-off, the drive to maturity, and high mass consumption. Since then, others have posited a sixth stage of the post-industrial or information society with productivity and prosperity through greater use of information (Bell 1973; Porat 1977; Masuda 1981). The idea has been popularized by best-selling authors such as Alvin Toffler (1970, 1980) and John Naisbitt (1982).

(Critics point out the loss of privacy and the loss of

labor through automation among other drawbacks of the information society (Schiller 1981; Mosco 1982; Ellul 1983; Hamelink 1983; Roszak 1986). Much of the criticisms center around the issue of power through control of technology in the information society. The aim is to give power and control of the technology to the grassroots (Tehranian 1990). To that extent, and for the purposes of this study, further discussion will be deferred to the section on the plurality paradigm below.)

The psychological component theorized that a society rose because of the individual make-up of its members. McClelland considered achievement-motivation to be instrumental (1961). Hagen (1962) thought it was withdrawal of status respect. Lerner's (1958) incorporation of the mass media, discussed below, was therefore an improvement on the psychological theories in that it suggested that modern man was produced by contact with a social institution.

Alvin So has observed that it is not easy to characterize the paradigm because "[d]ifferent disciplines raise different research questions, and different area specialists highlight different aspects of the modernization process" (1990:23). Nevertheless, the essential features that may be drawn from the modernization paradigm are:

1. a unilinear approach to development applied across all societies;

2. a focus on the internal factors of development to the exclusion of colonial and external influences;

3. a value judgment where progress is considered good;

4. a belief in evolutionary, not revolutionary, change, and

5. positivism in the belief that the scientific study of society will yield knowledge for development (Barnett 1988:26; So 1990:19).

In the field of communication, to these might be added a sixth feature: technological-determinism, a belief that technology will improve conditions of humankind.

Melkote (1991) has suggested that the paradigm stressed economic growth as key to development, the use of capital intensive industries, and blamed underdevelopment on internal constraints.

A definition of development by Rogers in the 1960s is illustrative: "a type of social change in which new ideas are introduced into a social system in order to produce higher per capita incomes and levels of living through more modern production methods and improved social organization" (1969:18).

In the field of development communication, Lerner has generally been credited with the strongest statement with his book, *The Passing of Traditional Society*. It is also of prime relevance here as Lerner gives prominent position to the role of the mass media, which was seen as a "magic multiplier" of development.

The theory itself is simple: to modernize, a society must first be urbanized, then become literate, be exposed to

media where, finally, its citizenry is then able to participate more fully both economically and politically in society.

In its more detailed form, only after a country reaches 10 percent urbanization is there any significant increase in literacy; thereafter, urbanization and literacy increase together until they reach about 25 percent; when societies are about 25 percent urbanized, the closest relationship of media growth is with the increase in literacy (Lerner 1958:63).

The progression may be illustrated thus:

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 >10 percent    >25 percent
Urbanization -> Literacy -> Media Exposure -> Participation
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The key to this progression was empathy: "the capacity to see oneself in the other fellow's situation" (*ibid*:50). Empathy made for a mobile personality and thereby made change possible.

Lerner's study highlights several themes common to modernization theory: a bipolar classification of society (modern vs traditional) modified with an intermediate category; the use of indices of modernity--urbanization and literacy; and the importance given to personality types.

Strengths of Lerner

For Lerner, the social processes of urbanization and mass media exposure are crucial to modernization. Such a social-process approach focuses on change. Its virtue lies

in its efforts to establish relationships between variables
and particularly between changes in sets of variables
(Huntington 1976:50).

Another strength of Lerner's research is that he was
able to attempt empirical construction and causation
modeling using some 2,000 interviews from six Middle Eastern
countries he had gathered. This is in marked contrast to
many critics then and now who have only attempted to
theorize relationships. It has been suggested that the
quantitative empiricism of North American social science
research was partly instrumental in the thrust of Lerner's
work (Rogers and Singhal 1989:20).

Weaknesses in Lerner

Although Lerner intended his model to be of universal
application, some cracks in the seams were, on hindsight,
emerging even in his book. For example, in Egypt and Iran,
literacy was making for an unemployed class of college
graduates in cities. In Syria, Lerner mentioned the need to
raise rural standards to "decelerate movement off the land"
and "to support industrial expansion" (*ibid*;267). In short,
he was actually discouraging urbanization so as to encourage
development, a process that went against his own model. Then
there were the Bedouin who did not want to be modernized in
Lerner's sense of the word. There were therefore even in
Lerner's book, exceptions to the model he created.

In a test of the model some 10 years later, Schramm and

Ruggels reported that they failed to find the basic relationship of urbanization to literacy. Further, they could not find one pattern of mass media growth but instead found that the pattern varied widely by region and culture (1967).

Lerner himself later noted that the pattern of urbanization->literacy->mass media exposure was reversed in the developing countries (1976:290). Along with explosive population growth and mass media exposure, those in rural areas migrated to the urban areas only to lead unproductive lives.

He has also noted the failures of development in many parts of the world. He said that just 15 years after Point IV, development programs have stalled and even reversed; stable traditional societies have fallen apart; the revolution of rising expectations has led to the revolution of rising frustrations (Lerner 1967). He blamed the failures on projects that were too small, the politicization of development policies both in the US aid agencies and in the developing countries and anti-Western rhetoric, which he considered an obstacle to development. Finally, he has also blamed people--"[t]hey don't do what, on any rational course of behavior, they should do" (1958, vii).

Rogers and Singhal say there were internal and external forces. The internal causes were traditionalism, widespread poverty, illiteracy, a burgeoning population, the lack of an adequate infrastructure to tap the resources, and a rigid

and often corrupt bureaucracy inherited from colonialism. The external causes were the international terms of trade, economic imperialism of multinational corporations, and the vulnerability and dependence of developing countries (1989:23-24).

Criticisms

Others criticisms are grouped into several several broad areas below:

Concept

The first is conceptual. There are several components to this. The major set of criticism is on the ambiguity in the definition of modernity.

Huntington has pointed out that modernity and tradition are essentially asymmetrical concepts, which means they cannot be contrasted (1976:35). Theorists, however, define modernity as a virtue where the modern ideal is set forth and the leftover is defined as traditional. This is not a true dichotomy and is therefore not a useful conception.

Another set of criticism is that the theory implies the elimination of tradition. This is not necessarily the case as So points out that a Chinese could well take a herbal drink in the afternoon and an aspirin in the evening (1990:56). Tipps points out that colonial domination has produced hybrid practices that cannot be considered modern nor traditional (1976:77). Further, some traditional

practices may be used to aid development.

Also, the focus by its own design, ignores external factors. An alternative explanation in the form of dependency theory (discussed more fully below) has been developed to counter this neglect. It is ironic that the politics of the context should be criticised because Lerner's model has a political goal--participatory democracy--as one of the ultimate goals of development.

Another criticism is that modernization is seen as a linear process heading in the general direction of progress, and even irreversible. This conceptualization is in contrast to earlier explanations that saw society as moving in a rise and fall pattern. Empirical evidence in the inner cities of developed countries has shown that urbanization does not necessarily lead to literacy, that the presence of mass media does not always help, and that development can be reversed.

Finally, the theory assumes the hypodermic needle model of the media where the effects of the media are direct and powerful. Around the time that Lerner was completing his book, Katz and Lazarsfeld (1955) were completing their description of the two-step flow theory of mass communication. The two-step flow theory suggests that mass media influence is mediated and indirect and much less powerful than the influence exerted by the opinion leaders. On hindsight, Lerner had the data to incorporate the change. In his study of Turkey, he mentions the grocer of Balgat who

has access to media and therefore can imagine a world different from the one he lives in. But this knowledge makes him different from other villagers and the grocer is disdained by the village chief. When Lerner returns a few years later, however, the grocer had died. But, in a sense, he had been resurrected by the chief's sons who were now grocers. The villagers now recognized the grocer as a man ahead of his time. The emulation of the grocer by the chief's sons suggests that personal influence had played a part in their change.

Ideology

The second area of criticism is ideological. Typical is the suggestion by Tipps that "[t]he idea of modernization is primarily an American idea, developed by social scientists in the period after the Second World War and reaching the height of its popularity in the middle years of the 1960s.

"American society tended to be viewed as fundamentally consensual, combining an unmatched economic prosperity and political stability within a democratic framework. Such social problems as might exist, moreover, were treated not as endemic but rather as aberrations which could be resolved by normal political processes within existing institutions. After two decades of turmoil, the postwar tranquility of prosperity and stability seemed no mean accomplishment. The future of modern society now seemed assured; only that of the 'developing areas' appeared problematic" (Tipps

1976:71). He suggests that optimism led scientists to believe that modernity was an unmixed blessing.

Modernization, therefore, does not reflect the state of the Third World but instead reflects "a particular phase in the development of a single society, that of the United States" (Tipps 1976:73).

Along a similar line, others have said that modernization does not draw a distinction between itself and Westernization. That is, modernization sees a modern society as a Western society. There is no model of a modern non-Western society.

To such criticisms, essentially of being ethnocentric and the then-vogue phrase "Ugly American", Lerner defends his model as being of universal application. Lerner (1967) replies that the model was not a Western model but a model developed in the West that is globally applicable. Further, other studies had borne out the model (*ibid*, viii). He also counters that it is the ethnocentricism of developing countries, expressed in wars, that hindered development (1958:viii).

He says, "One plain lesson is that many of the Asian peoples *do* want materialism in the sense of better homes, better food, better hygiene, better education, better lives for their children . . ." (emphasis in original 1967:114).

To some extent, Lerner is right. Ethnocentricism is not the monopoly of the Western world. There have been ethnic wars then and now. Further, universal indicators of

development such as literacy and longevity point to the Western world as being more developed. And critics who point out the absence of a non-Western model have not done better; they have not drawn up an Eastern or a Southern "counter-model."

Methodology

The third area of criticism is in methodology. Instead of doing before and after studies of developing countries, modernization studies have taken time-slices and compared them with developed countries. It is thus assumed, for instance, that 20th century Middle East is developmentally the same as 18th or 19th century Europe (So 1990).

It also assumes that the traditional societies have more in common with each other than with modernity.

Finally, where the model does not fit, "chance" factors are used to account for the deviation.

Result

The criticisms have led to divergent results.

One school has attempted an outright rejection of modernization. This school, dependency, will be discussed in greater depth below.

Another school has attempted to revise modernization through rectifying or eliminating the more glaring deficiencies. This is a new pluralism or multiplicity paradim, also known as Another Development. They are

discussed in depth below.

Whitacker suggests that it may be more useful to have limited but empirically grounded generalizations than to construct alternative models at the same high abstraction level of modernization theory (1967). The attraction of this approach is that its implications may be practicable. By and large, however, his call has not been taken up.

One school along this line is that the modernization theory is applicable to Asia. As Pye puts it: modernization has a closer empirical fit with Asia than Africa or Latin America (Pye 1985:3).

Apter has observed that confidence in modernization theory has "declined everywhere except perhaps in China, Japan, or Taiwan (where it is still accepted that innovation, increasing productivity, and growth will result in integrative change, more and better jobs, and greater choice despite temporary setbacks and the need for adjustments) (1987:17).

Pye says that Asia had elite-guided development; Japan and China wanted to gain strength and security by adopting modernizing technologies. He says Latin American states were not newly emerging but had evolved their own distinctive political and social systems. He says that postcolonial Africa lacked nationalism and earnest commitment to modernization that were characteristic of Asia. On this final point, his case is weak because if those two elements were key, then it is surely a matter of working them into

the model, rather than creating an exception.

So (1990) has suggested that there is a new school of modernization studies with several distinctive elements: they do not treat modernization and tradition as mutually exclusive concepts; their methodology is focused not at the abstract level but on concrete cases; development is not viewed as linear or unidirectional after the path of the West; and they consider also external forces.

Interestingly enough, two of the three studies he cites are of Asian cases, Hong Kong and Japan. The third is a case study of Iran suggesting that modernization does not necessarily lead to secularization (1990:63-78).

These cases, however, are not directly applicable to development communication. Perhaps the most elaborate statements of the changes are from Rogers (1976a, 1976b, 1989) and Servaes (1991). Although stating that they reject the modernization paradigm, they have in fact incorporated several key elements in the modernization paradigm. A discussion of this pluralism or multiplicity paradigm follows later.

Dependencia[3]

Introduction

The decline of the modernization theory and the failure in its application to Latin America in the late 1960s gave rise to *dependencia*. The school, however, has had many proponents each stressing a slightly different theme. Therefore in this part of the review, the discussion will be confined to the more salient parts of the theory.

Latin American development had begun promisingly. After World War II, countries there embarked on a policy of import substitution. The policy was pressed upon governments not by elites but by the business and labor classes for three reasons. First, much of the imports were luxury goods demanded by the elites. Second, local manufacturers were asking for protection from foreign competition. Third, nationals were asking for guaranteed jobs. It was thought then that only a complex industrial society could fully benefit from modern technology to reach high standards of living, enjoy a stable democracy and be truly independent (Kahl 1976:2-3).

Background

Lending theoretical and analytical weight to the above was perhaps the most sophisticated and influential of

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3 In this part, *dependencia* will be used to describe the dependency school. Blomstörm and Hettne (1984:77) consider the word "theory" unsuitable because "a number of different dependency theorists have received their theoretical impulses from different sources." Further, in the late

scenarios painted by Raúl Prebisch, who while still under 30, was under-secretary of finance in the Argentine government from 1930 to 1932 and later at the Central Bank. The period coincided with the worldwide depression. Argentina suffered a sharp decline in volume and prices of exports and a shrinkage in foreign exchange. Prebisch said it was in this setting that he was converted from neoclassical economic orthodoxy to protectionism (Meier and Seers 1984:175, 178).

But Prebisch's formulation of a theory of industrialization through import substitution in the 1940s was not just a rationalization of protectionism. It was to answer two deeper questions that had arisen from the Argentine crisis in the 1930s: "Why was it necessary for the state to play an active role in development? Why was it that policies formulated at the center (the developed world) could not be followed at the periphery (the undeveloped world)?" (*ibid*:176).

In 1949, Prebisch became the executive secretary of the United Nations Economic Commission of Latin America (ECLA in English, CELAP in Spanish) set up in Santiago, Chile. He could now put his theory into practice.

Prebisch's doctrine divided the world into two: Center, the developed and industrialized world, and Periphery, the undeveloped and agricultural world. The structures of

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1960s and early 1970s, a number of scholars wanted a distinct theory but the idea has since been abandoned.

production were said to be different; the Center was homogenous in productivity and diversified in output while the Periphery was heterogeneous in productivity (both high and low productivity existed side by side) and specialized in output, mainly primary products. Classical economics suggests that the international division of labor would benefit both. Prebisch challenged the assumptions behind such a conclusion. His basic thesis was that the problem of development in Latin America principally was reliance on export of primary products in which terms of trade had been deteriorating. That is, prices of agricultural products were falling in relation to prices of industrial products. Not much could be done about world prices so the ECLA suggested two courses of action: import substitution (which it called "inwardly directed development") with better economic planning and development of Latin American common market. These required active government planning as import substitution needed tariffs to protect local industries and the development of a common market required the cooperation of governments (Prebisch 1950, 1963).

Prebisch also suggested other reforms in, *inter alia*, banking, taxation and land. But there was resistance to some of these reforms so not all of them could be implemented (Baer 1969).

Nevertheless, the ECLA program was an initial success. In the late 1940s and early 1950s, the economies of

Argentina, Brazil and Mexico boomed. But in the mid 1950s, signs of trouble loomed.

Import substitution had indeed reduced the import of consumer goods. But it increased the imports of capital goods. Countries became more dependent on multinational corporations to fill in the gaps of technology and capital. The emphasis on industrialization led to the neglect of agriculture and thereby to increased imports of food (Seers 1981).

Improvements in health care lowered infant mortality so population growth surged. As the rural areas could not absorb them, many moved to the cities. The cities, however, were industrialized using labor-saving technologies from the West. According to Kahl, the proportion of workers in the industrial sector was half that of the developed countries at a comparable stage of industrialization (1976:6). Economic growth was also being distributed unequally between rich and poor.

Such negative effects of industrialization were discussed by ECLA economists under the rubric of "noneconomic concomitants of economic development" (Kahl 1976:7). Or as the president of Brazil, General Garrastazu Médici said, "The economy may be doing well, but the majority of the people are still doing poorly" (*ibid*).

In the late 1950s to early 1960s, some economists working for the United Nations began to question the

development policies. Gunnar Myrdal said that so-called "backwash" effects from trade might lead to underdevelopment (1957). Dudley Seers argued that the economic development policies implemented were not universally applicable but only worked in advanced industrial capitalist countries (1983).

Then in the early 1960s, some of the Latin American countries suffered economic downturns serious enough to threaten a breakdown in social order and eventually did lead to military rule to restore order (Kahl 1973:1-17; So 1990:91-94). A *dependentista*, Fernando Henrique Cardoso wrote *Empresário Industrial e Desenvolvimento Econômico (Industrial Entrepreneur and Economic Development)* with the thesis that special conditions of Brazilian development were leading the country into a crisis that would lead to a coup. The title page of the book carried the date "April 1964" though the book had been written earlier. On the first day of April 1964, a right-wing coup overthrew the Brazilian government.

The multitude of problems converted the ECLA "structuralists" into *dependentistas*. Palma points out that the *dependentistas* were helped by the spread of Marxist critiques of imperialism then (Palma 1981). Dependency thus is in part a reaction to modernization theory and in part an attempt to explain the Latin American condition.

The classical definition of *dependencia* is given by Dos Santos who states that dependence is not an effect but an

integral and deterministic part of development (1969:73).

His formal definition states:

> Dependence is a conditioning situation in which the
> economies of one group of countries are conditioned by
> the development and expansion of others. A relationship
> of interdependence between two or more economies of
> between such economies and the world trading system
> becomes a dependent relationship when some countries
> can expand through self-impulsion while others, being
> in a dependent position, can only expand as a
> reflection of the dominant countries, which may have
> positive or negative effects on their immediate
> development (1970:289-290).

Three schools

In a detailed analysis of dependency, Palma writes that there are three schools of thought: those who hold that developing countries can never develop (which some have called the catastrophic school); those who say that developing countries can develop but only in a dependent relationship; and those who concentrate on obstacles to development using the dependency analysis (Palma 1981).

Among *dependentistas* in the first school, the catastrophic, are the "father" of *dependencia,* Paul Baran (1957) and André Gunder Frank (1967, 1969). Baran, a Cambridge economist, argued that the British, as colonial master, deliberately underdeveloped its colony India. Thus was introduced the idea that underdevelopment was not just a the result of non-action but a possible outcome of planned action.

This theme was reiterated by Frank. One of the best known of *dependentistas*, Frank is not a Latin American but a German who was trained as an economist in Chicago and taught in Michigan State University from 1957 to 1961 (Contemporary Authors 28:181). He was a supporter of the Cuban revolution and a committed socialist (Harrison 1988:78). In 1964, Frank was a consultant to the ECLA and thereby became one of the first to work with an alternative theory of Latin American economic development.

(Mirroring the center-periphery relationship dependency described, scholars from the United States such as Frank got more recognition for the theory than their Latin American counterparts. According to Latin American scholars, Frank "produced the least number of ideas on dependency but monopolised all the adulation and limelight related to it" (Somjee 1991:54). Frank has been described as "one of the most intellectually influential" but also "one of the most polemical and simplistic" (Chirot and Hall 1982:83).)

Frank (1967, 1969) critiques modernization theory on several counts. He argues that first, the theory offers only an internal explanation. Colonialism, for example, was a common phenomenon in the Third World. Yet this was not considered in the formulation of modernization theory.

Second, he argues that modernization assumes that the Third World is undeveloped because something is wrong with it—lack of achievement motivation, traditional and resistant culture, overpopulation.

Third, he argues that modernization ignores the history of the Third World and thereby assumes that the path of development of the Industrial World is directly comparable.

Frank borrows from Prebisch's model of center and periphery and developed a model where the national cities of the Third World are satellites to the metropolises of the First World. The national cities in turn are metropolises to the satellite cities of the Third World. Among Frank's many hypotheses (see So 1990:97-98) is that satellites develop the most when their ties to the metropolises are weakest. Frank noted the autonomous development of Latin American industries during World War II. Frank therefore concluded that modernization was the cause of underdevelopment.

Among the theorists in Palma's second school of dependency, which focuses on problems of development, is Theotonio Dos Santos. According to Dos Santos, the structure of dependency takes three forms: colonial, financial-industrial and technological-industrial. Dos Santos laid particular stress on the industrial arguing that industrialization is dependent on technological innovations and equipment from the West. In many cases, Third World countries cannot pay the multinational corporations for the technology and so must offer special incentives to attract them. This means that the multinational corporations have an advantage over domestic companies (Dos Santos 1971).

What are the impacts? First, the economy is divided between the traditional agricultural and the modern technological instead of being treated as an integrated whole. Second, those in the modern technological sector enjoy a much higher income than those outside, thus increasing income disparity. Third, because there is a limited internal market, such industries look to exports and this in turn causes a further neglect of the internal market. Dos Santos therefore concludes that it is not the lack of integration into the world economy that is the cause of underdevelopment. Instead, as So (1990:102) summarizes succinctly: "it is the monopolistic control of foreign capital, foreign finance, and foreign technology at national and international levels that prevents underdeveloped countries from reaching an advantageous position, resulting in the reproduction of backwardness, misery, and social marginalization within their borders."

The third school, as categorized by Palma, is a compromise of the first and second schools mentioned above and combines elements of them. Criticisms of the two schools mentioned above therefore apply to this third school and will not be repeated here.

Recently, some in the first, ie catastrophic, school, appeared to have a change of heart in the light of developments in the Eastern bloc and other command

economies. Frank, for example, now appears to concede that development in the periphery may be possible (1984).

Essence of dependency

Dependencia, with its many shades and variations, has not always been captured successful by writers. Cardoso notes: "The most general and formal of Gunder Frank's works are received as though they were his best, the formal definition of dependency furnished by Theotonio dos Santos is appended, the problematic of subimperialism, and marginality is sometimes inserted, one or another of my works or of Sunkel is footnoted, and the result is a theory of dependency--a strawman easy to destroy" (Blomstörm and Hettne 1984:70). Cardoso himself sees it as an outlook more than a theory (Kahl 1976:176).

Blomstörm and Hettne (1984:70-76) have listed several dimensions to sketch out the "ideal-typical" *dependentista.*

First, the obstacles to development are seen as external, not individual-psychological (such as the lack of achievement motivation) or national (such as the absence of entrepreneurs). There have been attempts to explain the relationship of internal influences but the greater importance has been placed on the external.

Second, *dependencia* sees underdevelopment as part of the result of polarization in the world system where wealth and resources are transferred from the periphery to the center.

Third, *dependencia* thus treats development and underdevelopment as incompatible concepts.

Fourth, *dependencia* sees the phenomena of surplus transfer as a general and global process though the analysis is primarily concerned with the periphery. National and even regional variations are downplayed.

Fifth, as *dependencia* was rooted in economics, it emphasizes economic analysis.

Finally, as the cause of underdevelopment was the West, *dependentistas* see a cut in the linkage as an automatic spur to development. (So 1990:104-105; Blomstörm and Hettne 1984:71-76).

Policy implications

Because *dependentistas* argue that underdevelopment is caused by linkages to the Western world, they urge a withdrawal from the world economy as the path to growth. Frank recommended Castro's Cuba as the "nondependent" model.

Further, as the theory has roots in Marxism and neo-Marxism, they also recommend revolution. The title of Frank's book, *Latin America: Underdevelopment or Revolution* (1969), bears this out.

Advantages

The advantages of *dependencia* are that first it considers external factors in the development of a country.

This contrasts it with the modernization theory, which did not consider a common history of colonialism in many Third World countries.

Second, it accounts for the intranational and international power structures and the close interdependence between them (Lee 1979:32).

Third, by conceptualizing development as leading to underdevelopment, it forced a rethinking of the benefits and trade-offs in development.

Criticisms

Dependencia began to come under attack in the mid 1970s. Blomstörm and Hettne (1984:92-93) point out that empirical research began discovering flaws in the *dependencia*. Perhaps the best known of empirical studies was that performed by Bill Warren (1973). He found that in many Third World countries the outlook for development was good, that potential obstacles were more likely internal than external, that imperialism facilitated industrialization, and that the Third World's dependence on the First was declining. These findings were a direct frontal assault on the school.

Around that time too, some *dependentistas* began criticizing the theory. (It is instructive to note that the criticisms came from within. Modernization theorists

apparently ignored the debate and emerged with a new
paradigm discussed below.) One of them was Colin Leys, who
has been described as one of the best known *dependentistas*
in Kenya (Blomstörm and Hettne 1984). Leys in 1977 wrote an
article that called the theory "no longer serviceable and
must now be transcended." Leys said *dependencia* was, first,
repetitious and theoretically stagnant. Second, it was
silent on certain fundamental problems it could not neither
solve nor even formulate. Third, it was not having a
practical impact on the Third World but was instead being
co-opted by developmentalists in the First World (1977).

Other criticisms are categorized below.

Methodology

If modernization theory is seen as tainted by Western
ideology, *dependencia* is seen as tainted by Marxist
ideology. Indeed, while Palma notes that there is no single
Marxist theory of underdevelopment, the various strands of
dependencia may be grouped under the heading of Marxist-
inspired (1981:63).

Dependencia is partly clouded by rhetoric and emotion:
some *dependentistas* have paid a personal price for their
views, having been ostracized or thrown in jail by
governments.

Critics also observed that *dependentistas* adopt a
deductive approach where cases are made to conform to

theory. Such instances as Australia, New Zealand, Switzerland and Canada, which do not fit neatly into the model, are treated as anomalies, deviant and accidental (Lee 1979:33).

Further, in attempting to formulate a generally applicable model, they have ignored some of the historically-specific characteristics of individual countries. In their reaction to modernization, which focuses on the internal dynamics of states, *dependentistas* have ignored internal factors such as the absence of entrepreneurs, cultural patterns such as the exclusion of women (Barnett 1988:43) and corruption (Myrdal 1970:230-2231).

Finally, Seers has noted that while *dependentistas* write of the dangers of cultural dependence, ironically they draw on Marxism, a European doctrine (1981:15).

Usefulness of dependency as a scientific concept

Sanjay Lall (1975), who is generally sympathetic to dependency, said the theory was not useful for two reasons. First, it failed to identify characteristics of dependent economies not found in non-dependent. Second, it failed to show how the characteristics adversely affect development.

Marxist theorists have criticized dependency for not fitting in class analyses and the state (So 1990:132).

Overemphasis on economic determinism

Others have noted that *dependencia* overexaggerates the power of the center such that the periphery countries are deemed to be "passive victim[s] of capitalism from without" (Trimberger 1979:128). It has also been argued that however strong the dominanting force, the evidence is that nevertheless there are opportunities for the periphery to develop (Portes 1976:79).

Further, the overemphasis on economics neglects the social, political and cultural dimensions of development. There have been some attempts, both direct and indirect, to incorporate these dimensions. For example, Varis and Nordenstreng (1974) showed that many countries were dependent on programming from the West, principally the United States. Along a similar line, the MacBride Commission Report (1980) called for a more balanced flow of news from and to the West. These efforts, however, are piecemeal in the overall scheme of *dependencia*.

Myrdal suggests that the lack of development in Latin America during a period that saw development in Asia, may be traced to the colonial past. Myrdal argues that different colonizers have left different legacies. Britain, when it was pulling out of its colonies, was moving toward a liberal system of rule with a firmer and less corrupt government. In contrast, when Spain and Portugal where pulling out from Latin America, the two former powers were shadows of their greatness (1970:433-434).

Questionable policies

The policy recommendations are the most controversial aspect of *dependencia*. Recent history strongly suggests that withdrawal from the world economy may not just be unrealistic but harmful. The fastest growing economies in East Asia and parts of Latin America have been the ones most exposed to international linkages. On the other hand, insulated economies, such as those in the Eastern bloc, have stagnated.

The socialist model as applied by the former Soviet bloc, especially, has also been shown to be a failure economically--the very area where *dependencia* is supposed to be at its strongest. Berger (1976:88) had pointed out, before the command economies turned more capitalistic, that the policy recommendation of a socialist economy would merely exchange one form of dependency for another.

Finally, the recommendation of a revolution is not predicated on any empirical finding. The perspective does not answer the question: what happens after the revolution? The need for education, technology, and other aspects of development remains unchanged.

<u>Conclusion</u>

Despite the various shortcomings listed above, *dependencia* has played an important role in development.

First, it has had a lasting impact on theory. It was the Third World's first contribution to development theory, a significance that should not be underestimated. Jagdish Bhagwati (Meier and Seers 1984:197), commenting on the contribution of Raúl Prebisch, said:

> . . . [A]mong the colonial attitudes which afflicted our societies in those days was the belief that fundamental thinking required that one belong to the center, not the periphery. . . . Prebisch . . ., among a few key figures, helped to shatter that myth decisively.

Second, it has had an impact on development strategies, particularly in Latin America and parts of the Caribbean and Africa.

Third, it has played important ideological and sociological roles in Latin America during the 1960s (Blomström and Hettne (1984)), the effect of which still continues.

Dependencia provides both an easy and a difficult answer, both a spirit of optimism and a spirit of pessimism. The easy answer is that it offers a utopia--if only the linkages to the developed world are cut. But this is also a difficult answer because it is an unrealistic, and perhaps unrealizable, option; the result then is deep pessimism. It has been suggested that radical writers are good at diagnosis but poor at therapy (Lee 1979:63).

Perhaps the last pronouncement is particularly

instructive. It is made by a scholar of Asian descent and it is in Asia that *dependency* has been resoundingly rejected, even though one of the first dependency studies was of India (Baran 1957). As noted earlier, Apter has observed that while confidence in the modernization paradigm is declined everywhere, it is still strong in East Asian countries such as China, Japan and Taiwan (Apter 1987:17).

The confidence does not appear misplaced; countries such as Hong Kong, Singapore and South Korea have flourished economically using the modernization paradigm. The dependency analysis could not have worked in city-states such as Singapore and Hong Kong because self-sufficiency is unrealizable. This issue will be discussed in further detail below.

The newly-industrializing countries in the Far East, who were initially considered good examples of dependent economies, have now become competitors to the West and began to invest there (Somjee 1991:56).

In this writer's view, it is accurate to say that *dependencia* is on the decline. To most Western development economists, the conclusions of *dependencia* are "overdrawn . . . and [may] be questioned on both theoretical and empirical grounds" (Chirot and Hall 1982:92). The terms of trade apparently do not deteriorate continuously but fluctuate; Prebisch appears now to have captured a slice of reality (*ibid* 93). The evidence is increasingly mounting against it so much so that some writers now say that

dependencia is not a "precisely articulated theoretical model" but "a conceptual framework, a set of concepts, hypothesized linkages, and an optic that attempts to *locate and clarify* a wide range of problems" (Emphasis added. It is curious how one can clarify if one is not precise.) (Villamil 1979:2; Fagen 1977).

Among *dependentistas*, there have been two courses of action. So (1990) suggests that some *dependentistas* have attempted to refine a more sophisticated model. But the example he uses is of Cardoso, who had not associated himself closely with many of the *dependentistas* but had called some of them "vulgar Marxists" (Kahl 1973).

Then there has been criticism from theorists, principally Immanuel Wallerstein (1979), who believe that development should be analyzed from a "world system" perspective rather than the more parochial national angle. This world-system approach, as it is known, is often seen as heir to *dependencia* (Blomström and Hettne 1984).

The World-System Perspective

Introduction

First, the newly-industrializing countries from the Far East (South Korea, Taiwan, Hong Kong and Singapore) were growing economically and challenging even some developed countries world in some sectors. It was difficult to cast their success merely in terms of "dynamic dependence," "manufacturing imperialism" or "dependent development" (So 1990: 170).

Second, the command economies in the Eastern bloc were showing signs of crisis and there were questions raised as to the wisdom of severing links to the West (*ibid.*).

Third, the US was showing signs of weakening as a world superpower with a budget and trade deficit in part created by its involvement in Vietnam (*ibid.*).

Building on *dependencia*, which may account for why some have considered it as an extension of the school, Immanuel Wallerstein formulated an explanation that considers these "anomalies" and labeled it the world-system theory.

Background

Wallerstein began his career by studying development problem in post-independent Africa (Wallerstein 1964, 1967). With the failures of development in the late 1960s, his formulation of a development theory was strongly influenced by the *dependentistas*. Indeed, he has borrowed many key concepts from them--unequal exchange, core-periphery

exploitation and the world-market (1979). Probably because of this heritage, many scholars consider the world-systems perspective to be part of the dependency school (Lee 1979; Chirot and Hall 1982; Blomström and Hettne 1984).

More recently, however, Wallerstein has moved beyond the domain of the neo-Marxist dependency school. It has been suggested that the shift in orientation may be attributable to the influence of the French Annales school and its leader Fernand Braudel (So 1990: 172).

Braudel argued that history should be viewed as an all-embracing or "global discipline." That is, history should not be subordinated to any discipline but should be viewed in the "totality of the social force" (*ibid*).

Braudel also argued that history and the social sciences should be synthesized through a long-term perspective. Thereby, history would "move away from the 'uniqueness of events' (eventism), and the social sciences would gain a historical perspective lacking in much of its attempts to formulate trans-historical theory" (Kaye 1979:409).

Braudel played a key role in shifting the focus of history from a recording of periods to an orientation toward problems. Thus he asked "big" questions such as "What is capitalism?" and "What accounts for the failure of France ever to have dominated the European world?" (So 1990:173).

Wallerstein, after his success in expounding the world-system perspective, became director of Fernand Braudel

Center for the Study of Economies, Historical Systems and Civilization at the State University of New York at Binghamton. Besides producing working papers and holding an annual conference, this international enterprise publishes a journal called *Review* that urges "the primacy of analysis of economies over long historical time and large space, the holism of the socio-historical process, and the transitory (heuristic) nature of theories" (*ibid* 170). From its roots in sociology, the theory has been extended to anthropology, history, political science, and urban planning (*ibid* 171).

The Perspective

Wallerstein sees the world-systems perspective not so much as a theory but as "a protest against the ways in which social scientific inquiry was structured for all of us at its inception in the middle of the nineteenth century" (1987:309). Specifically, he challenges several assumptions embedded in traditional social science research (So 1990:173-180).

Disciplines

Wallerstein rejects the boundaries set up by disciplines in the social sciences, arguing that the differences within disciplines were often greater than the differences between them. He says that the cleavages in the social sciences emerged only in the 19th centry and that the boundaries are an obstacle to scientific inquiry (1979;

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History and social science

Wallerstein also calls for a synthesis of history, traditionally viewed as a generalization of the particular, with the social sciences, traditionally viewed as a generalization of the universal. He fuses them into what he calls in his own words, inelegantly, historical social science (1979). He writes:

> One cannot talk about (analyze) any particular set of occurrences without using concepts that imply theorems or generalizations about recurrent phenomena. Thus all "history" is based on "social science." However, conversely, not only is all "social science" a set of inductions from "history," but there are *no* generalizations which are ahistorical, that is, universal (emphasis in original. 1979:ix).

Unit of analysis

Wallerstein argues that the unit of analysis should not be the society or the state but the historical system. It is a term consistent with the integration of history and social science. The term divides the link between society and states, which were considered opposing concepts in the 19th century (So 1990:176). Society then was the sum of the manners and customs of a group of people and considered deeper than state. In modern terminology, this would be culture. (*ibid* 176-7).

Accordingly, the unit of analysis is the capitalist world economy. All phenomena is to be explained in that light. Thus internal political or class struggles in a state

are seen as "efforts to alter or preserve a position within
the world economy which is to the advantage or disadvantage
of particular groups located within a particular state"
(Wallerstein 1975:16).

Progress through development

Wallerstein says the traditional social sciences,
including developmentalists, see human history as
"progressive and inevitably so" but he argues that this is
not necessarily the case (1987:322). He writes:

> It is not at all certain that there has been a linear
> trend---upward, downward or straightforward. Perhaps
> the trend line is uneven, or perhaps indeterminate
> (1987:322-3).

That scholarship and politics should not mix

Wallerstein argues that the gap between social science
and politics should be narrowed. He writes (1979:x):

> Every choice of conceptual framework is a political
> option. Every assertion of "truth," even if one
> qualifies it as transitory truth, or heuristic theory,
> is an assertion of value. All good scholarship is
> polemic (but not all polemic is good scholarship).

Assumptions

In his work, Wallerstein made two key assumptions.
First, he assumes, without stating it baldly, that trade is
necessarily bad for a country.

Most Western economists adopt the view of David Ricardo
that there is mutual benefit to be derived from the
production of goods in which countries have comparative

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advantages and then trading them (Chirot and Hall 1982:87).

However, there is another school of thought argued by Friedrich List in 1841 that it would be better to promote infant industries that could not compete in the short-term because of the long-term advantages in technological know-how (Chirot and Hall 1982). The debate still continues but Wallerstein adopts the stance that Ricardo has lost.

The second assumption, stated explicitly this time, is that development is a zero-sum game. He says:

> If in the next 30 years, China or India or Brazil were in a true sense to "catch up," a significant segment of the world's population elsewhere in this world-system would have to decline as a locus of capital accumulation (1988:2022).

The experience of the Asian Tigers--South Korea, Taiwan, Hong Kong and Singapore, however, militates against this view. These countries have grown economically precisely because of the economic prosperity in China. Some implications of this assumption are discussed further below.

The theory

The use of the historical system as the unit of analysis is the key to Wallerstein's conception. He argues that human history has seen three forms: mini-systems, world empires, and world economies.

According to Wallerstein, all societies began as mini-systems, which are entities that have a self-contained division of labor, and a single cultural framework. Such

systems no longer exist today but were found in simple agricultural and hunting-gathering societies. They are called "mini" because they are small in space and time, with a life-span of about six generations. Their basic logic is "reciprocity" of exchanges. Wallerstein says there are not as many minisystems in the past as thought because once a minisystem paid a tribute as "protection costs" to an empire, it could no longer claim to be self-contained (1979:5; 1987:317).

The mini-system then evolved into the world-system, which is "a unit with a single division of labor and multiple cultural systems". There are two varieties of this: one without (called world-economies) and one with a common political system (called world-empires) (1979:5).

Without a common political system, world-economies are unstable and tend toward either disintegration or conquest by a group and thereby transformation into a world-empire. China, Egypt and the Roman Empire are examples of world-economies that, with common political systems, became world-empires. The basic logic of world-empires is "the extraction of tribute from otherwise locally self-administered direct producers (mostly rural) that is passed upward to the centre and redistributed to a thin but crucial network of officials" (1987:317). The European colonial powers of the 19th century are not world empires but "nation-states with colonial appendages operating within the framework of a world-economy" (1979:5-6).

World-empires were the dominant form of historical-
system between 8000 B.C. and 1500 A.D. These were vast
political structures encompassing a wide range of cultural
patterns. The basic logic was the extraction of tribute from
otherwise locally self-administered direct producers that
was passed up to the center and redistributed to a network
of officials.

From 1500 A.D., the capitalist world-economies emerged.
These are vast uneven chains of integrated production
structures with multiple political structures. Political
energy is used to distribute accumulated surplus in favor of
those able to achieve monopolies in the market networks. The
operation of the market therefore created incentives to
increase productivity and attain economic development
(1974c). The capitalist world-economies then expanded to
cover the entire globe, absorbing in the process all
existing mini-systems and world-empires. By the late 19th
century, only the capitalist world-system existed.

Wallerstein defines capitalism as "production for sale
in a market in which the object is to realize the maximum
profit" (1974a:399). This requires the cooperation of the
entire world; where there is free competition, it is because
the core allows it only when it is to its advantage
(1974b:1). Under this conception, uneven development is a
basic component of capitalist development.

Semiperiphery

To the core and periphery as understood by the dependency school, Wallerstein added a third position: the semipheriphery. According to him, this is not merely a position on the continuum but one that arises both inductively and deductively (1974a). The semiperiphery serves two functions: political and politico-economic. First, a bimodal perspective raises the issue of why the exploited majority do not overwhelm the exploiting minority. He suggests that the semiperiphery therefore plays a role in ensuring political stability by deflecting the anger of an otherwise polarized world.

Second, as the developed world loses its competitive edge through the rising wages of workers in the developed world and technological progress, they shift some of their production to countries that are in the semiperiphery (1974b: 69-70).

Core, periphery and semiperiphery refer to positions in the world economic system (1972:96). There can and has been movement in the position of countries into and out of the categories. Thus modern Japan has risen to the core while Spain has fallen to the semiperiphery.

Movement from Periphery to Semiperiphery

Wallerstein suggests three strategies of development for a country in the periphery.

First, in a period of economic contraction, countries

should "seize the chance" and adopt import-substitution industrialization (1974b:9-10). Wallerstein says this strategy accounted for the expansion of Russia and Italy in the late 19th century.

Second, the country could adopt what he calls "semiperipheral development by invitation" where multinational companies are invited to invest in the country (1974b:12). Unlike the first strategy, this is done during a period of expansion.

Third, a country could adopt a path of self-reliance. Wallerstein offers Tanzania as a model in this respect but cautions that the country may have been buffered from external pressures because of its poverty. Wallerstein also cautions that small countries will have greater difficulty being self-reliant because of their size (1974b:14).

Movement from Semiperiphery to Core

The key to entry into the core is to increase the size of its market enough to "justify an advanced technology, for which it must produce at a lower cost than existing producers" (1974b:15).

Wallerstein lists several ways: conquest, increasing the cost of imported goods, dencreasing the cost of exported goods, increasing wages, and finally manipulating the tastes of consumers. According to Wallerstein, the United States, Canada, New Zealand and Australia had high wages before industrialization; their distance from the then more

developed world offered some protection for industries
(1974b:16). However, he observes that if Russia, which is a
large country, just barely made it, the prospects for other
countries must be worse (*ibid*).

Advantages

The world-system perspective explains the rise of
Western societies and the poverty of non-Western societies
on a long-term and large-scale global basis. Instead of
looking at even a decade or two, the perspective looks at
centuries. Wallerstein has studied the period from 1450 to
1750 to develop his thesis. Two other researchers using the
perspective studying colonialism have covered the period
1415 to the present (Bergesen and Schoenberg 1986). Thus the
perspective goes beyond a slice of reality to analyze
historical dynamics.

' Such a perspective directs attention to new research
agenda on a global scale. The questions the perspective
raises are not raised by modernization nor dependency
theorists.

The perspective has also been said to lead to a "more
parsimonious interpretation of statemaking, international
conflict and social change" (Lee 1979:32).

Policy implications

Wallerstein and many other prominent world-system
theorists share a common optimism in the belief in socialism

as an answer to development problems. So Wallerstein rejects
Great Britain and the United States as models for
development. But so is the Soviet Union similarly rejected
because it was operating in a capitalist world (1979:133).

The world-system perspective's goal is for a truly
egalitarian democracy worldwide. He therefore argues for a
movement world-wide (not a coordinated world-wide movement)
instead of one at the national level (1988:2021).

Key is Wallerstein's call for an attack on surplus at
the point of production. He says:

> Suppose that anti-systemic movements concentrated their
> energies everywhere--in the OECD countries, in the
> Third World countries, and yes, in the socialist
> countries as well on efforts defined as retaining most
> of the surplus created. One obvious way would be to
> seek to increase the price of labor or the price of
> sale by the direct producers (1988:2022).

Wallerstein argues that such increases would be more
effective today than before because the world's resources
are reaching the limits of exhaustion.

In the call for a more equal distribution of resources,
the world perspective has provided theoretical and
ideological support for the new international economic order
(NIEO) (Chirot and Hall 1982:81).

Criticisms

In general, it has been difficult to mount a frontal
attack on the world-system perspective because of the
encyclopedic knowledge needed. Perhaps the strongest attempt

in this regard has been made by Robert Brenner who
demonstrates that Wallerstein has reversed the causality of
dependence and backwardness. Brenner (1976) shows that the
economic backwardness of eastern Europe (primarily Poland)
in the late medieval and early modern period did not arise
from dependence but instead was the cause of dependence.[4]
Along a similar line, Perry Anderson (1974) concluded that
Poland in the late middle ages was a vast underpopulated
area with predominantly poor soils, a backward agricultural
technology, and a fragile, decaying urban network *before* the
grain trade with the West began (emphasis in original.
Chirot and Hall 1982:98).

The emphasis on the world system has tended to be
carried so far as to neglect internal factors such as class
and political struggles, as Marxist scholars have noted.
This neglect of historically specific development weakens
the world system perspective as an attempt to be a
comprehensive theory. For example, Amin (1974:3) writes that
"[n]ot a single concrete socio-economic formation of our
time can be understood except as part of this world system."

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4 First, the availability of forced labor discouraged the
landlords, the ruling class, from introducing agricultural
improvements. Second, the landlords by continuing to
increase the extraction of surplus from the peasants
limited the home market for industrial goods. Third, direct
and powerful controls over the movement of peasant labor
eventually suffocated industries. Finally, the landlords
usurped the functions of merchants by acting as middlemen
and encouraged industrial imports from the West. All these
resulted in dismal productivity and unequal distribution of
income, which together led to dependence on trade in
primary products to the West.

This makes the countries out to be pawns of the world system, leading in turn to the error of teleological explanation. That is, explaining the behavior of states by the presumed needs of a larger system (Koo 1984:37). Critics have noted that Wallerstein commits historical teleology by using historical events to explain the origins of the world economy and then insisting that these historical events had to happen because the world economy required it (Skocpol 1977; Zeitlin 1984). Thus Zeitlin (1984:228) quotes Wallerstein:

> The world economy was based precisely on the assumption [whose?] that there were in fact these three zones and that they did in fact have different modes of labor control. *Were this not so,* it would not have been possible to assure the kind of *flow* of the surplus *which enabled the capitalist system to come into existence.* (emphasis added by Zeitlin).

Zeitlin (*ibid*) says the statement argues that the world economy originated because of its consequences.

Marxists have also noted that Wallerstein neglects to account for the role of technology. Chirot and Hall (1982:98) noted that this was a curious omission considering that this was one of the strongest Marxian contributions to economic development. Brenner (1977) argues that the neglect was necessary to prove that Poland was not much behind the most advanced parts of Western Europe in the 15th century.

Also, the lumping of precapitalist societies into minisystems and world-empires has been described as being "perilously close to the ahistorical eurocentrism that

characterized modernization theory" (Chirot and Hall
1982:99). China as a world-empire underwent technological
change and economic growth from the Han to the Ming dynasty.
But another world-empire, Egypt, remained largely stagnant
from the time of the Pyramids to the Macedonian conquest
2,300 years later (*ibid*). By lumping all world-empires under
one head, the perspective does not explain the differing
reception and results of the entry of capitalism.

Wallerstein's assumption that capitalist economic
development is a zero-sum game has also been questioned.
Kuznets (1971) and Bairoch (1977) have shown that this is
not the case and that the growth rate of poorer countries
after World War II was higher than the historic growth rate
of core countries.

The ideological bias of the world-system toward
socialism has been questioned as it has led to blind spots.
Besides ignoring the question of core and periphery among
socialist states, world-system theorists do not answer the
question of how socialism can increase labor productivity in
the long-run (Chirot and Hall 1982).

Finally, the policy recommendation of Wallerstein
(1988) is weak. Wallerstein does not elaborate how "an
attack on surplus at the point of production" is to be
carried out beyond the concentration of energies everywhere.
It appears to be a call to raise prices through some cartel
arrangement among producing Third World countries.
Wallerstein's call in 1988 postdates several attempts by

Third World countries to do precisely that. There have been cartels attempted in such commodities, besides oil, such as tin and rubber. All of them, however, have met either limited success, as in the case of oil, or dramatic failures, as in the case of rubber.

The world-system perspective has made important contributions to the field of development theory as outlined above. Perhaps because it is an offshoot of *dependencia*, theorists who ignored *dependencia* have also ignored the perspective, choosing instead to develop a perspective called variously pluralism, multiplicity and Another Development. This perspective is discussed next.

The Plurality/Multiplicity Paradigm (a.k.a. Another Development)

Introduction

The failure of the modernization paradigm to predict the path and consequence of development did not go unnoticed by its theorists. As early as 1967, empirical research had rejected Lerner's thesis of modernization through the mass media (Schramm and Ruggels 1967).

Meanwhile, Third World intellectuals were looking to base their development on self-reliance rather than foreign assistance, coining slogans such as "Development without modernization." They endorsed the goals of development and the equitable distribution of the benefits, such as better health, better housing, and better education, but they rejected the adoption of Western-derived institutions. Development and modernization were to be deliberately chosen values of each country (Berger et al 1973:173,174).

Against this backdrop, some development theorists did adopt the dependency and world-system perspectives. Others attempted to change the paradigm.

One of the instrumental figures in the change was Everett Rogers who in 1976 called for a new paradigm to replace the old. (This period also marked the rise of the New World Information Order talks, the consideration of UNESCO's "Draft Declaration on Fundamental Principles Governing the Use of the Mass Media in Strengthening Peace and International Understanding and in Combating War

Propaganda, Racialism and Apartheid" and the formation of the MacBride Commission (McPhail 1981:98-100).)

The paradigm

Rogers (1976b) said that a distillation of the literature yielded four main elements in the modernization theory, which he called the dominant paradigm. These were: a focus on economic growth both as a measure of and the goal of development; reliance on capital-intensive technology; centralized planning for development; and an almost exclusive stress on internal causes of development.

Field experience and criticisms, however, indicated that a new paradigm should include elements such as: integration of the traditional with the modern systems of communication; self-reliance at both the local and national levels in development; popular participation; and equality in the distribution of information and social benefits (Rogers 1978). Rogers' paradigm is based in part on these new elements as well as based on a reaction to the elements in the dominant paradigm. Instead of economic growth, Rogers suggested a focus on the quality of life and equality of distribution. There was, in part, a recognition that the distribution of communication tended to reinforce existent economic and social inequalities and provide unequal access.

Capital-intensive technology, almost invariably imported, was to be avoided in favor of labor-intensive methods and "traditional" and "modern" systems should be

integrated. This incorporated the recognition that
technologies such as labor-saving devices that were suitable
for the West could inflict more harm than good on developing
countries and that "traditional" systems and technology were
therefore not always bad.

Instead of a top-down approach, he urged self-reliance
in development and popular participation in planning and
execution at the village level. Here, Rogers, along with
many in the field, was recognizing that some development
projects had failed as the locals were not consulted and
therefore valuable local knowledge missed.

Finally, instead of focusing only on internal causes,
he pointed out the need to look at external causes (Rogers
1976a). This final point takes into consideration the
criticism of *dependentistas* that the modernization paradigm
tends to reject the possibility that deep structural factors
might impede development.

The two paradigms are contrasted in the following Table
2.1 below.

Rogers' paradigm is a reflection of the change in
emphasis in economic development. At the start of the 1970s,
mainstream economists began putting greater emphasis on
equity instead of merely growth (Lewis 1987:6). The shift is
not new in that as early as 1961, the Indian Planning
Commission was attempting to fight poverty, as opposed to
merely encouraging growth, by implementing a minimum-needs
program (*ibid*).

Table 2.1.--Alternatives to the Dominant Paradigm

Main Elements in the Dominant Paradigm	Alternatives to the Dominant Paradigm
1. Economic growth	1. Equality of distribution 2. Quality of life
2. Capital-intensive technology	1. Greater emphasis on labor-intensive strategies 2. Integration of "traditional" and "modern" systems
3. Centralized	1. Self-reliance in development planning 2. Popular participation in decentralized planning and execution (eg at village level)
4. Internal causes of undevelopment	1. Internal and external causes of undevelopment

Source: Rogers 1976b:50-51.

Several influences appear to have been at work behind
the pluralism paradigm. Rogers appears to have been
influenced by a Pakistani economist, Chaudry Inayatullah. In
1964, at a conference where Lerner and Schramm were also
present, Inayatullah had called for a non-Western model of
development. In a criticism then that seems, on hindsight,
prescient, Inayatullah said the modernization paradigm
presupposes that societies that have not developed
technologically by Western standards were "sterile,
unproductive, uncreative and hence worth liquidating"
(1967:100). He noted that the limited measures of
industrialization and urbanization ignored non-material
areas of creativity. Development, he said, should be
voluntary; the process should be through innovation rather

than imitation. He suggested that development be defined as "a process through which a society achieves increased control over environment, increases control over its own political destiny, and enables its component individuals to gain increased control over themselves" (1967:101).

Inayatullah's definition bears some resemblance to Rogers' definition of development of 1976 which is "a widely participatory process of social change in a society, intended to bring about both social and material advancement (including greater equality, freedom, and other valued qualities) for the majority of the people through their gaining greater control over their environment."

This is in contrast to Rogers' earlier definition (1971) of development as "modernization at the social system level" which occurs when "new ideas are introduced into a social system in order to produce higher per capita incomes and levels of living through more modern production methods and improved social organization" (11).

There also appear to be traces of the "Buddhist economics" written about by E. F. Schumacher in 1973 in his book "Small is beautiful." In one chapter, Schumacher uses Buddhism, although he said it could just as well have been another religion, to point out the inadequacies of economics. Schumacher said that labor from a Buddhist or religious standpoint, was intended to be a liberating experience in that it was supposed to enliven man and release his creative energies. Full-employment would

therefore be a goal of Buddhist economics. In the pluralism
paradigm, this idea is reflected in the preference for
labor-intensive over capital-intensive industrialization.

Schumacher said meeting needs not through imports but
through local production was less likely to lead to
exploitation of limited physical resources in faraway
places. In the paradigm, this is reflected in the emphasis
on local production.

Schumacher also said modernization as practiced needs
to heed religious and spiritual values (1973:62). This point
has been resurrected recently through scholars using
Buddhist development projects as models of how the new
paradigm works (Dissanayake 1984, 1991).

More recently, five elements of the paradigm have been
suggested by Jayaweera (1987a:xvii):

1) modernization as recommended by the West is neither
   practical nor desirable;

2) Third World societies should aim to satisfy "basic
   needs";

3) fundamental reforms in the structures of
   international trade and monetary institutions are a
   necessary condition of development;

4) similarly, fundamental structural reforms within
   Third World societies themselves, such as land
   reform, opportunities for political participation,
   decentralization, etc., are a prerequisite for
   development;

5) reliance on foreign aid and capital-intensive technology must give way to self-reliance and appropriate technology; the bias for industry must give way to a greater commitment to agriculture; and

6) development is unthinkable except within a framework of culture.

Jayaweera's approach attempts a middle path between *dependencia* and the traditional modernization paradigm. It considers both internal and external factors with an emphasis on control by the individual over self and environment.

Most recently, these ideas have been expounded more fully by Jan Servaes, who calls the paradigm "one world, multiple cultures" or "multiplicity".

Servaes summarizes the paradigm thus:

' "1. All nations are, in one way or the other', dependent upon one another. Consequently, internal as well as external factors may influence the development process.

2. development has to be studied in a global context, in which both the Center and the Periphery, as well as its interrelated sub-divisions, has [sic] to be taken into consideration.

3. More attention should be paid to the content of development, which implies a more normative approach.

4. There is no universal model for development. Each society must develop its own development strategy"

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(1990:39).

He says the central idea behind the new paradigm is that there is no universal development model. Development is that there is no universal development model. Development is "an integral multidimensional and dialectic process that can differ from society to society" (1990:38). Development is a relative problem and should be defined as need-oriented, endogenous, self-reliant, ecologically sound and based on participatory democracy and structural transformations.

Servaes has drawn up a list of 27 items for the ideal-typical model of multiplicity, contrasting the new paradigm, which he calls organic, with the old, which he calls mechanistic. The items are listed in Table 2.2 below.

Table 2.2.--Contrasts between the old and new paradigms

Overall Objectives	Mechanistic Model	Organic Model
Motive to cooperate	People need to be helped Charity	People are able to help themselves Empowerment
Assumption about target group	People lack skills and resources to develop selves They are helpless	People have skills to develop selves They can be mobilized
Attitude to problems	Problem-solving	Problem-posing
Attitude to participation	Means to achieve ends	Never-ending process
Objective of policy makers and researchers	Implementation of project objectives	Striving for a common vision and understanding of self-development

Table 2.2.--continued

Learning relationship	Teacher-student: know-all vs know nothing	Everyone is teacher-student at the same time; all have something to share
Valuation of knowledge	Western knowledge is superior	Traditional knowledge is as relevant

Actors

Agent of change	Policy maker or researcher	People themselves
People seen as	Targets, objects	Subjects, actors
"Leadership" position	Project leader	Coordinator, animator, facilitator
Selection of "Leaders"	Appointed by higher authority	Preferably by people chosen
"Leadership" qualifications	Decision making, management, authoritative	Cooperation, delegation, receptive, adaptability to new circumstance
Relationship with people and colleagues	Expert-counterpart; authority centered	Shared leadership; shared responsibility

Table 2.2.--continued

Policy and planning

Design criteria	Productivity and economic growth criteria	Needs and for well-being formulated by people
Organizational structure	Hierarchical, vertical	Horizontal, two-way
Type of work	Technical-economic	Education-organizational
Approach to work	Executing tasks	Listening to people; facilitating
Organization of work	Formal, static	Informal, dynamic
Mode of communication	Monologue, consultation	Dialogue

Communication Projects

Type of media used	Mainly mass media	Mixed and integrated media; Interpersonal communication
Direction of ideas and information	Top-down, one-way	Bottom-up, two-way

Implementation and Evaluation

Planning format	Blueprint Project approach	Open-ended Process approach
Change seen as	Improvements	Transformation
Time perspective	Short term	Long term
Effect of absence of leader	Project activities slow down	Development process continues
Initiative for evaluation	By funding agency or higher authority	Usually initiated by people themselves

Table 2.2.--continued

Type of solution	Symptom curing	Aimed at elimination of root causes
	Evolutionary change	Structural change

Source: Servaes 1991:77-78.

Advantages

The new paradigm is an improvement over modernization theory because it considers some of the criticisms of *dependencia*, particularly those relating to external factors. This makes development theory and policy richer and more holistic.

Instead of mere economic growth, the new paradigm also attempts to look into other factors of development that determine quality of life.

Second, the paradigm by considering local context is more culturally sensitive. Lerner has consistently argued that the criticism of ethnocentricity in the modernization paradigm is not valid as his model is based on historical happenstance of development in the West (1967; 1976). Even allowing for his defense, it is clear that not everything that has accounted for development in the West has worked when transplanted to developing countries.

Third, the need to listen brings humility to development agents and thereby reduce, if not eliminate, mistakes (Oshima 1976).

Policy implications

To the extent that the pluralism paradigm is a reaction to the dominant paradigm, its policy implications are diametrically opposite those previously recommended. Instead of an emphasis on big media, pluralism puts as much as, if not more, emphasis on "little media" such as puppetry, local dances and plays. Instead of an emphasis on urban projects, pluralism looks at rural projects. Where the policies in the dominant paradigm are effected through the rich and powerful, the pluralism paradigm aims to effect change through the poor and powerless. Consistent with the paradigm, many of these implications are at the project or individual level.

From a macro perspective, the major implication of the pluralism or multiplicity paradigm is that a developing country cannot merely ape the West. In the more extreme form of the paradigm, which stresses a culture-specific approach, there is no model to follow, not even that of a developing country (Eisenstadt 1976). Development agencies and officials therefore have to consider local knowledge instead of merely forcing down their own ideas.

Another implication is that the indicators of development must consider the impact on individuals and their quality of life, not just macro-level economic statistics.

<u>Criticisms</u>

Although it has been more than 15 years since Rogers proposed the "new" paradigm, there has been little criticism of it. *Dependentistas* and world-system theorists appeared to have ignored it. Perhaps it is because this paradigm is less intellectually stimulating than *dependencia* in opening up new avenues of research.

Inayatullah, who in 1964 proposed a model similar to the new paradigm, has criticized himself in a conference in 1976 and his criticisms are incorporated below.

Methodology

A major problem with the new paradigm is that it is normative and not empirically grounded. It may be inevitable that development is normative. But the theories and approaches in modernization, dependency and world-system were grounded in historical and social research. Coupled with the fact that the new paradigm is a reaction to failures in modernization, the paradigm is able to give a laundry list of practical policies for development but is a weak stab at a theory of development. Significantly, among the many authors Servaes says has influenced him is Guy Gran, who wrote a book on a participatory approach to development. Gran himself appears to see the participatory approach as "an operational response," rather than a theoretical reply, to development (1983:19).

The result is that the paradigm does not quite knit

itself neatly into a logical, consistent and coherent whole.
Instead, it incorporates many elements, some conflicting
with others. Inayatullah, for instance, has criticized
himself for not establishing a balance among the development
goals of increased control over the environment, over
national destiny and over individual lives. A desire to
control the environment could lead to its destruction, the
subjugation of weaker nations by stronger ones to control
resources and the regimentation of individuals (1976:59).

The paradigm implies that developing countries have the
freedom to choose their paths of development when in reality
there are constraints "imposed by the historical evolution
of these societies and their contemporary internal and
external environments" (Inayatullah 1976:58).

Usefulness as a concept

' The paradigm suffers from a dialectical incohsistency:
it makes an absolute case for cultural relativism. That is,
the only absolute sure thing in development is the paradigm
and the norms that flow from it. The logical conclusion for
some is that everything else has to be culture-specific, a
conclusion that Lerner has tried to avoid (1976:62).

This contradiction within the paradigm is evident in
studies and development approaches. Nordenstreng and
Schiller (1979) compliment those who adopt the plurality
paradigm for noting some of the criticisms from dependency
but observed that this has not influenced their

conceptualization and that many of the notions of the modernization paradigm are still extant.

Others have noted that "[t]here is at present a manifest disjuncture between general theory, where the world-system perspective has become dominant, and the myriad lower-level focused studies--national, local, and thematic-- based on the earlier modernization model" (Portes and Walton 1981:13).

In a survey of 224 studies that examined the role of media in development, Jo Fair found little difference between studies conducted from 1958 to 1975 and those from 1976 to 1986. They varied little in theoretical framework, were cross-sectional and seldom examined media content. Some even used Lerner's model as late as 1984 (Fair 1989). Indeed, Inayatullah notes that it is possible to argue that the modernization paradigm was equally concerned with increasing control over the environment, national' determination and the individual (1976:59).

Conceptually, it is unclear as to whom the grass-roots refers to. Is it the village chief or the villagers? Development researchers almost invariably recount initial skepticism and resistance from village chief or villagers, and sometimes both, even to eventually successful projects.

According to the paradigm, development should be halted when villagers resist the innovations being introduced. But in practice, researchers have simply tried to change the villagers minds through persuasion.

Finally, it is hard to romanticize the role of grass-roots development after Pol Pot when millions of Cambodians were killed. Just as abuses can occur from the top in a top-down approach, so abuses can occur from the bottom in a bottom-up approach.

Policy

It is clearly difficult to implement the bottom-up approach. Rogers, who had earlier noted a subculture of peasantry (1969), has not explained what happened to that subculture under the new paradigm.

Perhaps an ideal case where the paradigm would apply is that mentioned by Marcus Linear (1985) of a Dutch farmer who went on his own to Ghana specifically to teach the Africans new farming techniques. At first, the elders in the village welcomed him, expecting more Western aid. Instead, the farmer, Johan Spee, merely listened to them. Later Spee introduced a few minor changes to improve crop output and reduce harvest time. According to Linear, Spee encountered resistance from the elders and the aid agencies and had to leave. However, word of his work spread and Spee was later invited back to Ghana by another village to demonstrate his farming techniques (1985:220-229).

The above scenario, however, still requires a top-down method. In fact, by its very definition, development requires a top-down approach. If the natives knew how to develop, why would not they want to develop themselves?

Spee's experience indicated that the natives did not know better farming methods. They had merely carried on the methods used by their forefathers and did not even consider the possibility that there were better ways to do what they had been doing.

Many instances of development also appear to have succeeded only with the support, at least tacitly, of top officials (Schramm and Lerner 1976). Indeed, Arnold Pacey has shown that the top-down approach, where innovations are introduced by central officials or a central bureaucracy, has worked in such diverse places as Persian (current Iran) and China and as far back as the AD 900s (Pacey 1990:1-19).

Also, it is not always the case that a bottom-up approach works. This is especially true in modern inventions—one either knows it is there or one does not.

Further, for modern interactive media such as telecommunications, where the usefulness of the medium increases with the number of users, the top-down approach has worked. In Singapore, a top-down electronic data interchange (EDI) system was constructed and software was then developed for the trading and shipping community. The system today is widely used and praised. In Hong Kong, a similar system from the ground up by the trading and shipping community failed to take off.

Finally, the policy implications of the paradigm are difficult for development officials to accept: it says that every country has to start from scratch without reference to

any other country's development. If so, development studies
have nothing to offer to developing countries. If there is
no model to follow, how can one know if an innovation will
succeed or fail? How does one explain the benefits of, say,
telecommunications investment?

Conclusion

The new paradigm specifically rejects the modernization
paradigm. The rejection is fundamental, down to the
philosophical level. While modernization was said to have
reflected the Protestant ethic, the new paradigm reflects
the Buddhist ethic. Buddhist development projects have been
used as models of how the new paradigm works (Dissanayake
1984, 1991).

The strong pragmatic orientation, however, has not been
supported with an equally strong theoretical underpinning.
The result, as Inayatullah has pointed out above, is that
development agencies must grapple with balancing contending
forces. For instance, balancing control over the environment
and exploitation of it, balancing self-determination and too
much individualism.

The goal of self-reliance, too, appears similarly
difficult to realize. The new paradigm cites problems of
imported technology. But some dependence on imported
technology is unavoidable. This is true especially of such
new technologies in telecommunications and computing. Only
the First World has them.

Also, the evidence from collapsed closed economies in the Eastern bloc suggests that self-reliance and development are conflicting goals. Those countries most closed in their attempt to be self-reliant were least developed.

In sum then, pluralism may be too expansive in its claim of being a paradigm. Certainly, Fair's research shows that the dominant paradigm is still alive.

Kuhn has defined a paradigm as the generally accepted view of scientists on fundamental facts, that determines the object of research and how research should be conducted (1962). Clearly, there is much in pluralism to be clarified and much more need to be done before a consensus can be reached. To the extent that pluralism has more to say in practical than in theoretical implications, it is half a theory. It is debatable if half a theory is better than none.

' Kuhn (*ibid*) argues that turmoil in theory is·an indication of dissatisfaction with the explanations and a movement toward resolution. If Kuhn is right, the emergence of development theory may lie just ahead.

Development Theory and East Asia

The current turmoil in development theory has been called a period "between conventional wisdoms" (Lewis 1987:4). It has been argued that the paradigms in modernization, dependency and world-system are extant, with researchers adapting them to suit modern context (So 1990).

East Asia, however, does not appear to have felt this turmoil. Instead, the modernization paradigm, or some variant of it, appears to have been adopted by the newly industrializing economies (NIEs). As noted earlier, Apter has observed that confidence in the modernization paradigm has declined everywhere but in East Asian countries such as China, Japan and Taiwan (Apter 1987:17).

Dependencia and the world-system perspective were rejected by Asian intellectuals (Blomstörm and Hettne 1984:6, Pye 1985:3). This may be attributed largely to the development success of the Asian NIEs, which spoke louder than any possible theorizing. South Korea, Taiwan, Singapore and Hong Kong achieved annual growth rates of 9.3 percent for more than a decade from the 1970s. Contrary to the predictions of *dependencia*, growth was attained through outward-looking export-oriented industrialization. Further, the growth provided rapid labor absorption and did not increase inequality to the level as predicted by *dependencia* (Lee 1981:12).

In essence, these countries subscribed to theories and ideologies that viewed economic growth and institutional

modernization as good in themselves. Marxist critics in Latin America, however, deride such an outlook as *desarrolismo*--developmentalism (Berger et al 1973:161).

To be sure, economic prosperity in the NIEs has brought problems. But the surest sign of success is that many countries are adopting the model of opening their economies and inviting more foreign investments.

Lucian Pye observed that the modernization paradigm had a closer empirical fit with Asia than with Africa (particularly Senegal and Tanzania) or Latin America or the Caribbean (Guyana, Trinidad and Jamaica) where *dependencia* was accepted (1985:3). Pye theorized that postcolonial Africa lacked nationalism and earnest commitment to modernization that were characteristic of Asia. (Pye's theorizing on this point raises the question of why the two elements of nationalism and commitment could not be incorporated into a new theory.) At that same time, Latin America states were not newly emerging but had evolved their own distinctive political and social systems. Asia, however, had elite-guided development; Japan and China wanted to gain strength and security by adopting modernizing technologies (*ibid*).

So East Asia wooed, instead of shooed, multinationals (*ibid*:4). Recently, China has set aside special economic zones for MNCs; India, which had attempted to develop on the paths of self-reliance, is also opening up to foreign investments.

How satisfactory is the new pluralism-multiplicity-Another Development paradigm in explaining East Asian development? To the extent that the pluralism paradigm of self-reliance and bottom-up development adopts *dependencia*, it militates against the evidence. One could stretch the paradigm by stressing the culture-specific approach. That is, one could argue that because the pluralism paradigm accommodates the particular context of each country, it is therefore able to "explain" each of their development. But, as pointed out earlier, this is not a methodologically satisfactory approach. Among other things, by explaining everything, the paradigm is therefore incapable of being tested and explains nothing.

Is there therefore no development theory except those from economics? In the late 1960s, Benjamin Higgins wrote, "Sociologists, psychologists, political scientists, anthropologists are flocking to the development field. . . . Yet we seem as far from a general theory as ever. Indeed, the flood of new knowledge seems to make generalizations of a kind useful for policy purposes in all developing countries more and more hopeless. . . . It is my view that no Newton will appear, no breakthrough will occur. Development is not that kind of problem" (Higgins 1968:843).

Thus far, Higgins has been right. It may be that the development of a development theory, at least from the sociological approach, is difficult. It has been suggested that no one single body or theory about development is

likely to develop because the field engenders "political conflict and sharp intellectual divergences" (Bernstein 1973:2).

This author, however, feels that it is possible at least to winnow out "bad" theories by studying instances of development failures and, more importantly, success. A development strategy is unlikely to work if it is inconsistent with demonstrated theory or if it does, the theory has to be modified or abandoned. Even if consistent with demonstrated theory, a development strategy is unlikely to work if it is applied in the wrong context (Geiger and Geiger 1976:23).

A case study of Singapore's development is therefore instructive. The tendency is to dismiss Singapore as a special case, a deviance from the norm. A robust development theory, however, should be capable of explaining this "special case." As will be shown next, Singapore's development strategy may be loosely classified as falling under the modernization paradigm.

Development Theory and Telecommunications

Introduction

Telecommunications role in development has risen in status. Back in the 1960s, Schramm criticized India's policy to allocate two-tenths of one percent of outlays to developing the broadcasting system, but 14 times as much to posts and telegraphs. He said, "This is a type of policy which the developing countries would do well to review. The growth of modern communication must go along closely with other modernization. It can lag *slightly* behind without greatly delaying the general pattern of advance. On the other hand, if it runs slightly *ahead* it can, to a degree, hurry the general rate of advance" (1967: 9. Emphasis in original.). This remark was set against the backdrop of the modernization paradigm where the use of the mass media was thought to be key in a country's development.

By the late 1970s, however, the telephone had replaced the mass media as the key to development (Parker and Mohammadi 1977). For example, Hudson said that when she asked natives in remote northern Canada what their priorities were from a list that included better housing and electrification, they replied, "We need communications first. Once we get that, we'll discuss other things we need" (Hudson 1984:xiii). Conciously or otherwise, the telephone was being used to resurrect the modernization paradigm.

<u>Modern Literature</u>

As with early studies on mass media and development, an early study of the telephone showed a correlation between telecommunications and what was called the "wealth of nations" (Jipp 1963). Since then, the evidence from various studies strongly suggests that telecommunications has a direct positive benefit in the economic development of a country.

The studies are well documented and summarized in three sources: *Telecommunications and Economic Development* (Saunders, Warford, and Wellenius 1983), *Telecommunications for Development* (Pierce and Jéquier 1983), and *When Telephones Reach the Village* (Hudson 1984). The first book, by Saunders *et al*, is geared toward telecommunications planners; it reviews micro and macro economic studies and examines telecommunications financing and management. The second book, by Pierce and Jéquier, is an ITU-OECD (International Telecommunication Union-Organization for Economic Cooperation and Development) project synthesizing all known studies on telecommunications and development. It was brought out in 1983, the year declared by the UN General Assembly as World Communications Year. The objectives of the Assembly included development of telecommunications facilities and equipment, a thorough review of national communications and overall development policies, and the establishment of better national and international coordination machinery (Pelton 1990:17).

The third book, by Hudson, was done independently of the other two but in one of those coincidences, was completed at about the same time. It is also a synthesis of studies, with an emphasis on rural development.

Until these books that were published in the early 1980s, studies on telecommunications and development typically correlated telephone density with economic growth. These studies were analogous to previous studies correlating newspaper circulation with economic growth. For virtually all countries, there is a 70 to 80 percent correlation between telephones per capita and GNP per capita (Hudson 1984:39; Pelton 1990:16). Several of the studies cited in the three books mentioned above go beyond simple correlations to determine the causal link between investment in telecommunications and economic development.

The common thread running through these studies is that investment in telecommunications pays off in the form of general economic growth. That is, the benefit is spread throughout the economy, and not limited to the telecommunication authority. This suggests that telecommunication authorities should not focus on direct monetary payback to determine if they should invest in a system.

A study in the then Soviet Union in 1977 indicates that each rouble of investment in long-distance telephones led to an eight-fold return in contribution to the GNP (Pierce and Jéquier 1983). This is close to the estimate of six- to

seven-fold investment returns predicted in a study done later by Edwin Parker (1981). The Soviet study found that big enterprises benefited more than small enterprises from the telephone. Further, 90 to 95 per cent of the benefit accrues to the economy as a whole, not just to the telecommunications sector (Pierce and Jéquier 1983).

In another study, Jean-Francois Berry suggests that France's underinvestment in telecommunications caused it to lag economically behind Spain. He found that between 1972 and 1977, France's gross national product (GNP) per capita grew by 95 per cent while Spain's grew by 145 per cent. Berry admitted that it was too simplistic to attribute the growth only to investments in telephone, but added that the figures were suggestive of a correlation (Berry 1981). Berry's data when reanalyzed indicated that France's under-investment in telecommunications cost it 2 per cent of its GNP 'or around 20 billion francs in 1975 through lòsses caused by poor telecommunications. As an indication of cost-benefit, Berry noted that in 1975 France invested 12 billion francs in its telecommunication system (*ibid*). He concluded that "telecommunications confers benefits on society which are over and above the private benefits represented or captured by the price system" (*ibid* 34).

A slightly more sophisticated analysis by Andrew Hardy in 1981 suggested that the benefits were inversely proportional to per capita GNP, being greater in developing countries than in developed. That is, the less developed a

country, the greater the benefits from telecommunications. Contrary to expectations, Hardy also found that in developing countries the telephone was more important in residences than business, and that penetration in residential telephones preceded economic development (1981). It has been suggested that in developing countries, poor telecommunication links force businesses to use residential telephones for commerce (Hudson 1984:43). Recently, another study analyzing investment in telecommunications and economic growth found that in developing nations, the telecommunications sector precedes national economic growth while the situation was reversed in developed countries (Kim 1992).

These findings concerning the causal link between telecommunications and economic growth have not always been replicated. Perhaps this may be due to a difference in the impact of investment in a developed against a less developed country. Or perhaps, it may be because telecommunications entities do use the economy to predict the volume of investments needed in telecommunication infrastructure. In Singapore, a study found that investment in local telecommunications and economic development interacted such that one could not be said to have preceded the other in time (Kuo and Chen 1985).

But even where a causal relationship is found, the studies may be criticized. First, these studies overlook the "double counting" inherent in them: investment in

telecommunications is counted as part of economic growth. Second, although time-series data are used, the Durbin-Watson statistic, as far as the author is aware, is absent from the analyses.

Then there is the critique that ultimately, these studies assume the modernization paradigm, a paradigm that has been discredited in development literature. Further discussion on this issue follows later in this section.

International Telecommunications

It should be noted that the above studies focused on domestic telecommunications and on investment in the domestic front. This research goes beyond investment to look at the flows itself. It also looks to the international telecommunications arena to test the robustness of the findings of previous studies.

ꞌ In the international arena, which is the focus of this study, the best statement of the expected benefits of international telecommunications is summed up in "The Missing Link" report of Sir Donald Maitland:

An expanded world telecommunications network would benefit both developing and industrialised countries. The process of improving and expanding networks in developing countries will create a major market for telecommunications equipment. A more comprehensive world system will increase international traffic to the advantage of the operators. Where information flows so

does commerce. More world trade and other contacts will increase understanding. An expanded telecommunications network will make the world a better and safer place (1984, note 4).

The Maitland Commission, or more formally, the Independent Commission for World-Wide Telecommunications Development, was established in 1983, the World Communications Year by the ITU Plenipotentiary Conference. It has been described as "the most formidable body yet appointed to promote the worldwide development of telecommunications" (Pelton 1990:17). The Commission urged governments to accelerate development of telecommunications as it was a prerequisite for social and economic development.

The Maitland Commission's recommendations were based on studies of a nation or comparison of several nations. In fact, virtually all the recommendations could be acted upon by individual countries. Some require action by the ITU, others require cooperation among countries. In the latter case, the cooperation lies in the pooling of equipment purchase.

It has been suggested that one way in which international telecommunications can help development is through gains in foreign exchange and (Hudson and York 1988). The gains in foreign exchange, it is argued, will probably come from those engaged in business activity.

Another advantage, it is argued, is that international telecommunications, by virtue of the high profit margins (in the order of 80 to 90 percent) could cross-subsidize residential telephone services (Sharp 1985).

Both arguments look attractive: the gains in foreign exchange come from sources that are capable of paying; the benefits to residential services, especially those in the rural areas, will aid in development, as Hardy's research had found. Both arguments, however, are, in the author's opinion flawed. They fail to consider the earlier research on telecommunications--that the benefits are spread throughout the economy. This means that the more efficient the telecommunications services in a country, the greater the benefits. Higher prices, be they for foreign exchange gains or for cross-subsidy, imply inefficiencies. Further, there is the trend worldwide to introduce reduce rates in long-distance telecommunications, which includes ` international traffic.

For all the theorizing, there has been surprisingly little done in the area of telecommunications and trade. Saunders *et al*, without giving precise citations, said the Consultative Committee on Telephone and Telegraph (CCITT) found that "international traffic through time was most closely associated with changes in the volume of international trade" (1983: 81). Moss (1986) showed that there was a close relationship among the internationalization of trade and finance, the

centralization of such activities in a few global cities, and the development of the telecommunications infrastructure in these cities. More recently, Kellerman (1990) found that for all countries except the US and the UK, trade explained telecommunications more than incoming tourism.

The proposed study is a departure from the earlier studies in that it looks at international, as opposed to domestic, telecommunications, and it looks at services and traffic, as opposed to hardware.

Paradigm

On hindsight, it should have been obvious that the telephone can play a significant part in development. Back in 1967, Schramm listed, among the several conditions of effective communication that support national development, two-way communication. Citing the Katz and Lazarsfield study (1955), Schramm advocated the radio-forum and other devices that offered feedback (Schramm 1967). Later, Lerner and Schramm observed: ". . . most media, well used, can contribute to development. . . . And *any medium is likely to be more effective when combined with two-way communication* of one kind or another" (1976:343. Emphasis added.). But, as pointed out in the beginning of this chapter, Schramm criticized the Indian government for allocating more funds to education and telecommunications than to the traditional mass media. The concept of the telephone as a contributor to development came later, after the pluralism paradigm was

unveiled.

From the start, it appeared that the telephone was a
technology almost too good to be true. Unlike traditional
mass media, the telephone was found to offer economic
benefits that is maximized when implemented in the rural
areas. This appears to be universally true in countries in
the First World, in Africa, and in the Soviet bloc (Pierce
and Jéquier 1983). In general, the quality of life is
improved as death-threatening emergencies are responded to,
families kept in touch, and communication with the outside
world maintained. As a technology, it should therefore fit
the pluralism/multiplicity paradigm well.

In reality, however, it fits unevenly. First,
telephones in Third World countries have been run by
government or government-sponsored authorities on a top-down
basis. Second, despite the evidence that the benefits to the
poorer are greater than the benefits to the richer,
especially in developing nations, many governments still
give priority to the urban areas. This may be attributed to
pork-barrel politics, and the fact that the
telecommunications system is usually run as a revenue
source. Third, there is evidence that some leaders love
large expensive projects such as telecommunications because
of the potential to hide bribes. In sum, there are
extraneous factors that can inhibit even a potentially
useful development tool such as the telephone.

The problem, however, is not easily resolved. Hudson,

for instance, in the introduction to her review of studies, was uncertain as to where the telephone stood in development theory (1984). The dependency and world-system perspectives are not helpful; under them, nations would have to sever links with the industrialized world, from which telecommunication technology originated. Having fewer links undermines the usefulness of the telephone.

The pluralism/multiplicity paradigm is, at best, uneven in application. The paradigm is strongest in the emphasis on the rural. The rest of the paradigm, however, offers little guidance as to how telecommunications should be deployed. As an imported technology, it needs top-down management from those with the expertise. It is hard to see how Servaes can achieve the approach under the "organic" model--for technicians and peasants to learn from each other, and for them to see traditional knowledge to be just as relevant as Western knowledge.

Understandably therefore, in considering the role of telecommunications in development, the tendency has been to use the dominant paradigm. Journal articles writing of new technologies and development are particularly prone to using the old paradigm.

For example, a recent article about satellites in development communications, said: "telephone, data and TV transmissions, made easier by satellites, *are now seen as prerequisite* for national development" (Flournoy 1991:41. Emphasis added.). The author, without mentioning who sees

satellite transmissions as prerequisite of national development, then pointed to the potential for disseminating health, education, social services. Substitute satellites with airwaves and "telephone, data and TV transmissions" with radio and one is back to the era of Lerner's study. That is, telecommunications has now replaced the mass media in Lerner's model.

The replacement is ironic. As noted above, Lerner's modernization paradigm was criticized for being a simplistic linear model and for adopting the discredited magic bullet conception that the mass media have direct uniform and powerful effects.

There is, however, no ready paradigm for telecommunications to fit. Perhaps it is this lack of a paradigm that accounts for the resilience of the dominant paradigm in telecommunications use in development theory.

' To some extent, this research will test that paradigm. If international telecommunications does cause economic development, the dominant paradigm role in development will be bolstered. On the other hand, if economic development causes international telecommunications, the dominant paradigm's role will be questioned.

CHAPTER THREE

The Singapore Context

Introduction

Currently, more than half of Singapore Telecom's revenue is derived from the international market. Singapore has the highest call volume per capita in the world (Singapore Telecom 1992). Volume would be even higher if telephone calls to Peninsular Malaysia, the nearest neighboring country, were counted. Instead, for historical reasons, calls to Peninsular Malaysia (as opposed to East Malaysia, which is on the island of Borneo) are billed as "trunk calls." This may be thought of as the equivalent of long-distance calls in the United States.

(Trunk calls are not measured and are not switched through the international gateway. Plans are afoot, however, to move the trunk calls to an international gateway (Lim 1993).)

Singapore therefore represents an extreme case in international telecommunications. Conceptually at least, a study of Singapore as an extreme case should evidence the effects of international telecommunications more readily.

History

Singapore's links with the international community have long historical roots. The openness of the Singapore economy to international forces is probably the main reason for the high volume of international traffic.

The Republic of Singapore is one of the smallest countries in the world. It consists of a group of islands occupying a total area of about 250 square miles, 10 percent of which was reclaimed from the sea. This area is about the size of Greater Boston or Greater Los Angeles. Nearly all three million residents live on the main diamond-shaped island, which is 26 miles from east to west at its widest and 16 miles from north to south at its longest. The main island lies at the southern tip of the Malaysian Peninsula and is 85 miles north of the equator.

From its earliest recorded times, Singapore has been a trading center. There is evidence that it was one of the three capitals of the Srivijayan empire based in Sumatra in the 7th century AD (Lee 1973:2). By 1330, it had become an important communication node on the trade route between the Indian Ocean and the South China Sea, appearing in Chinese, Javanese, Vietnamese and Arabian records (Chew 1991).

Singapore's modern history, however, began on January 30, 1819 when its founder Stamford Raffles established it as a British maritime base because of its natural advantages--a deep harbor, sheltered anchorage and plentiful fresh water. There were at most 150 residents then, most of them Malay natives eking out a living through fishing (Lee 1973).

Britain chose Singapore to be a strategic seaport in the region. During the Napoleonic War, the French had ruled Holland and the British had used the ports of the Dutch colony Indonesia. After the War, Indonesia was returned to

the Dutch as part of the peace settlement. The Dutch,
however, then tried to exclude the British from the region.
Singapore was therefore intended to be a British foothold
right next to Dutch Indonesia, as well as a center for trade
links with the surrounding countries from which resources
could be drawn.

The British brought to Singapore some uniquely Western
benefits that soon attracted migrants with hopes of making
their fortune here (Lee 1973). The formalized British legal
system offered Asian merchants, financiers and manufacturers
better protection of private property and fewer restrictions
on commercial activities than the "usually extortionate and
often capricious administration of justice by Chinese
magistrates and Malay sultans." The port grew so quickly
that in 1824, the British bought the entire island and the
58 offshore islets, a total area then of 225.6 square miles
(Geiger and Geiger 1976:4,5).

Singapore soon became the administrative and
communication center for trade in South-east Asia. Its
position as the main British colony in the area was
strengthened in the early 1830s when with two other British
posts on the Malay peninsula, Penang and Malacca, it was
incorporated as the Straits Settlements. The British
Governor of the Straits Settlements ruled from Singapore
(Lee 1973).

For much of its history, Singapore's economy was highly
dependent on its entrepot port. Its function was to link the

hinterlands of Malaya and Indonesia with the world through the colonizer, Britain, functioning as a distribution, collection, financial, transportation and communication center. From the import and export activities grew supporting services such as banking, legal, and accounting services. Singapore also nurtured English as this was the language of commerce. So compared with other countries in the region, Singapore had a more literate population with more varied skills. It has been noted that, as with any successful entrepot port, it was "outward oriented, attentive to changes elsewhere in the world that could affect its own interests, and inclined to import innovations from other countries that could help it protect or improve its competitive position" (Geiger and Geiger 1976:8).

Singapore's early development as a commercial center was accelerated by the arrival of steam-powered boats in 1845 (which helped stamp out piracy in the region), the Australian gold rush of the early 1850s, the opening of the Suez canal in 1869 and the introduction of the telegraph in the 1870s (Lee 1973:3).

The regional importance of Singapore was enhanced by the Japanese when they defeated the British and occupied the island for three and a half years during World War II. A local historian noted that the "irrelevance of colonial boundaries meant that Syonan (Singapore) became a convenient focal point for official and private business extending into the Peninsula and beyond" (Thio 1991:96).

After World War II, with the myth of the invincibility of the British shattered, and the international trend of freeing the colonies, Singapore was allowed greater self-rule. Unlike most other developing countries, however, Singapore did not then relish the prospect of independence. Economists deemed it too small to be economically viable on its own. At the time of self-government in 1959, there were other compounding problems: unemployment was rising and the outlook for entrepot trade, which had been stagnating, was not promising. (See Table 3.1.) So, upon taking office in 1959, and following the recommendations of development theorists, the Singapore government embarked on industrialization aimed at import substitution.

Table 3.1.--Singapore's stagnant entrepot trade 1953-1962

Year	Total Trade	% +/-	Imports	% +/-	Exports	% +/-
1953	5,673		3,201		2,652	
1954	5,705	0.6*	3,024	-5.5*	2,681	1.1*
1955	7,220	26.6	3,851	27.3	3,369	25.7
1956	7,358	1.9	3,929	2.0	3,429	1.8
1957	7,570	2.9	4,092	4.1	3,478	1.4
1958	6,880	-9.1	3,740	-8.6	3,140	-9.7
1959	7,348	6.8	3,908	4.5	3,440	9.6
1960	7,555	2.8	4,078	4.4	3,477	1.1
1961	7,272	-3.7	3,963	-2.8	3,309	-4.8
1962	7,453	2.5	4,036	1.8	3,417	3.3

Source: Singapore Yearbook of Statistics, various years.
* Percent change from the previous year.

The ruling party still had no confidence that Singapore could survive on its own and so worked toward a political union with its neighbor, Malaya. The idea was that with a

hinterland to buy from and sell to, Singapore would have an
enlarged market. So, in 1963, Singapore merged with Malaya
to become part of the Federation of Malaysia. But there was
disagreement among the leaders of Singapore and Malaya and
so in August 1965, Singapore was asked to withdraw from
Malaysia (Lee 1973:10). Once again the threat of economic
doom loomed large. Prime Minister Lee Kuan Yew actually wept
at the press conference announcing the dissolution of the
merger.

Singapore at first continued the policy of import-
substitution but soon found this to be not feasible as the
Singapore market was too small. Another problem arose in
1966 when the British Labour government announced that it
was to close its military base and withdraw from Singapore
over the following four years. The military base was
estimated then to employ 30,000 civilians directly and 8,000
indirectly (together forming 16 percent of the workforce)
and to account for 14 percent of the gross national product
(Lee 1973:45-46, 96; Buchanan 1972:86-87).

So from 1966, Singapore changed direction, switching to
labor-intensive export-oriented industrialization (Tan and
Ow 1982:283). The aim of the industrial policy during this
period was job creation.

The policies adopted were largely based on the
recommendations of a 1959 United Nations' Industrial Survey
Mission. This was the team that the United Nations had sent
at the request of the Singapore government to help it build

a manufacturing base. The mission proposed the establishment of a non-political government organization, the Economic Development Board, to spearhead the industrialization drive (Lee 1973:17, 27-29).

The industrialization plan aimed at attracting multinational corporations to set up operations on the island and bring their expertise. Coincidentally, this was a period in which banks and manufacturing concerns from developed nations were looking abroad to establish bases of operations. The Singapore government also hoped that the large foreign companies would subcontract work to the small local companies (Lee 1976:7). The plan succeeded. By 1971, MNCs accounted for 26 percent of all firms, 63 percent of employment, 75 percent of total value added, and almost 75 percent of manufacturing exports, excluding re-exports (Tan and Ow 1982:283). In short, soon after the implementation of the industrial policy, MNCs were a dominant force in the economy.

Other chance factors helped Singapore's growth. World trade boomed in the late 1960s. Unexpectedly, entrepot trade also began a period of expansion. Oil exploration in the region increased and Singapore soon became the management headquarters and the center for producing and servicing equipment. The escalation of the Vietnam War provided further opportunities. Up to 1972, South Vietnam was Singapore's largest customer for refined oil. The external factors, coupled with increased public expenditure in social

services and infrastructure, enabled the government to create jobs. By 1972, the unemployment rate was half that of the mid-1960s (Geiger and Geiger 1976:163-166, 170). The period of industrialization was a period of fast economic growth as shown in Table 3.2.

Table 3.2.--Indigenous GNP Per Capita

Year	Amount (S$)	Change From Previous Year (%)
1960	1,252	
1961	1,327	6.0
1962	1,369	3.2
1963	1,495	9.2
1964	1,466	-1.9
1965	1,613	10.0
1966	1,740	7.9
1967	1,819	4.5
1968	1,949	7.2
1969	2,189	12.3
1970	2,405	9.9
1971	2,761	14.8
1972	3,206	16.1
1973	3,849	20.1
1974	4,491	16.7
1975	4,888	8.8
1976	5,496	12.4
1977	6,011	9.4
1978	6,303	4.9
1979	6,892	9.3
1980	8,343	21.1
1981	9,854	18.1
1982	11,085	12.5
1983	12,533	13.1
1984	13,599	8.5
1985	13,044	-4.1
1986	12,824	-1.7
1987	13,733	7.1
1988	15,424	12.3
1989	17,093	10.8
1990	18,865	10.4
1991	20,031	6.2

Sources: Singapore Department of Statistics, Monthly Digest of Statistics, various years.

By the mid-1970s, the government had solved the problem of unemployment and was discouraging enterprises that wanted to set up simple production processes using large numbers of unskilled or semi-skilled workers (Goh 1977:199). In 1979, discouragement of labor-intensive manufacturing was made part of a new phase of industrial policy, which some have called the "Second Industrial Revolution." Wages were allowed to rise 20 percent a year between 1979 and 1981. Capital-intensive and higher value-added high-technology and information industries were encouraged at the expense of labor-intensive industries, which did indeed either fold or move to neighboring countries. But not as many of the desired industries were attracted as was wanted principally because Singapore did not have enough of the skilled labor necessary for the high-technology industries. Partly because of this, Singapore's economy suffered a decline in 1985--its first in more than two decades. The "high-tech" policy has since been abandoned.

The vision that information industries would be the next wave of economic development in Singapore, however, has remained. A key industry within the definition of "information industries" is the telecommunications industry. Singapore's telecommunications authority, Telecommunications Authority of Singapore, is working with the Economic Development Board both to woo investments and to invest abroad (Kuo, et al, 1989).

Development Paradigm

The modern history of Singapore sketched out above does not indicate any clear development paradigm. Before World War II, Singapore was a British colony and treated accordingly. Development was centered on meeting the demands of colonial master Britain. Unlike other colonies, Singapore had little by way of natural resources to be exploited. Its strategic location was used as a staging post for trade in the region and so the British built up Singapore's infrastructure. Singapore may therefore have benefited more from colonialism than resource-rich colonies such as India. Bearing in mind also that Britain wanted Singapore as a seaport for strategic purposes, Singapore cannot therefore be considered the periphery in the sense of an exploited colony.

' After World War II, Britain granted more autonomy to its colonies, weakening the direct colonial links to the point of self-government for the colonies. In its attempt to be self-reliant and in common with development thinking then, Singapore's economic development policy was import-substitution. To the extent that the import-substitution policy is derived from *dependencia*, Singapore was testing the theory. In a matter of years, however, *dependencia* was found wanting. Singapore's small market forced it to abandon import-substitution and adopt an export-oriented stance.

The export-oriented stance adopted has little to do

with the plurality paradigm. Decisions were made and
implemented top-down with little popular participation.
Initially, the government encouraged labor-intensive
industries to be established. Unemployment eased and a tight
labor market emerged. So Singapore turned to more capital-
intensive industries from the mid-1970s, the very period
that the plurality paradigm was being elucidated. In the
1980s, the Singapore government embarked on a campaign to
encourage greater use of technology in all aspects of
society. This too militates against the plurality paradigm.

Perhaps the closest of any paradigm is Wallerstein's
characterization of a country like Singapore as a semi-
periphery. Singapore may be considered part of the semi-
periphery even in colonial times but development theory then
had not evolved the concept. The island even then was a go-
between for the colonial master and the outlying colonies.

' The characterization, however, does not sit easily for
at least three reasons. First, as shown earlier, Wallerstein
assumes trade is bad. In Singapore, trade is a major
economic sector and is essential for the economic wellbeing
of the country.

Second, a small country such as Singapore tests the
limits of Wallerstein's world system theory. As noted
earlier, Wallerstein himself cautions that small countries
will have greater difficulty being self-reliant because of
their size (1974b:14). But he does not answer the question
of whether self-reliant is therefore limited or cannot even

be practiced. Singapore has chosen the latter, holding that self-reliance cannot be practiced in the small economy.

Finally, Wallerstein neglects the role of technology in development. In Singapore, however, technology is afforded a very important role. As outlined above, technology is to be the springboard for the next level of development in Singapore.

In sum, no theory has sufficiently explained the development of Singapore. In fact, the former deputy prime minister, who holds a doctoral degree in economics, wrote in the preface to a book that he was not into the theory but the practice of development (Goh 1977). Perhaps Singapore is too small to be self-reliant, a state that all the later paradigms have recommended. Perhaps as Singapore developed, its needs change, outpacing the paradigm themselves. Plurality in its insistence on popular participation and little media, for instance, seems more suited for·rural villages than urban metropolises. Finally, technology, especially those employed in commerce, is embraced in Singapore, but eschewed by the paradigms. Without technology, especially in communication, Singapore's role as a staging post for the region would diminish. A classic example of the use of technology is telecommunications.

Singapore Telecommunications

As a trading post, Singapore had been among the first cities in East Asia to have telecommunication links with the

Western world. Telephone services were first provided by a private company, Oriental Telephone and Electric Company and regulated by a government agency called the Telecommunications Department. In 1953, the phone company was taken over by a government body, the Singapore Telephone Board (STB). In 1974, the government agency and STB were merged to form the Telecommunication Authority of Singapore (TAS). In 1982, contrary to the worldwide trend of separating postal and telecommunications services, TAS was merged with a government agency, the Postal Department, to be established as a statutory board, which is a quasi-government company set up under law. The entity so established was called Singapore Telecom (Kuo *et al* 1989). At the time of writing, the company had plans offer the public its shares and be listed on the Singapore stock market. It is widely expected to be a blue-chip stock.

' Because of Singapore's open economy, international telecommunications has played a dominant role in Singapore telecommunications as far back as 1966. Revenue from international and other services in 1966 amounted to S$8 million (US$5 million), more than the S$7 million (US$4.4 million) revenue from the national telephone service (Singapore Telephone Board 1966). Today, international telecommunications continues to contribute more than half the revenue of the operating company Singapore Telecom (Singapore Telecom, various years).

CHAPTER FOUR

Research Design

Introduction

This chapter begins by stating the hypotheses to be researched. It then explains the data collected and the limitations inherent in them. The variables used in the study are then defined. Finally, a major part of the chapter is devoted to justifying the use of economic indicators despite their limitations.

Hypotheses

This dissertation investigates the magnitude and direction of the impact of international telecommunications on economic development.

As previous research has identified international telecommunications to have the greatest impact on trade and tourism, economic development will be considered only to the extent that it includes these sectors. Further, as it is generally assumed that the financial services sector is also affected, this was also studied.

International telecommunications is identified in this study as a causal variable in economic development. For the purposes of this study, it is not a necessary or sufficient cause. It is probably best described as a facilitating or contributing cause because development of the trade, tourism and financial services sectors has taken place without international telecommunications. What is meant therefore is

that international telecommunications facilitates growth above and beyond what is attributable to other causes.

The following are the hypotheses tested.

H1. International telecommunication correlates strongest with trade, tourism and financial services among all the sectors of the Singapore economy.

H2. International telecommunication causes trade development more so than vice versa in Singapore.

H3. International telecommunications causes tourism development more so than vice versa in Singapore.

H4. International telecommunication causes financial services development more so than vice versa in ¹Singapore.

H5. International telecommunication causes more growth in trade development than tourism development or financial services development in Singapore.

H6. International telecommunication causes more growth in tourism development than trade development or financial services development in Singapore.

H7. International telecommunication causes more growth in

financial services development than trade development or
tourism development in Singapore.

Limitations and Key Assumptions

The above approach considers but does not adopt the
dependency paradigm, which argues for self-sufficiency.
Instead, implicitly it holds that the more linkages to the
world, the better for development. This assumption is backed
up by strong evidence that a more open outlook to external
communication linkages improves the economic well-being of a
nation.

The major limitation of this study is that the data
collected are restricted to international telecommunications
whereas previous research has been almost exclusively
focused on domestic telecommunications. Strictly speaking
therefore, the implications of this research will refer only
to the international arena.

Research on domestic telecommunications has tended to
imply that the same benefits that accrue to domestic
telecommunications would accrue to international
telecommunications. To the extent that the findings in this
study diverge from that found in domestic
telecommunications, they contradict conventional wisdom that
the two arenas are similar.

A frequent criticism of a study such as this is that it
is confined to only one country--in this case, Singapore.
However, many of the conditions that are theorized to be

present in the telecommunication-economic development relationship—telecommunications-intensive, open trade and business policies—are to be found in Singapore. The criticism in this context, therefore, is a two-edged sword.

Data

Data were obtained from several published sources. The Singapore Monthly Digest of Statistics was the source for economic indicators and data on international outgoing telegram, telex and telephone calls by volume and month. The data were available on a computer database called Public Access Time-series (PATS) and the relevant data were downloaded on to a diskette after a search. The digest and the database are maintained by the Department of Statistics, the government body charged with the task of collecting and compiling such information.

' For this study, GDP instead of GNP was used.' The difference between the two economic measures lies in their territorial coverage. GDP covers the domestic economy, which is the purpose of this study.

Three levels of aggregation of data were used. First, data for all the sectors used in computing GDP were collected. Next, data for trade and tourism data were collected. Finally, data for trade and tourism between Singapore and various countries were extracted and compiled.

Telecommunications data are restricted to outbound international telephone calls made on the public switched

network. Calls on leased lines are excluded. International telephone traffic in this study is measured by the number of calls. Although it has been suggested that it would be better to use minutes (Staple and Mullins 1989b), such data were not available for this study. Most of the telecommunications data were also from the computer database. Those that fell outside the scope of the Digest of Statistics were obtained from the following publications: International Telecommunications Union Yearbook of Common Carrier Statistics, AT&T's World's Telephone, Singapore Telecom Annual Report and Singapore Telecom's Statistical Bulletin. The quality and scope of the data varied. For example, Singapore Telecom's Statistical Bulletin provided international telephone calls broken down monthly for outgoing for the top 20 countries by call volume only from 1976 to 1985.

' Most of the other variables are in dollar value at current prices unless otherwise indicated. The obvious divergence from the use of dollar value is in visitor traffic where the unit is a person.

Operational Definitions

International telecommunications in this study refers to international telephone traffic switched through the public network flowing to a party outside the country. It covers voice and data transmissions such as faxes but excludes telegram, telex, maritime, television and radio

transmissions. Voice and data transmissions through leased lines are also excluded. Where the specific variable is referred to, the term International Telephone will be used in the uppercase.

The various economic indicators are defined according to official classifications by the Department of Statistics as placed in Appendix 1. As above, where the specific variable is referred to, the term will be used in the uppercase.

The theme of telecommunications and economic development is open to two interpretations: first, telecommunications as a means to attract business to or retain business in a country, and, second, telecommunications as a factor of production (Jurgen and others 1989). As this study does not look into the role of telecommunications in attracting or retaining businesses, the second interpretation is adopted and telecommunications is taken to be as a factor of production.

The development of a country has political, social and economic dimensions. Rogers (1976) sees development as involving the equality of distribution of wealth and socioeconomic benefits, decentralization of decision-making, planning and execution, self-reliance and independence. Development by this notion is not limited to economic wealth. Economic indicators such as GDP (gross domestic product) and GNP (gross national product) per capita are therefore not the best measures of development as defined.

Some quality of life index would be ideal.

Ideally, therefore, a quality of life index would be the best measure of the national impact of international telecommunications. As the rest of this chapter will show, however, such an indicator is difficult to arrive at and therefore development has been defined by the traditional economic indicators of GDP and various economic sectors.

Definitions of Economic Development

Development is necessarily a normative concept. It has been variously defined as economic growth, structural economic change, autonomous industrialization, capitalism, and self-determination of the nation and individual (Harrison 1988:154). In the 1950s and 1960s, under the modernization paradigm, economics loomed large. During this period, developmentalists focussed on the increase of goods and services produced by a country, and therefore GDP, as indicators of development.

This is illustrated by Rogers who initially defined development as "modernization at the social system level" that occurs when "new ideas are introduced into a social system in order to produce higher per capita incomes and levels of living through more modern production methods and improved social organization" (1971:11).

By the 1970s, the emphasis had shifted to redistribution and other "softer" goals such as improvements in health, welfare, education and the general quality of

life. This is illustrated, again by Rogers who in 1976 modified his definition of development to "a widely participatory process of social change in a society, intended to bring about both social and material advancement (including greater equality, freedom, and other valued qualities) for the majority of the people through their gaining greater control over their environment" (1976a:215).

That definition is in line with the attempt during the period to move away from merely equating development with economic growth to defining development in terms of "distributive justice and general human fulfilment" (Dissanayake 1984:43). Taking this track, others have defined development to be "the deliberate attempt to reduce the discrepancy between conditions of the rich and the poor" (Narula and Pearce, 1986:xviii).

The idea is not new. In 1969, Dudley Seers said that the questions to ask about a country's development are: What has been happening to poverty? What has been happening to inequality? What has been happening to employment? He wrote: "If all three of these have declined from high levels, then beyond a doubt, this has been a period of development for the country concerned. If one or two of these central problems have been growing worse, especially if all three have, it would be strange to call the result 'development' even if the per capita income doubled" (1969:2).

Others have pushed this idea further, and in effect have given up the attempt at definition. They have instead

gone on to define the goals of development as "increased
economic output, improvement of health and life expectancy,
a reliable civil service, an appropriately educated
population, the achievement of governable urban areas"
(Moore, 1979:1).

To measure these less easily quantifiable factors, it
is not enough to use GDP alone as it would assume a trickle
down of wealth. Indicators of development have therefore
been used. The indicators are used partly for comparison and
partly to measure equality of income distribution (Hicks and
Streeten 1981).

Among the various approaches of measuring development,
three are particularly relevant. They are: first,
adjustments to the GDP to try to capture welfare, second,
the use of social indicators and, third, the use of
composite indices to measure and compare development.

1. Adjustments to the GNP

In the first approach, the GNP is adjusted to "to
capture some of the welfare aspects of development and to
improve international comparability" (Hicks and Streeten
1981:54).

One method of doing this is to use "purchasing power
parities" where the output of the country is converted into
local purchasing power. *The Economist* magazine, for example,
measures the number of hours a worker needs to work to buy a
MacDonald's Big Mac hamburger as an indicator of purchasing

power. Using purchasing power parities, a study by Kravis *et al* (1978) suggested that the Indian GDP per capita should be increased by 3.5 times.

But using purchasing power parities encounters a major problem: some countries would spend more on certain services than others because of differences in location or climate. For example, comparability between Canada and Singapore is reduced because Canada has snow and Singapore is in the tropics--differences that would affect expenditure in areas such as clothing, transportation and housing. Furthermore, this method is demanding as a wide range of goods and services must be compared.

Another method, propounded by Nordhaus and Tobin (1972), suggests that "regrettable necessities" such as defense and "disamenities" such as crime and pollution be subtracted from the GDP while leisure activities should be added to create a "Measure of Economic Welfare." In their study, the US GNP doubled because of the weighting given to leisure, a weighting hard to defend. This method of measuring development runs into the problem of using GNP for something it was not intended: to capture welfare.

2. Social indicators

The second approach is to use measures such as health, nutrition, housing, income distribution, and other aspects of social and cultural life to indicate the level of development. Several international agencies have used this

method (UN 1975; OECD 1977; AID 1976; UNESCO 1977).

The key advantage of this method is that it is concerned with ends as well as means. The disadvantage of the method is that there is no conceptual framework for unifying the indicators. Further, the data needed tend to be unreliable, and are particularly weak in those countries that probably need the information most for development (Hicks and Streeten 1981).

Just how close economic and social indicators are correlated is uncertain. Studies on the correlation between economic and social indicators have produced conflicting results. Some studies have shown a high correlations (McGranaham, et al 1972; United Nations 1975; Sheehan and Hopkins 1978) while others have found weak correlations (Morawetz 1977).

Hicks and Streeten suggest in Table 4.1 below that the contradictory conclusions arose from the use of differing indicators, differing sources of data, differing country samples as well as "differing interpretations of results" (1981:58). Using the World Bank's Social Data Bank, they showed that there was a correlation between social indicators and GNP of $r^2=0.5$. The correlation rose to $r^2=0.71$ when economic indicators were used. But when the social indicator data are disaggregated into samples of developing and developed countries, the correlations for both dropped to $r^2=0.25$ and $r^2=0.18$ respectively, showing that the data are sensitive to aggregation. Hicks and

Streeten concluded that "studies which examine only social variables for developing countries are apt to discover a poor relationship, while those that consider economic and social variables for all countries are likely to find better relationships" (1981:59).

They suggest that the correlation between social indicators and GNP is weak because of the "ceiling effect." That is, beyond a certain level of GNP, it is impossible to achieve, in linear fashion, literacy growth of more than 100 percent and life-expectancy of much more than 70 years. The limits are reached by the more developed countries, which may explain why social indicators are better correlated in developing countries (Hicks and Streeten 1981:59).

Table 4.1.--Correlation of indicators with GNP per capita (1970).

	Coefficients of determination (r^2)		
	All countries	Developing	Developed
Social indicators			
Life expectancy	0.53	0.28	0.13
Calories (% of need)	0.44	0.22	0.02
Infant mortality	0.42	0.34	0.25
Primary enrolment	0.28	0.24	0.05
Literacy	0.54	0.47	0.16
Avg persons per room	0.58	0.08	0.29
Homes w/o piped water (%)	0.74	0.13	0.36
Average	0.50	0.25	0.18
Economic indicators			
Newsprint use	0.79	0.20	0.46
Automobiles	0.85	0.59	0.46
Radios	0.43	0.14	0.07
Electricity use	0.67	0.30	0.24
Energy use	0.82	0.28	0.49
Average	0.71	0.30	0.34

Source: Hicks and Streeten (1981:58).

3. Composite indices

The third approach develops composite indices by combining several social indicators into a single index of human and social development. The difficulty with such indices though is that they run into problems of scaling, weighting and data collection, problems similar to that in the second approach of using social indicators.

The UN Research Institute for Social Development (UNRISD) performed substantial research during the 1960s to develop better social indicators, including composite indicators.

Jan Drewnowski and Wolf Scott (1966) under the UNRISD developed the "Level of Living" index, which is defined as "the level of satisfaction of the needs of the population as measured by the flow of goods and services enjoyed in a unit of time" (1966:1). They divided needs into "Basic" and "Surplus over Basic" or "Higher" needs. The basic needs included some indicators for which data were difficult to obtain: the amount of leisure time available, the number of people who had private savings, and the quality of housing. The index was therefore difficult to apply. Even in their sample of 20, some shortcuts were needed. Their work ceased after 1966 (Hicks and Streeten 1981).

There have since been attempts to formulate social indicators of developments. Perhaps the best publicized social indicator is the Physical Quality of Life Index by M.D. Morris (1979). She argued that indicators of

development should concentrate on outputs or results rather than inputs. He therefore measured literacy, infant mortality and life expectancy, weighted them equally, and arrived at an index.

Critics, however, noted that the term "quality of life" was a misnomer. What Morris really measured was effectiveness in reducing mortality and raising literacy, in effect, the "quantity of life." Second, the weighting system was arbitrary and could not be defended (Hicks and Streeten 1981:61-62).

Two studies in the 1970s using social indicators found that they had a high correlation to per capita GNP. The first, by D. V. McGranahan *et al* (1972), examined and found a high correlation among 73 social and economic indicators. Through elimination, they devised a "Development Index" based on 18 "core indicators" that included nine social and nine economic characteristics. The resulting index was highly correlated ($r^2=0.89$) with GNP per capita.

A few years later, a study by the UN Economics and Social Council (1975) analyzed development by ranking 140 countries with seven indicators other than GNP. There were two social indicators (literacy and life expectancy) and five economic indicators (energy, manufacturing, share of GDP, manufacturing share of exports, employment outside agriculture, number of telephones). An overall rank was created by giving equal weight to each indicator. The study found that the overall ranking closely matched ranking by

GNP.

The problem with indicators of development that are highly correlated with GNP is that one is tempted to simply use GNP, especially as the indices are difficult to create.

Hicks and Streeten have argued for a composite index to supplement, not replace, GNP. They suggested six essential and non-exhaustive measures: nutrition, basic education, health, sanitation, water supply and housing, and related infrastructure (*ibid*). Nothing, however, has come out of their proposal.

Summary

In sum, there are good reasons for using GDP/GNP and their components to analyze development. First, as noted above, social indicators appear to suffer from a ceiling effect in more developed countries. Although Singapore is not 'a developed country, its GDP and standard of living is neck-and-neck with Hong Kong, behind only Japan's in Asia.

Second, there is often a high correlation between the more complex social indicator and the simpler GDP/GNP. This militates against the use of the complex indicators.

Third, by the 1980s, it was clear that without an increase in the economic performance of a country, there would be less to redistribute. So the use of GDP is seen today as useful for indicating quality of life.

CHAPTER FIVE

Analysis of Quarterly Data

Method

As originally conceived, the method to be used for determining causality of international telecommunications and economic development was the cross-lagged correlation. This was the method Hardy used in his 1980 study and had been used in other communication studies such as agenda-setting (Shaw and McCombs 1974). The idea is that if A causes B, then the correlation should increase if prior values in A are used to correlate with B. This is best illustrated in the following examples.

Table 5.1 shows the usual manner in which ordinary least squares (OLS) correlation is performed. Trade in one year is correlated with International Telephone traffic in the corresponding year.

Table 5.1.--Correlation between Trade (tr) and International Telephone (tc) traffic.

Trade	1980tr	1981tr	1982tr	1983tr	1984tr	1985tr
TC traff	1980tc	1981tc	1982tc	1983tc	1984tc	1985tc

Table 5.2.--Correlation between Trade (tr) and time-lagged International Telephone (tc) traffic

Trade	1980tr	1981tr	1982tr	1983tr	1984tr	1985tr
TC traff		1980tc	1981tc	1982tc	1983tc	1984tc

Table 5.3.--Correlation between time-lagged Trade (tr) and
International Telephone (tc) traffic.

Trade		1980tr	1981tr	1982tr	1983tr	1984tr
TC traff	1980tc	1981tc	1982tc	1983tc	1984tc	1985tc

In Table 5.2, International Telephone traffic is
regressed against Trade with a lag of one period. If
International Telephone traffic causes Trade, then one would
expect a *higher* R^2 here compared with the R^2 in Table 5.1.
In Table 5.3, Trade is regressed against International
Telephone traffic with a lag of one period. If International
Telephone traffic causes Trade, one would expect a *lower* R^2
here compared with the R^2 in tables 5.1 and 5.2. If, on the
other hand, Trade causes International Telephone traffic,
then the correlation should be highest in Table 5.3, second
highest in Table 5.1 and lowest in Table 5.2.

In the above tables, causality does not refer to an
exclusive relationship where other variables must be
excluded. It does not mean the *only* cause. Rather, the
causality refers to a contributory cause. The requirements
for causality in the sense used above between two variables
A and B are therefore as follows:

    1. there must be a relationship between A and B;
      and

    2. A must be causally prior to B.

Data

Data for the performance of the entire Singapore

economy are released quarterly. Table 5.4 shows the

contribution each sector to GDP at constant 1985 prices from

March 1975 to March 1992.

Table 5.4.--Average percentage contribution of various
sectors to GDP at constant 1985 prices (March 1975 to March
1992).

Sector	Percent of GDP
Manufacturing	27.29
Financial Business	23.38
Commerce	18.28
Transport and Communication	12.58
Other Services	11.62
Construction	8.09
Utility	2.02
Agriculture and Fishery	0.87
Quarry	0.24

Source: Author's calculations from data by the
Department of Statistics.

A preliminary test of the correlation was run using the

quarterly data of economic activity. As the data were an

aggregation intermediate between yearly and monthly, it was

expected that a preliminary analysis could highlight

problems common to all three levels of aggregation.

Indeed, the "eyeballing" of the raw data suggested that

a straightforward correlation would not be appropriate.

Figure 5.1 shows that International Telephone traffic has

been growing significantly, at a seemingly exponential rate.

Such a curve suggests that the data should be log-

transformed. (An advantage of using natural log

transformations is that it shows the elasticity in the

regression relationship, where regression may validly be used.) Regressions were therefore performed first on raw untransformed data and then on log-transformed data.

Even with untransformed data, OLS regressions yielded high R^2s, as evidenced by Table 5.5. Of the 10 sectors, eight had adjusted-R^2s higher than 0.80. Further, in all but one instance, significance was at the <0.001 level. The one exception—Construction—had significance at the 0.003 level.

Table 5.5.—Relationship between untransformed quarterly International Telephone by call volume and various economic sectors (in Singapore dollars) in decreasing order of R^2.

Sectors	Rsq-adj	t-ratio**
Commerce	.903	25.16
Manufacturing	**.887**	**23.10**
Utility	.882	22.55
Agriculture	**.878**	**-22.11**
Finance	.872	21.55
GDP	**.868**	**21.13**
Transport	.855	20.02
Other Services	**.819**	**17.58**
Construction	.108	3.04*
Quarry	**.047**	**30.21**

Alternate rows have been made bold for easier reading.
*p<0.003.
**p<0.001 level unless otherwise indicated.

When OLS regressions were performed on log-transformed data, the R^2s rose for all sectors except Agriculture. (See Table 5.6.) The two tables, however, have a low Spearman's *rho* rank-order correlation—0.318. The low statistic shows that the data, and by implication the results, are susceptible to transformation.

Figure 5.1 International Telephone Traffic
and GDP at 1985 prices
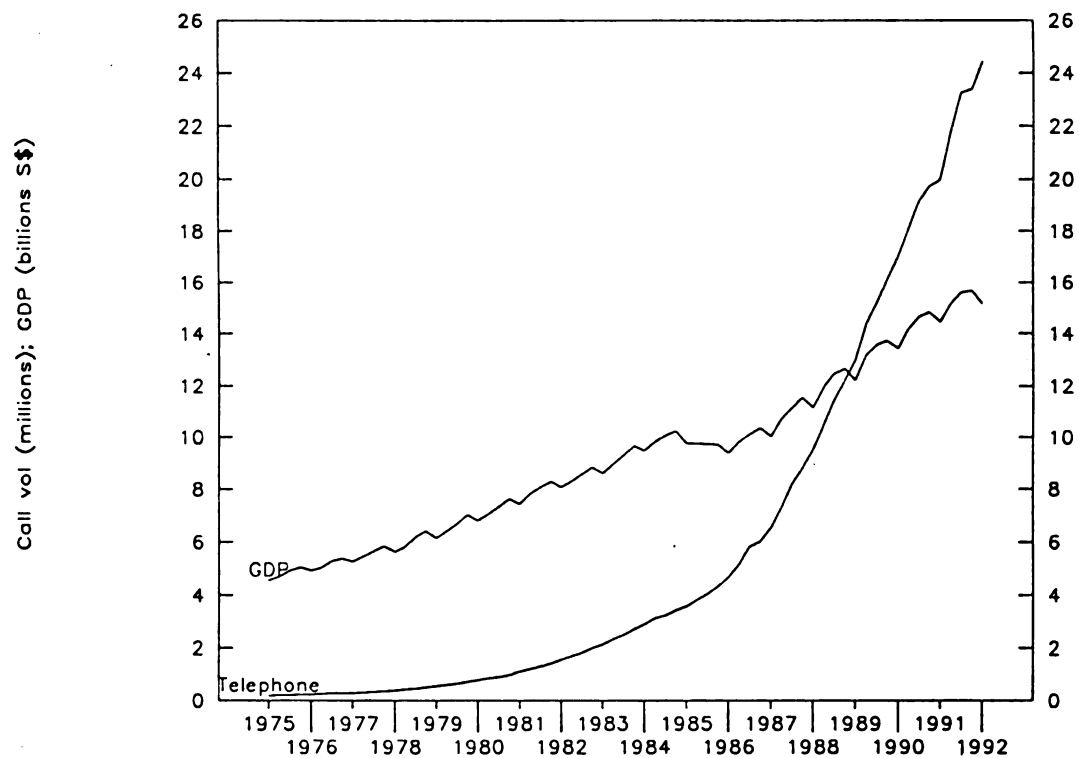
Table 5.6.--Relationship between the natural log of International Telephone and the natural log of various economic sectors in decreasing order of R^2.

Sectors	R-sq	Rsq-adj	t-ratio*	DW
Finance	.991	.991	85.97	0.30
Other Services	**.991**	**.991**	**85.40**	**1.24**
Utility	.986	.986	69.43	0.72
GDP	**.985**	**.985**	**67.10**	**0.51**
Transport	.980	.979	56.75	0.12
Commerce	**.959**	**.958**	**39.48**	**0.68**
Manufacturing	.926	.925	28.90	0.56
Agriculture	**.656**	**.651**	**-11.32**	**0.09**
Construction	.488	.480	7.99	0.04
Quarry	**.422**	**.414**	**7.00**	**0.08**

Alternate rows have been made bold for easier reading.
*p<0.001

These high R^2 and significance, however, are *not* grounds for rejoicing. A key assumption in OLS regression is that the data are not autocorrelated. That is, the residuals are not related among themselves. OLS estimation disregarding the presence of autocorrelation will lead to underestimation of variance and overestimation of R^2 (Gujarati 1988:364).

The degree of autocorrelation is measured by the Durbin-Watson statistic, which determines if the residuals are stationary. If the residuals are stationary, then they are not autocorrelated. If they are not stationary, then the residuals are autocorrelated and OLS cannot be taken as a good method for estimation and prediction.

The Durbin-Watson (DW) statistic, d is defined as:

$$d = \frac{\sum\limits_{i=2}^{n} (e_i - e_{i-1})^2}{\sum\limits_{i=1}^{n} e_i^2}$$

The above equation may be looked upon as the sum of squares of the first difference of residuals divided by the sum of squares. (The first difference is the difference between the value of a period and the value in the earlier period. See Appendix B for a more detailed explanation.) Ideally, the DW statistic should be at 2. If as in above, the DW statistic tends to zero, the residuals are not stationary and using R^2 in such a context will lead to spurious inferences.

The DW statistic is such that there is an upper and lower limit, usually designated d_U and d_L respectively. There is a zone of indecision between the upper and lower limits such that if the test statistic falls between two, one cannot conclude if autocorrelation does or does not exist. The situation is illustrated in Figure 5.2.

Figure 5.2.--Durbin-Watson d statistic

Positive Auto- correlation	Zone of Indecision	No Auto- correlation	Zone of Indecision	Negative Auto- correlation
0	d_L	d_U	2	$4-d_U$	$4-d_L$	4
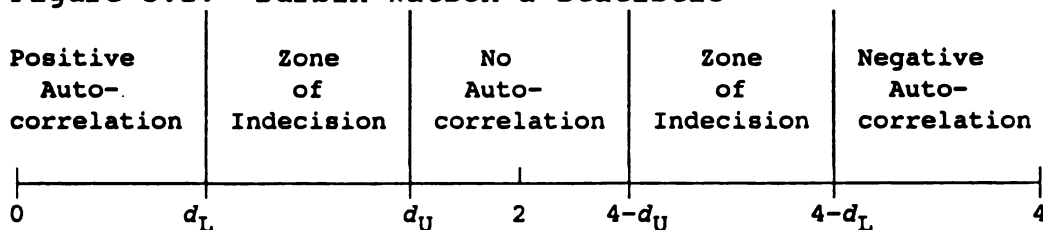
Where the test statistic falls into the "zone of indecision, it has been suggested that the upper limit of the d-statistic be used as the critical value (Gujarati 1988:379).

The critical values of the DW statistic for the current data set with 68 observations are listed in Table 5.7.

Table 5.7.--Critical Values of the Durbin-Watson statistic

Significance	1%	5%
d_L	1.420	1.577
d_U	1.478	1.636

Source: Gujarati (1988:686-689)

In the regressions presented in tables 5.5 and 5.6, none of the variables had significant DW statistics. With log-transformation, the DW statistic increases but not to a significant level.

The above analysis raises the question of whether the conclusions of Hardy's 1980 study were based on spurious relationships. It is not possible based on the information available to decide one way or the other. Certainly, there is no indication that Hardy computed the DW statistic. On the other hand, the data Hardy used were annual, not quarterly or monthly, and a recent study of telecommunications and economic development in South Korea suggests that the problems of autocorrelation may not be as serious when annual data is used (Kim 1992). Nevertheless,

it will undoubtedly be worthwhile to reanalyze the Hardy study with an eye on the DW statistic.

Why Does Autocorrelation Occur?

Six reasons have been given for the existence of autocorrelation such as that in the above data set (Gujarati 1988:356-9). The first three reasons are beyond the control of the current study.

1. The regression has excluded important variables. In the current analysis, only two variables are intended to be studied at one time.

2. The regression uses incorrect functional forms. The current study assumes a linear or, at most, a log-linear relationship. Other functional forms may fit better but they will complicate the study; finding the "right" functional form alone could be the basis of an entire study. For uniformity and ease of both application and understanding therefore, the simple regression is used in this study.

3. The manipulation of data has contributed to autocorrelation. "Massaging" of data through seasonal adjustments may impose on the data a systematic pattern that might not have been there before. Some key data, particularly GNP, are known to be seasonally affected and therefore seasonal adjustments are necessary. In the present study, it is assumed that there are similar seasonalities and charts of the data do suggest seasonal variations. For consistency of analysis, seasonal adjustment was applied to

all the data in this study. The analysis was carried out on both seasonal and non-seasonal data for comparison.

The next three reasons may be inherent in the data under study. Autocorrelation arises because the error terms are not random but are related to the variables under consideration.

4. The two series could have a "cobweb" phenomenon. This is when the supply of one product reacts to the price of another product.

5. The two series may have inertia or sluggishness in that the series move together. This means the data are interdependent.

6. The two series may have lags, where one series lags behind another. In the current study, this would mean that the leading series is "causing" the second series.

The latter two reasons will leave behind non-random residuals, which explains the high autocorrelation extant.

Consequences of OLS Estimation Disregarding Autocorrelation

Using ordinary least squares regression in the presence of autocorrelation will lead, first, to an underestimation of variance, which leads next to an overestimation of R^2. This leads to Type I errors, where the null hypotheses are rejected when they should not be. The usual t and F tests of significance are likely to give misleading conclusions about the statistical significance of the estimated regression coefficients (Gujarati 1988:364). As the current study

compares R^2s, their overestimation could lead to spurious results.

The Solution: Time Series Analysis

How is it possible to achieve high R^2s and high significance if a key assumption of OLS is violated? The answer lies in the fact that the data are time-series data. That is, they share the common element of time.

As far back as the early 1900s, if not before, statisticians found that time-series sometimes yielded what they called "non-sense correlations" (Yule 1926). An example of such a nonsense correlation found was between rainfall and inflation. As in the analyses of telecommunications and various economic sectors above, analyses of "nonsense correlations" found high R^2 and significance but low DW values (Hendry 1986). Indeed, it has been shown that where two time-series are unrelated and the variance in each series is not constant, that is non-stationary, the R^2 of the regression tends to unity (Yule 1926; Banerjee *et al* 1986).

The answer to avoiding such spurious estimates is to use time-series analysis. The basic logic behind time-series analyses is to transform the series and make it stationary so that linear regression is possible. A time series is said to be stationary if there is no systematic change in mean (that is, there is no trend), if there is no systematic change in variance, and if seasonal or other periodic

variations have been removed (Chatfield 1989:10).

Seasonal adjustments are necessary in the data sets. For example, GDP on a quarterly basis is known to be affected by seasonal trends. Figures 5.3 and 5.4 plot GDP against time to illustrate the effect of seasonal influences and the effect of smoothing respectively.

Data were smoothed using the X-11 procedure in the statistical software package SAS. The X-11 procedure is the same procedure used by the US Census Bureau in making seasonal adjustments. The major function of the procedure is to pick out a seasonal trend and to remove it. Other adjustments in X-11 are minor, such as adjusting for the number of days in a quarter or month.

Regressions were then performed using smoothed and log-transformed smoothed data and the results tabulated in tables 5.8 and 5.9. They showed that R^2s were higher for smoothed than raw data, indicating that seasonal influences introduced some random errors that should be removed for analysis. The presence of random errors is corroborated by the DW statistic. It is higher for the regressions pre-X11 adjustment.

Figure 5.3 GDP Before Seasonal Adjustments

Constant 1985 Prices
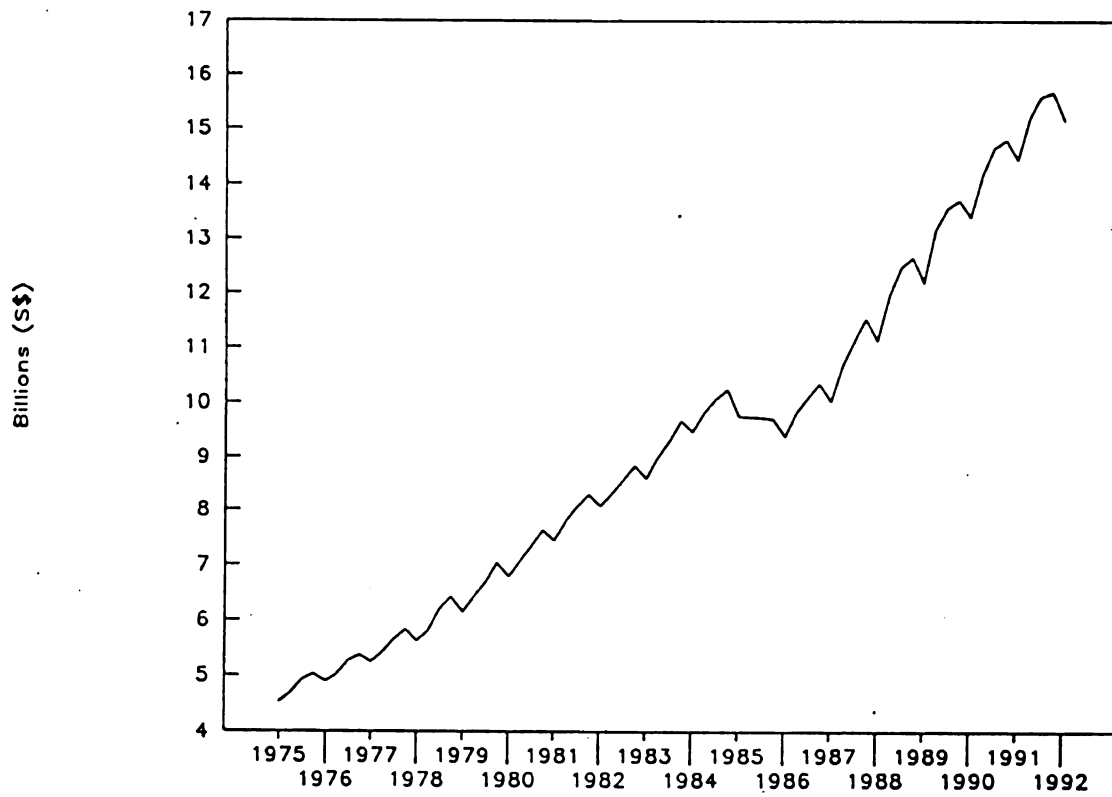
Figure 5.4 GDP After X11 Seasonal Adjustments

Constant 1985 Price
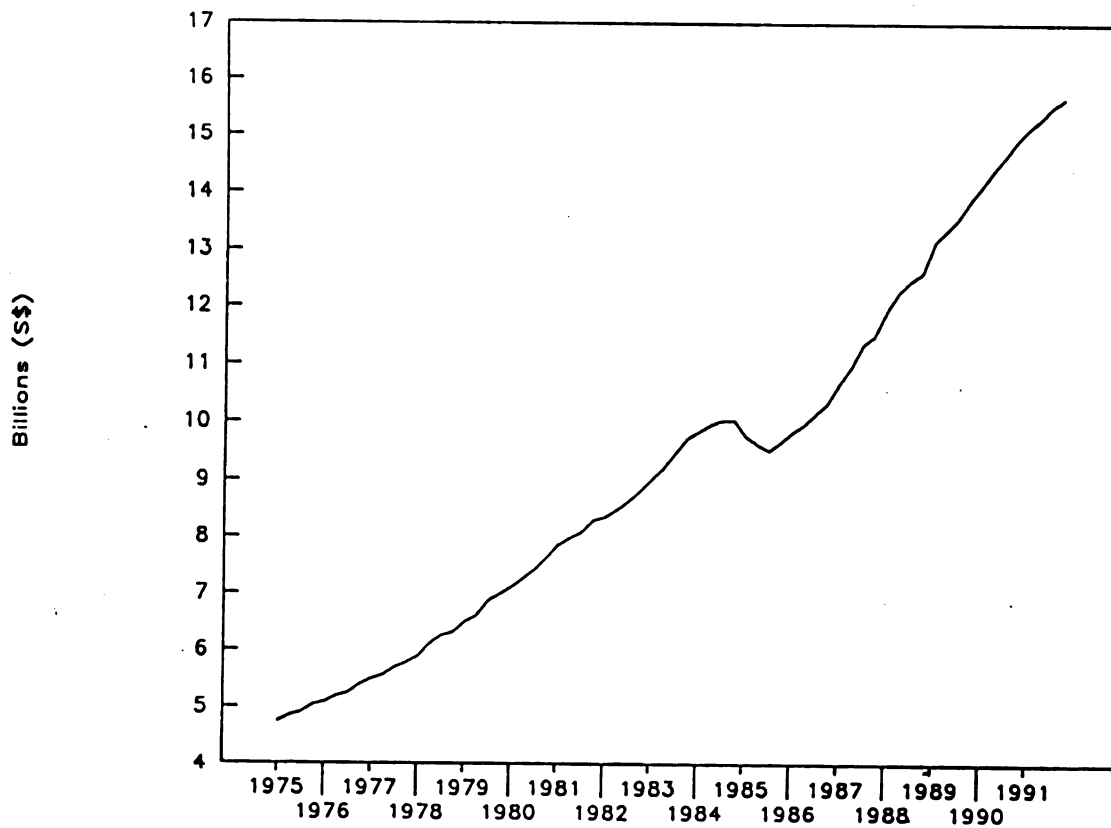
Table 5.8.--Comparison of Untransformed Data Pre- and Post-X11 Seasonal Adjustments.

	Pre-X11		Post-X11	
Sectors	R-sq	DW	R-sq	DW
Commerce	.904	0.35	.916	0.07
Manufacturing	**.888**	**0.46**	**.911**	**0.07**
Agriculture	.879	0.47	.894	0.25
Utility	**.884**	**0.10**	**.889**	**0.02**
Finance	.874	0.04	.874	0.03
GDP	**.869**	**0.07**	**.873**	**0.02**
Transport	.857	0.02	.857	0.01
Other Services	**.822**	**0.08**	**.824**	**0.03**
Construction**	.121	0.06	.121	0.04
Quarry	**.061**	**0.11**	**.062***	**0.06**

Alternate rows have been made bold for easier reading.
*p<0.04.
**p<0.003.
***p<0.001 unless otherwise indicated.

Table 5.9.--Comparison of Natural Log Transformed Data Pre- and Post-X11 Seasonal Adjustments.

	Pre-X11		Post-X11	
Sectors	R-sq	DW	R-sq	DW
Other Services	.991	1.24	.994	0.49
Utility	**.986**	**0.72**	**.990**	**0.16**
Finance	.991	0.30	.991	0.24
GDP	**.985**	**0.51**	**.988**	**0.08**
Transport	.980	0.12	.981	0.06
Commerce	**.959**	**0.68**	**.969**	**0.14**
Manufacturing	.926	0.56	.942	0.09
Agriculture	**.656**	**0.09**	**.667**	**0.04**
Construction	.488	0.04	.489	0.03
Quarry	**.422**	**0.08**	**.427**	**0.06**

Alternate rows have been made bold for easier reading.
*p<0.001.

Table 5.9 again shows that despite higher R^2s, all the variables do not have significant DW statistics. Time-series analysis suggests that with an apparently exponential curve of International Telephone traffic and a relatively flat GDP

pattern, regression cannot be run on untransformed data and may not be used even on log-transformed data. The usual next step in time-series analysis is to analyze the percentage growth rates. In equation form the variable becomes transformed thus:

$$X = \ln X_t - \ln X_{t-1}, \quad \text{where X is first log transformed}$$
$$\text{and then differenced.}$$

Table 5.10 shows the outcome of the regressions of International Telephone traffic growth rate against the growth rate of various economic sectors.

Table 5.10.--The relationship between International Telephone traffic and various economic sectors' growth percentages after X-11 seasonal adjustments.

Sectors	Rsq	Rsq-adj	p<	DW
Transport	.133	.120	.002	1.52
GDP	**.082**	**.069**	**.018**	**1.81**
Finance	.036	.021	.123	1.62
Manufacturing	**.035**	**.020**	**.128**	**1.74**
Commerce	.025	.010	.198	1.68
Utility	**.021**	**.006**	**.241**	**1.63**
Construction	.004	.000	.588	1.58
Agriculture	**.003**	**.000**	**.684**	**1.61**
Quarry	.002	.000	.741	1.60
Other Services	**.000**	**.000**	**.864**	**1.60**

Alternate rows have been made bold for easier reading.

In Table 5.10, the R^2s are not as high as before, but there *is* ground for rejoicing as the key DW statistic is significant for all variables at least at the .05 level. As noted earlier, apart from significance, the key concern is

the direction of causality. As causality has been defined above to mean contributory causality, the low correlations (0.133 and less) are not a cause for concern in this analysis.

Proving Causality

Of the time-series tests to prove causality, probably the easiest to use and understand is the Granger test (Granger 1969). The method checks if lagged terms of the independent variable offers additional explanatory power when the lagged terms of both the dependent and independent variables are included in the regression. The idea is similar to that used in cross-lagged correlation: if the independent variable causes the dependent variable, then lagged terms of the independent variable must offer additional explanatory power when included in the regression.

In the present study, the variables are run with four lags in the following form:

$$X_t = A_1 + B_1 X_{t-1} + B_2 X_{t-2} + B_3 X_{t-3} + B_4 X_{t-4} + error$$
(Equation 1)
$$and$$

$$X_t = A_2 + C_1 X_{t-1} + C_2 X_{t-2} + C_3 X_{t-3} + C_4 X_{t-4} +$$
$$D_1 Y_{t-1} + D_2 Y_{t-2} + D_3 Y_{t-3} + D_4 Y_{t-4} + error.$$
(Equation 2)

H_o: X does not cause Y
$D_1 = D_2 = D_3 = D_4 = 0$ using the F-test.

(where t-1 is a lag of 1, t-2 is a lag of 2, t-3 is a lag of 3 and t-4 is a lag of 4.)

The number of lags is arbitrary and as many may be added as desired. But adding more lags decreases the explanatory power of the regression. In line with econometric convention where the data are quarterly, four lags were used.

The question is whether the additional variable and its lags in Equation 2 add significantly to Equation 1. That is, whether Equation 2 increases the R^2 significantly. The F-statistic is used for the test and is derived thus:

$$F = \frac{(R^2_u - R^2_r)/4}{(1-R^2_u)/(n-9)}$$

R^2_u is the R-sq of the unrestricted eight-variable Equation 2.
R^2_r is the R-sq of the restricted four-variable Equation 1.

Analysis of Data

The results of the Granger test as outlined in the previous chapter are presented in Table 5.11.

Table 5.11.--Causal relationship of percentage growth rates of season-adjusted International Telephone traffic and various economic sectors.

	Unrestr R-Sq	Restr R-Sq	F-Value
GDP Causes Phone	.356	.231	2.67**
Phone Causes GDP	.292	.238	1.05
Agriculture Causes Phone	.281	.231	0.96
Phone Causes Agriculture	.122	.079	0.67
Quarry Causes Phone	.288	.231	1.10
Phone Causes Quarry	.206	.080	2.18*
Manufacturing Causes Phone	.336	.231	2.17*
Phone Causes Manufacturing	.230	.222	0.14
Utility Causes Phone	.300	.231	1.36
Phone Causes Utility	.116	.057	0.92

Table 5.11.--cont'd

Construction Causes Phone	.389	.231	**3.56****
Phone Causes Construction	.300	.244	1.10
Commerce Causes Phone	.332	.231	**2.08***
Phone Causes Commerce	.218	.107	1.95
Transport Causes Phone	.340	.231	**2.27***
Phone Causes Tranport	.293	.139	**3.00****
Finance Causes Phone	.277	.231	0.88
Phone Causes Finance	.123	.020	1.62
Other Services Causes Phone	.247	.231	0.29
Phone Causes Other Services	.198	.127	1.22

  * Significant at the 0.10 level. $F_{4,55}$
 ** Significant at the 0.05 level. $F_{4,55}$
For keys to abbreviated variables, see Appendix A.

Discussion

The generally high autocorrelation among the variables and International Telephone suggests that demand for International Telephone is inelastic. This is confirmed by the improved R^2 when seasonal effects are smoothed out, which suggests that International Telephone use is relatively independent of season.

The exponential curve of International Telephone traffic precludes the use of OLS regression in analyzing its direct relationship with other economic sectors.

Table 5.11 yields some surprises in the relationship between telecommunications and economic growth rates. Six sectors are shown to be causally related with International Telephone traffic: GDP, Manufacturing, Construction, Commerce, Quarrying, and Transport and Communication.

The first four sectors--GDP, Manufacturing, Construction, Commerce--are shown to be the cause in the relationship with International Telephone traffic. This means that growth in these sectors causes growth in International Telephone traffic. As these sectors measure income, the causal direction may be attributable to the greater use of International Telephone when there is higher income. This does not, however, explain why such use exists in these sectors and not others. The presence of Manufacturing and Commerce is not surprising as they indicate the openness of Singapore to foreign investments and trade. The presence of Construction as a cause is unexpected. Perhaps it is better understood as an indicator of wealth. The Construction sector covers the building industry so purchase of properties would increase the growth of the sector. Such purchase increases during economic booms and is therefore an indicator of wealth.

The causal relationship running from International Telephone to Quarrying is disturbing. Because the Quarrying sector is on the decline, it means that growth in International Telephone traffic causes the decline in Quarrying activity. It is hard to explain the connection as the sector is largely domestic and very small, less than a quarter of 1 percent. In any event, Table 5.10 showed Quarrying to be the second least correlated with International Telephone.

The causal relationship between growth in International

Telephone traffic and Transport and Communication is bidirectional. This means that both cause each other with a bias in favor of International Telephone. The dual causality may be because International Telephone traffic *is* part of the Transport and Communication sector. This is the problem of double counting: telecommunications is part of the Transport and Communication sector. Table 5.10 lends some confirmatory support. It shows that Transport and Communication is the most significant and most highly correlated sector.

The mix of significant and non-significant sectors raises questions about the weight to be attached to the significance of the GDP-International Telephone relationship. Table 5.10 shows GDP as the second most highly correlated, with the most significant DW statistic. This is against the backdrop of lower correlations and significance levels for the other sectors that, when aggregated, make up GDP.

On its causality, GDP is significant at the .05 level while *none* of the other sectors are significant in the same causal direction. Perhaps the fact that it is at constant prices may have something to do with it. Nevertheless, its high significance is puzzling.

As for the non-significant variables, Agriculture and Utility seem to have a slight bias in favor of them causing International Telephone traffic growth. It should be noted, however, that Agriculture is on the decline in Singapore and

that Utility is another domestic-oriented sector.

In the cases of Financial Business and Other Services, the relationship favors International Telephone traffic causing growth in those sectors. Financial Business is significant at the .20 level but that would be too low a level to accept.

Accepting the causal sectors in tables 5.10 and 5.11, what can one say about the weight of contribution? Table 5.12 summarizes the results of ordinary least squares regression on the relevant sectors. In all instances, the contribution of the economic sector was greater than 1 while the contribution of International Telephone traffic was smaller than 1.

Table 5.12.--The relationship between International Telephone and various economic sectors growth percentages. Sectors ranked in decreasing order of R^2.

Causal Sectors 1% Increase	Growth in International Telephone %
Commerce	5.04
GDP	4.27
Manufacturing	4.05
Transport	3.08

Int'l Phone	0.319 Growth in Transport

Table 5.12 shows Commerce, essentially the trade sector, having the greatest contribution--a 1 percent increase in the *growth rate* of Commerce will cause a 5.04

percent increase in the *growth rate* of International Telephone traffic. Among the four sectors, Transport and Communication has the lowest contribution--a 1 percent increase in the sector will increase International Telephone traffic growth rate by 3.08 percent.

Of the sector where International Telephone traffic is a causal factor, a 1 percent growth in traffic growth rate will cause a 0.319 percent growth in Transport and Communication growth rate.

Conclusion

The analysis of economic sectors from quarterly data has yielded mixed results. Contrary to what might be expected from previous studies, it was the economic sectors that caused International Telephone traffic. The only sector that International Telephone traffic appeared to have caused is Transport and Communication. But that sector subsumes International Telephone traffic.

In line with expectations, Commerce (the trade sector) was found to be causally related to International Telephone and of the greatest weight. But contrary to expectations, Financial Business as a sector was *not* found to be causally related. This was unexpected as it is usually taken for granted that financial institutions in the world rank among the heaviest users of telecommunications. There are at least two explanations for the absence of causality. The first is that the finance industry has its own dedicated network,

SWIFT (Society for Worldwide Funds Transfer). Major banks even have their own network outside of SWIFT. Traffic on the network is not captured in the current data.

The second explanation is that some of the difficulty in finding a causal relationship may be attributable to the definition of sectors. For example, Financial Business covers a range of services that include detective agencies and modeling. But this second explanation implies that the benefits of international telecommunications are not widespread, as frequently said to be, but confined to the sectors of immediate impact. The third, and probably the most viable explanation is that of *instantenous causality*. This is the idea that in Finance Business, a call creates an instant impact. A monetary transaction is made at the time that the call is made. There is no time lag. The present Granger causality uses a lag of up to a year and cannot measure instantenous causality. Some other method of analysis would be needed to measure instantenous causality.

The most baffling aspect of the analysis is the causal relationship of GDP and International Telephone. It is significant as an aggregate, while its components that are significantly related make up a little over two-thirds (67.35 percent) of GDP. That leaves almost a third of GDP that are not significantly related. This raises the issue of whether the components of GDP, when combined, somehow interact such that they correlate with International Telephone traffic. It should be noted that GDP in the data

set is fixed at constant 1985 prices. Whether this may have
an impact on the correlation is not clear. This suggests
that the relationship between telecommunications and
economic development is not as simple and direct as earlier
thought.

One firm conclusion is that International Telephone
traffic appears to be insensitive to seasonal forces: when
data are adjusted for seasonality, there is an improvement
in the R^2. But for other equally firm conclusions to be
drawn in the area of causal relationships, further research,
is needed, especially as businesses and government
throughout the world regard telecommunications as vital to
their well-being.

CHAPTER SIX

Analysis of Aggregate Trade and Visitor Arrivals

Data

In this chapter, data on trade and visitor arrivals are analyzed. Singapore has detailed statistics on trade because of the of sector's importance to the economy. Unlike the data set in Chapter 5, the data here are on a monthly basis.

The left column of Table 6.1 shows that trade data aggregated (Trade) as well as broken down into Imports, Exports, Re-Exports and Domestic Exports. The data are also available in both constant and current prices. Visitor arrivals are captured in Plane Landings, Transit and arrivals by Air and Sea. (Definitions are in Appendix 1.)

As with the analysis in Chapter 5, International Telephone traffic grew exponentially while the other variables had essentially straight line patterns. It was therefore expected that at the minimum, log-transformation would be necessary.

First, correlations of the original and seasonally-adjusted data sets were calculated and the results presented in Table 6.1.

Table 6.1 shows high R^2s and a statistical significance of .001 for all variables. The X-11 seasonal adjustments removed some random errors and improved the R^2s of all the indicators. The average change is an increase of about 0.01 if the outlier variable, Transit, is excluded.

Table 6.1.--Correlation (R^2) of monthly International Telephone Traffic and Trade and Visitor Arrivals.

Sectors	Pre-X11 R-sq	DW	Post X-11 R-sq	DW
Trade (Constant)	0.959	0.83	0.964	0.65
Exports (Constant)	**0.954**	**0.85**	**0.961**	**0.63**
Domestic Exports (Constant)	0.953	0.79	0.958	0.67
Imports (Constant)	**0.948**	**1.03**	**0.955**	**0.87**
Re-Exports (Constant)	0.923	0.94	0.936	0.70
Visitors (Total)	**0.920**	**1.00**	**0.956**	**0.47**
Plane Landings	0.893	0.64	0.913	0.17
Re-Exports (Current)	**0.877**	**0.42**	**0.886**	**0.29**
Domestic Exports (Current)	0.865	0.25	0.871	0.20
Exports (Current)	**0.864**	**0.21**	**0.869**	**0.15**
Imports (Current Prices)	0.831	0.19	0.834	0.12
Visitors (Air)	**0.890**	**0.71**	**0.929**	**0.30**
Visitors (Sea)	0.792	0.37	0.815	0.20
Transit	**0.438**	**0.83**	**0.724**	**1.40**

All relationships were significant at the .001 level. Alternate rows have been made bold for easier reading. Definitions of the variables are in Appendix 1.

But from Table 6.2, the DW statistic is insignicant for all variables even at the .01 level. That is, one can say with 99 percent certainty that the relationships are autocorrelated.

Table 6.2.--Critical Values of the Durbin-Watson statistic with 1 variable and 200 observations.

Significance	1%	5%
d_L	1.664	1.758
d_U	1.684	1.778
$4-d_U$	2.316	2.222
$4-d_L$	2.336	2.242

Source: Gujarati (1988:686-689)

As with Chapter 5, the data set was log-transformed and regressed. Unlike Chapter 5, however, the non-seasonally

adjusted data were included in the analysis for two reasons.
First, the non-adjusted data have higher DW statistic. It
suggests that they are less autocorrelated. Second, it is
not known what the order of seasonality is in the data.
Typically, it is assumed that there is an annual seasonal
cycle. In Chapter 5, it is known that GDP has a year-on-year
seasonal effect. The results of the analysis of non-adjusted
and adjusted data are presented in Table 6.3.

Table 6.3 shows that, once again, high R^2 and
statistical significance are achieved but the DW statistic
is once again not significant for any variable, even at the
.01 level. From tables 6.1 and 6.3, it is worth noting that
R^2 is generally higher when the data are in constant dollars
than at current prices.

Table 6.3.--Regression of International Telephone traffic
and Trade and Visitor Arrivals after log transformation.

Sectors	Pre-X11		Post X-11	
	R-sq	DW	R-sq	DW
Export (Constant)	0.938	0.74	0.947	0.50
Export Domestic (Cons)	**0.932**	**0.65**	**0.940**	**0.49**
Total Trade (Constant)	0.927	0.66	0.936	0.43
Export (Current)	**0.921**	**0.29**	**0.926**	**0.18**
Export Domestic (Curr)	0.914	0.36	0.920	0.26
Visitors (By Air)	**0.910**	**0.84**	**0.948**	**0.29**
Re-Export (Constant)	0.909	0.92	0.925	0.68
Re-Export (Current)	**0.906**	**0.51**	**0.916**	**0.34**
Import (Current)	0.900	0.29	0.905	0.19
Total Visitors	**0.899**	**0.70**	**0.931**	**0.19**
Import (Constant)	0.896	0.71	0.908	0.53
Plane Landings	**0.646**	**0.12**	**0.655**	**0.03**
Visitors (By Sea)	0.515	0.09	0.531	0.07
Transit	**0.511**	**0.76**	**0.752**	**1.55**

All relationships were significant at the .001 level.
Alternate rows have been made bold for easier reading.

With the data still non-stationary, the next step is to difference the log-transformed data to arrive at the percentage growth rates of the variables. This is similar to the step taken in Chapter 5. The results of the regressions are presented in Table 6.4.

Table 6.4.--Regression of International Telephone Traffic and Trade and Visitor Arrivals after log transformation and first differences.

Sectors	R-sq	Rsq-adj	t-ratio*	DW**
Export (Current)	0.123	0.119	5.36	3.06
Export (Constant)	**0.111**	**0.106**	**4.59**	**3.07**
Total Trade (Constant)	0.104	0.098	4.42	3.07
Re-Export (Current)	**0.098**	**0.094**	**4.59**	**3.05**
Re-Export (Constant)	0.093	0.088	4.16	3.10
Transit	**0.091**	**0.067**	**0.062+**	**2.60**
Import (Current)	0.079	0.075	4.20	3.04
Export Domestic (Cons)	**0.073**	**0.067**	**3.64**	**3.01**
Import (Constant)	0.063	0.058	3.38	3.09
Export Domestic (Curr)	**0.062**	**0.058**	**3.59**	**3.05**
Plane Landings	0.011	0.004	0.217+	2.45
Total Visitors	**0.007**	**0.001**	**0.289+**	**2.57**
Visitors (By Air)	0.004	0.000	0.399+	2.58
Visitors (By Sea)	**0.006**	**0.000**	**0.323+**	**2.62**

*$p<0.001$ unless otherwise indicated
+p value
Alternate rows have been made bold for easier reading.

The analysis shows a drastic reduction in R^2 from the high 0.9s to smaller than 0.1. The level of statistical significance has also been reduced with the largest reductions in Visitor Arrivals. The last four variables in Table 6.4 are not even significant at the 0.2 level.

Ordinarily, such log and difference transformation should make the data set stationary. But none of the variables are significant in the DW statistic either. From

Table 6.3, the DW statistics have to be smaller than 2.316 or 2.222 to be significant at .01 level and .05 level respectively.

In technical terms, the non-stationary data set shows that the data are highly autocorrelated. In plainer terms, it means that from month to month, Trade, Visitor Arrivals, and International Telephone Traffic do not vary much. What happens in one month depends very much on what happened in the previous month. This is even more so when one assumes a seasonal effect, that is, that what is expected to happen in one month may be expected to happen based on the same month's results a year ago.

Solution

There are econometric methods to control the resulting severe autocorrelation. A decision was made not to use econometric methods in this study for the following reasons:

First, the methods of correction are, necessarily, complicated. For example, a test to determine autocorrelation in the corrected data, called the Durbin h-test, could not always be performed as there were several occasions where the test needed the square root of a negative number. Even after overcoming that complication, it was not always possible to achieve stationary data.

Second, the method of analysis after obtaining the corrected data was also more complex. With monthly data, the first question to be answered is the number of lags to be

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used. Depending on the number of lags used, it is possible to arrive at different and contradictory results.

For these reasons, and to achieve consistency in the method of analysis used earlier, it was decided to aggregate the data from monthly to quarterly. Stationary data were obtained at log differences, ie the percentage growth rate.

Analysis

Because the high autocorrelation could be caused by seasonal adjustments of the data, it was decided to include both seasonally adjusted and non-adjusted data in the analyses. Table 6.5 suggests that the seasonal adjustments have indeed contributed to the autocorrelation. The Durbin-Watson statistic is much higher in the non-adjusted than in the adjusted data. The higher DW statistic indicates less autocorrelation.

Table 6.5 also shows a higher R^2 for each variable but the increase is small, mostly less than 0.01. This increase pales in comparison with the change in the DW statistic.

Table 6.5.--Correlation between International Telephone traffic and quarterly economic indicators.

	Pre-X11		Post X-11	
	R-Sq	DW	R-Sq	DW
Trade (Constant)	0.971	0.53	0.973	0.38
Exports (Constant)	**0.967**	**0.51**	**0.970**	**0.35**
Imports (Constant)	0.967	0.59	0.969	0.48
Domestic Exports (Constant)	**0.966**	**0.53**	**0.969**	**0.41**
Visitors (Total)	0.946	0.76	0.961	0.28
Re-Exports (Constant)	**0.945**	**0.56**	**0.950**	**0.33**
Visitors (Air)	0.915	0.62	0.934	0.22
Re-Exports (Current)	**0.893**	**0.22**	**0.896**	**0.13**
Domestic Exports (Current)	0.877	0.17	0.880	0.11
Exports (Current)	**0.873**	**0.13**	**0.876**	**0.07**
Imports (Current Prices)	0.840	0.09	0.840	0.06
Plane Landings	**0.820**	**0.89**	**0.924**	**0.12**
Visitors (Sea)	0.818	0.20	0.825	0.13
Transit	**0.687**	**1.21**	**0.842**	**0.88**

All relationships were significant at the .001 level. Alternate rows have been made bold for easier reading.

Two observations may be noted from Table 6.5. First, arranged in order of R^2, Table 6.5 resembles Table 6.1, with a Spearman's *rho* rank-order of 0.881. This means that the aggregation to a quarterly basis did not change the data set too much.

The second observation is that constant prices are placed higher on the scale. Although no inference can be made in view of the statistically insignificant DW values, this ordering of constant prices will be noted for analysis later in this chapter.

As the DW statistics were not statistically significant, the data were log-transformed and reanalzyed with the results presented in Table 6.6. Once again, the DW statistics are not significant.

Table 6.6.--Correlation between log of International
Telephone traffic and log of quarterly economic indicators.

	Pre-X11		Post X-11	
	R-Sq	DW	R-Sq	DW
Exports (Constant)	0.953	0.32	0.955	0.20
Domestic Exports (Constant)	**0.946**	**0.33**	**0.949**	**0.24**
Trade (Constant)	0.943	0.23	0.945	0.15
Re-Exports (Constant)	**0.936**	**0.41**	**0.94**	**0.23**
Visitors (Air)	0.932	0.77	0.953	0.22
Domestic Exports (Current)	**0.924**	**0.15**	**0.926**	**0.10**
Imports (Constant)	0.922	0.21	0.923	0.15
Visitors (Total)	**0.921**	**0.49**	**0.935**	**0.13**
Re-Exports (Current)	0.921	0.22	0.924	0.13
Exports (Current)	**0.929**	**0.11**	**0.930**	**0.07**
Imports (Current Prices)	0.908	0.10	0.91	0.07
Transit	**0.715**	**1.26**	**0.860**	**0.90**
Plane Landings	0.558	0.55	0.667	0.03
Visitors (Sea)	**0.525**	**0.07**	**0.533**	**0.04**

All relationships were significant at the .001 level.
Alternate rows have been made bold for easier reading.

As in Chapter Five, it was therefore necessary to difference the data to achieve stationarity. The results are presented in Table 6.7. At the .05 level, about half of all the variables have statistically significant DW statistics. That is, they are not autocorrelated. At the .01 level, all but two variables are significant. The two variables, shown at the bottom of the table, are seasonally adjusted Visitors Total and Re-Exports (Current). They are included in the analysis but their results cannot be relied upon.

Table 6.7.--Correlation between percentage growth rates of International Telecommunication and quarterly economic indicators.

Variables (X for seasonal adjustment)	N	R-Sq	DW	Decision at p<.05	p<.01
Transit	14	0.122	2.11		
Plane LandingsX	48	0.082	1.83		
Export (Current)	69	0.101	1.70		
Export (Constant)	57	0.128	1.67		
Domestic Export (Current)	65	0.112	1.67		
Import (Current)	69	0.109	1.67		
Export (Current)X	69	0.070	1.66		
Trade (Constant)	57	0.118	1.65		
Re-Export (Current)	65	0.040	1.64		
Plane Landings	49	0.003	1.64		
Domestic Export (Constant)	57	0.143	1.63		
Import (Constant)	57	0.068	1.61		
TransitX	14	0.086	2.41		
ReExport (Constant)	57	0.021	1.59	Undecided	
Visitors (Sea)	57	0.011	1.59	Undecided	
Trade (Constant)X	57	0.091	1.57	Undecided	
Export (Constant)X	57	0.082	1.57	Undecided	
Import (Current)X	69	0.168	1.56	Reject	
Domestic Export (Constant)X	57	0.079	1.53	Reject	
Import (Constant)X	57	0.066	1.53	Reject	
Visitors (Air)	57	0.023	1.53	Reject	
Visitors (Total)	57	0.023	1.52	Reject	
Re-Export (Constant)X	57	0.009	1.50	Reject	
Visitors (Air)X	57	0.091	1.50	Reject	
Visitors (Sea)X	57	0.004	1.47	Reject	
Domestic Export (Current)X	65	0.104	1.41	Reject	
Visitors (Total)X	57	0.088	1.43	Reject	Undecided
Re-Export (Current)X	65	0.012	1.40	Reject	Reject

Alternate rows have been made bold for easier reading.

Results

Using the method in Chapter 5, each variable was regressed against four of its own lags. This is called the restricted equation and the resultant R^2 is called the restricted R^2. Then four lags of the variable to be tested were added to the restricted equation to produce the non-restricted R^2. The question to be determined is whether the

R^2 in the non-restricted equation adds a statistically significant difference under the F test. If it does, it means that the variable that made the difference is a causal factor. The results of the analysis are presented in Table 6.8 and the significant findings summarized in Table 6.9.

Table 6.8.--Correlation between percentage growth rates of International Telephone traffic and Trade and Visitor Arrivals.

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,55 (p<.10;p<.05) 2.05;2.5397;			
Import (Current) Causes Phone	.254	.203	0.94
Phone Causes Import (Current)	.252	.221	0.5699
Import (Current)X Causes PhoneX	.271	.232	0.7356
PhoneX Causes Import (Current)X	.305	.262	0.8507
Export (Current) Causes Phone	.227	.203	0.4269
Phone Causes Export (Current)	.264	.204	1.1209
Export (Current)X Causes PhoneX	.254	.232	0.4055
PhoneX Causes Export (Current)X	.234	.158	1.3642
Critical Values F4,51 (p<.10;p<.05) 2.0585;2.5534;			
Domestic Export Causes Phone	.297	.267	0.5078
Phone Causes Domestic Export	.166	.117	0.7491
Domestic ExportX Causes PhoneX	.267	.242	0.4349
PhoneX Causes Domestic ExportX	.197	.11	1.3814
Re-Export (Current) Causes Phone	.289	.269	0.3586
Phone Causes Re-Export (Current)	.336	.177	3.0531**
Re-Export (Current)X Causes PhoneX	.284	.242	0.7479
PhoneX Causes Re-Export (Current)X	.27	.183	1.5195
Critical Values F4,43 (p<.10;p<.05) 2.0804;2.5889			
Trade (Constant) Causes Phone	.372	.315	0.9757
Phone Causes Trade (Constant)	.243	.158	1.2071
Trade (Constant)X Causes PhoneX	.395	.277	2.0967*
PhoneX Causes Trade (Constant)X	.105	.05	0.6606

Table 6.8 cont'd

Import (Constant) Causes Phone	.384	.315	1.2041
Phone Causes Import (Constant)	.168	.067	1.305
Import (Constant)X Causes PhoneX	.395	.277	**2.0967***
PhoneX Causes Import (Constant)X	.131	.058	0.903
Export (Constant) Causes Phone	.362	.315	0.7919
Phone Causes Export (Constant)	.268	.217	0.749
Export (Constant)X Causes PhoneX	.374	.277	1.6657
PhoneX Causes Export (Constant)X	.103	.0408	0.6591
Domestic Export (Constant) Causes Phone	.361	.315	0.7739
Phone Causes Domestic Export (Constant)	.172	.142	0.3895
Domestic Export (Constant)X Causes PhoneX	.364	.277	1.4705
PhoneX Causes Domestic Export (Constant)X	.13	.087	0.5313
Re-Export (Constant) Causes Phone	.358	.315	0.72
Phone Causes Re-Export (Constant)	.356	.23	**2.1033***
Re-Export (Constant)X Causes PhoneX	.365	.277	1.4898
PhoneX Causes Re-Export (Constant)X	.295	.149	**2.2262***
Visitors (Total) Causes Phone	.365	.315	0.8465
Phone Causes Visitors (Total)	.658	.652	0.1886
Visitors (Total)X Causes PhoneX	.309	.277	0.4978
PhoneX Causes Visitors (Total)X	.077	.059	0.2096
Visitors (Air) Causes Phone	.368	.315	0.9015
Phone Causes Visitors (Air)	.67	.661	0.2932
Visitors (Air)X Causes PhoneX	.321	.277	0.6966
PhoneX Causes Visitors (Air)X	.049	.095	0.5464
Visitors (Sea) Causes Phone	.333	.315	0.2901
Phone Causes Visitors (Sea)	.355	.325	0.5
Visitors (Sea)X Causes PhoneX	.295	.277	0.2745
PhoneX Causes Visitors (Sea)X	.252	.203	0.7042
Critical Values F4,35 (p<.10;p<.05) 2.118; 2.6499			
Plane Landings Causes Phone	.44	.319	1.8366
Phone Causes Plane Landings	.678	.662	0.4224
Plane LandingsX Causes PhoneX	.449	.36	1.373
PhoneX Causes Plane LandingsX	.558	.501	1.0962

* p<.10
** p<.05
Bold text indicates statistically significant results.

For ease of comprehension, the significant findings are presented in Table 6.9.

Table 6.9.--Summary of Significant Findings

Result	F value	Signif. p >
Phone Causes Re-Export (Current)	3.0531	0.025
Phone Causes Re-Export (Constant)	2.1033	0.096
PhoneX Causes Re-Export (Constant)X	2.2262	0.082
Trade (Constant)X Causes PhoneX	2.0967	0.098
Import (Constant)X Causes PhoneX	2.0967	0.098

Table 6.9 shows three relationships: first, that International Telephone "causes" Re-Exports, second, that seasonally-adjusted Trade at constant prices causes International Telephone and third that seasonally-adjusted Import at constant prices causes International Telephone.

Assuming the relationships above to be true, coefficients of regressions will yield the impact of growth of one variable on the other. Table 6.10 below shows the result of a 1 percent growth of the independent variable on the dependent.

Table 6.10.--The relationship between International
Telephone and various economic sectors' growth percentages.

Causal Sectors 1% Increase	Growth in International Telephone %
Trade (Constant) Import (Constant)	0.18115 0.14569

Int'l Phone	0.1953 % Growth in Re-Export (Constant)

The findings here are in contrast to those in Chapter 5
where the growth of 1 percent in the causal economic sectors
caused growth of more than 1 percent in International
Telecommunication. Table 6.10 shows that a 1 percent growth
at the subsectoral level will cause growth of between one
fifth (0.2) and one seventh (0.14) of 1 percent in the
dependent variable.

Discussion and Conclusion

The findings for Trade and Import are consistent with
that in Chapter 5, which found that Commerce (the sector
that embraces Trade) causes International Telephone traffic.
This suggests some internal validity.

The relationship between International Telephone
traffic and Re-Export is interesting because of the presence
of the latter variable in current and constant prices and
adjusted and non-adjusted forms. (It should be noted here
that seasonally adjusted Re-Export at current prices is
absent as it was not stationary even after log-

transformation and differencing.) It would appear that International Telephone traffic takes on great importance when coordination is needed, such as in the coming and going of goods for Re-Export.

The degree of causality, however, is less significant than that at the aggregated level presented earlier in Chapter 5. The degree of causality in this chapter is smaller than that in Chapter 5 where it was found that the economic sectors caused International Telecommunication growth greater than unity. (The exception was the impact of International Telecommunication on Transport, where it was less than unity. Nevertheless, it is greater than the 0.19 in this chapter.) Exactly what this means is not clear from the current analysis. It does suggest, however, that the level of aggregation of data may have some impact on the results of analysis.

One clear thread from this study is that constant prices dominate in the causal relationship over current prices. Table 6.9 shows the dominance well. Constant prices have a deflator that is typically equivalent to the inflation rate. The relationship with constant prices may be better understood if it is borne in mind that International Telephone traffic is measured by the number of calls and not the length of the call. If one phone call is all that was needed to deal with a lot of goods 10 years ago, there is no reason to believe that more phone calls are needed for that same lot now. The value of the lot would likely have

increased and perhaps the length of the call would have increased with the increased value. But the value of the lot is discounted by constant prices and the length of call is ignored in the data.

Conspicuous by its absence in Table 6.9 is tourism. Neither Visitor Arrivals nor Plane Landings had significant relationships. The variable that comes closest is Plane Landings, with an F-value of 1.8366, which is significant at $p > .15$. One possible reason for the absences is the eruption of the Gulf War from late 1990 to early 1991. Visitor arrivals fell while International Telephone traffic remained the same during the period. Figure 6.1 shows the fall-off in visitor arrivals.

Seasonal adjustment appears to increase the likelihood of finding significant results. Figure 6.2 shows that there is very little seasonal variation in International Telephone traffic. In contrast, GDP and many of the visitor variables have marked seasonal variations. This is clear in Figure 6.1 showing total visitor arrivals.

Figure 6.1 *Total Visitor Arrivals*

March 1989 to 1992
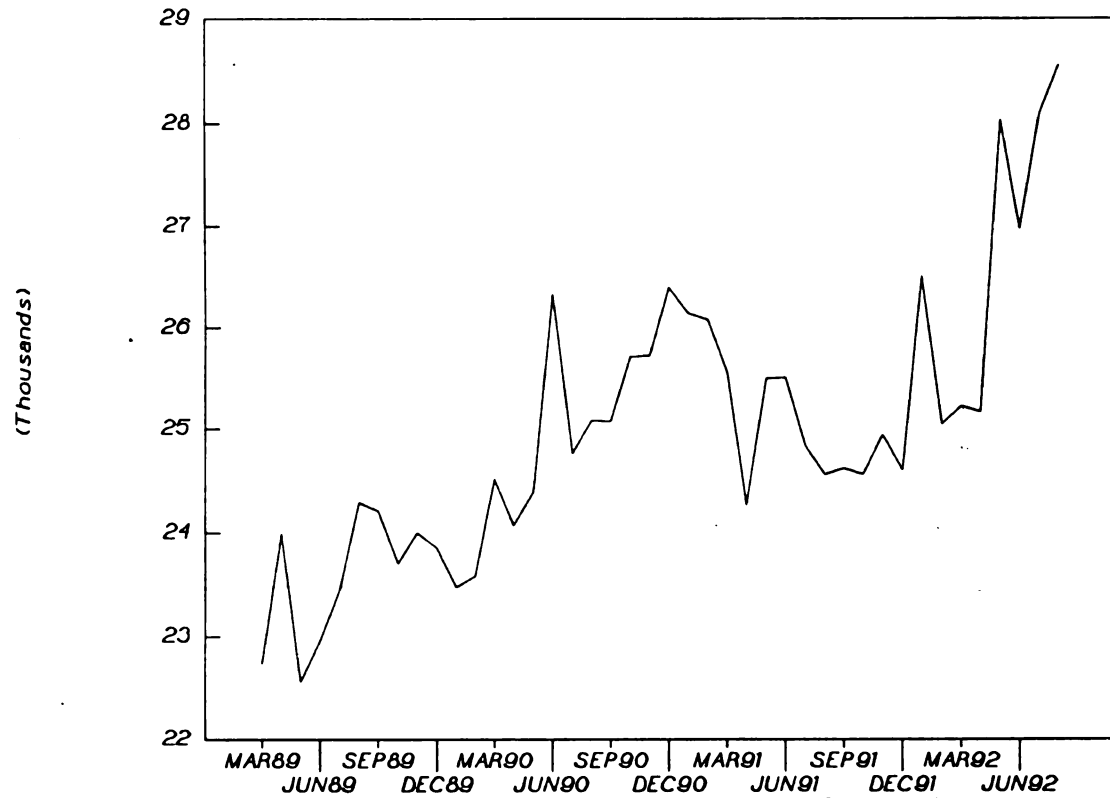
Figure 6.2 *International Telephone Traffic*

March 1989 to 1992
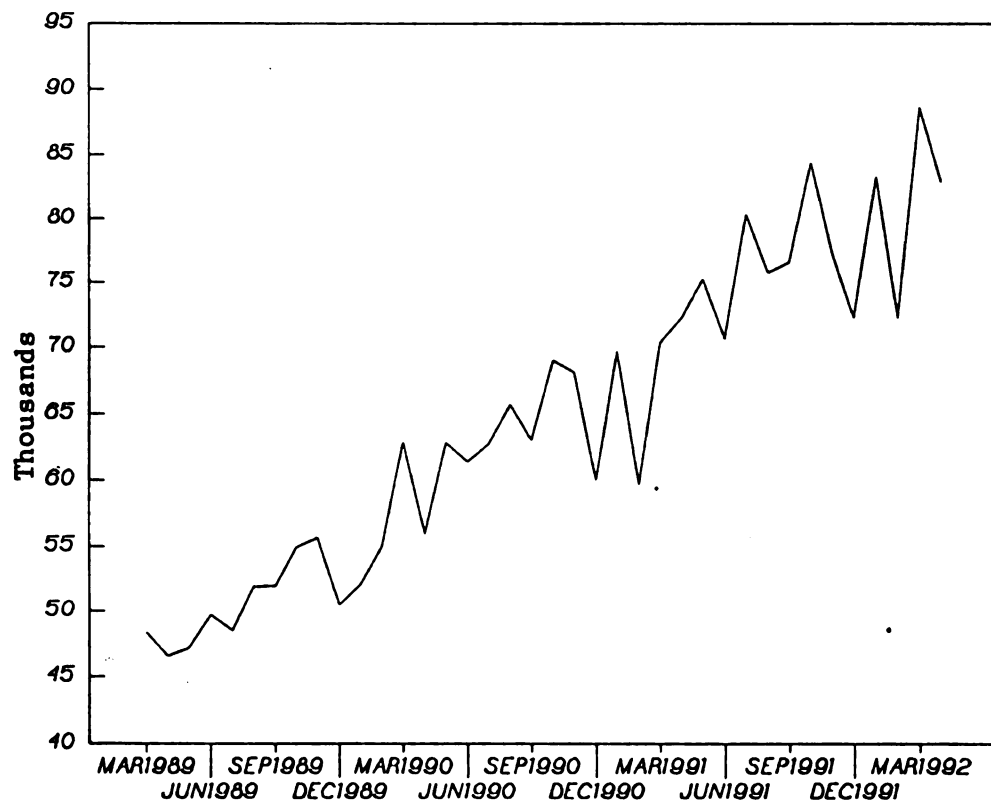
On the whole, the findings in this chapter are consistent with that found earlier. The absence of Visitors as a significant variable, however, runs counter to various hypotheses that a good telecommunication system is necessary for tourism.

CHAPTER SEVEN

Analysis of Trade and Visitor Flows

Introduction

This chapter looks at outgoing International Telephone traffic to various countries and compares them with data in trade and tourism.

The data, unfortunately, are available only from 1976 to 1985. Various attempts to obtain more up-to-date information from Singapore Telecom, including an appeal through the minister in charge, failed to yield any result. A Singapore Telecom spokesman said that there were two reasons for this reserve. First, other telecommunication authorities, both regional and international, were known to be using such information for their own competitive purposes. Second, the authority is preparing for an initial public offering of its shares in late 1993. For fear of giving away any "financial advantage," all information were being closely guarded. (Foo 1992).

Caveats

Several caveats about the data are therefore in order. First, unlike chapters five and six, which used recent data, the current data set is more than seven years old.

Second, while the data are supposed to reflect International Telephone traffic between Singapore and various countries, the top two destinations are either absent or have very little data available. The top

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international destination for Singapore, like many
countries, is its next-door neighbor Malaysia. Calls to
Malaysia, however, are considered trunk calls as they are
not routed through an international gateway. The analogy to
the American situation would be to consider calls to
Malaysia long-distance instead of international traffic. The
treatment of calls is a throwback to the period when
Singapore was part of Malaysia or governed as such by the
British.

The top international destination is the next closest
neighbor, Indonesia. Analysis for flows into and out of this
country was curtailed for lack of data. International
Telephone traffic data were available but data on trade were
absent. This is another historical quirk. When Singapore
agreed to join Malaysia to form a federation in the early
1960s, Indonesia objected. Trade between Singapore and
Indonesia collapsed. (As a matter of interest, the drop in
trade was so severe that the X-11 seasonal adjustment could
not handle the drastic change. Under the adjustment, trade
was negative!) Since then, trade between the two countries
has not been publicly reported.

For several other countries, data collection began much
later. Fortunately, the data were either absent or in
sufficient quantity as to make analysis possible. Thus,
although Singapore Telecom reported the call volume to the
top 20 countries for each of the years under study, only
data for 14 countries could be analyzed.

Third, it should be noted that the year that the data set ended--1985--was the year of a recession in Singapore, the first in living memory for many Singaporeans. The last time that happened was in 1961. This means that for half the period of the data set, Singapore was on an economic decline. Although the analysis may be valid for Singapore, caution should be exercised in comparing the results with those of other countries.

Finally, although the data set was available on a monthly basis, it had to be aggregated to quarterly. The autocorrelation for monthly data was extremely high. After several months of attempts, it was concluded that the analytical method needed to obtain meaningful results was beyond the scope of this dissertation. The result of the aggregation to a quarterly basis was to reduce each variable to 37 data points, or fewer, from the more than 100 they started out with.

With these caveats, the analysis was performed on the top 14 countries in outgoing calls from Singapore. From 1976 to 1985, Singapore Telecom released data on the top 20 countries but these 14 were consistent enough in the top rankings so that analysis was possible. Data for other countries had gaps when they were not among the top 20, making analysis difficult. The 14 countries are: Indonesia, Philippines, South Korea, Australia, France, Italy, Taiwan, West Germany, USA, Hong Kong, India, Japan, Netherlands and United Kingdom.

In the data sets below, Visitors refer to tourists and their country of residence. A data set of say, Taiwan Visitors thus refers to tourists who are residents of Taiwan.

Arrivals and Departures refer to embarkation and disembarkation at the airport; Arrivals and Departures exclude transit passengers but include Visitors entering Singapore by air.

Analysis and Results

As with the earlier chapters, the data were first smoothed with X11 adjustments, then logged and then differenced. It was necessary to log and difference the data to make them stationary. Then, as in the previous chapters, the F-test was used to determine causality.

The full results of the analysis are presented in Appendix C. Significant findings are presented in the tables below.

It should be noted that both adjusted and non-adjusted data were used in this analysis because the seasonality of the data is not known. Seasonality is very marked for the data from European countries but less so for that in other countries. In general, the results of analysis from non-adjusted data should be treated with caution because of possible correlations with the seasonal instead of the underlying trend.

Philippines

Table 7.1.--Causal factors for Philippines

	F Value	p
Air Arrival Causes Phone	2.3229	.0885

NB. Arrivals, and Departures, include those coming for business. Visitors are tourists.

Some caution is in order when interpreting Table 7.1, which shows that Arrivals by Air was found to cause International Telephone traffic. Non-adjusted data were used to arrive at the conclusion.

South Korea

South Korea was another country that lack data present in other cases. Here, Visitor traffic was not available. The causal factors are listed in Table 7.2 below.

Table 7.2.--Causal factors for South Korea

	F Value	p
PhoneX Causes Domestic ExportX	2.3667	.0841
PhoneX Causes ExportX	2.4305	.0780
Import Causes Phone	2.5710	.0663

International Telephone traffic contributes to the growth of Exports and Domestic Exports. Imports were found to cause International Telephone traffic growth but it should be noted that the finding is of non-adjusted data.

France

The data on France yielded a highly statistically significant finding for Export causing International Telephone traffic growth as shown in Table 7.3. The finding was true for both adjusted and non-adjusted data. The finding of Visitors by Air and Land causing International Telephone traffic growth is interesting but again, it should be noted that these are for non-adjusted data.

Table 7.3.--Causal factors for France

	F Value	p
Export Causes Phone	5.8903	.0022
ExportX Causes PhoneX	3.7523	.0179
Visitors (Air) Causes Phone	2.5532	.0822
Visitors (Land) Causes Phone	4.4037	.0146

Italy

The data on Italy showed that Domestic Export and Total Export caused International Telephone traffic growth. The verdict for Visitors by Sea is mixed. Table 7.4 shows causality going both ways, particularly for adjusted data. Such bi-directional causality is called feedback. It should be noted, however, that Visitors by Sea from Italy have been on the decline since 1979 while International Telephone traffic has been on the increase. This result may therefore be spurious.

Table 7.4.--Causal factors for Italy

	F Value	p
Domestic Export Causes Phone	5.0068	.0050
Domestic ExportX Causes PhoneX	2.8680	.0472
Export Causes Phone	3.7060	.0188
ExportX Causes PhoneX	2.4111	.0708
Phone Causes Visitors (Sea)	3.8873	.0232
Visitors (Sea)X Causes PhoneX	3.8764	.0235
PhoneX Causes Visitors (Sea)X	3.2964	.0398

Taiwan

The data on Taiwan shows International Telephone traffic growth to that country to be caused by Imports and Visitors by Land from it. The number of Visitors by Land from Taiwan, however, is small. Toward the end of 1985, it was between 500 and 700 a month.

Table 7.5.--Causal factors for Taiwan

	F Value	p
ImportX Causes PhoneX	2.5246	.0699
Visitors (Land) Causes Phone	3.3151	.0391
Visitors (Land)X Causes PhoneX	2.4745	.0890

West Germany

The data from West Germany showed that International Telephone traffic growth caused growth in Domestic Exports, Total Exports and Total Imports. These were true both with non-adjusted and adjusted data. The findings from West Germany are instructive as the country is one of the largest trading nations in the world.

The verdict for visitors is mixed. The number of Visitors by Land and Sea has leveled off after 1980 so interpreting causality here should be cautious.

Table 7.6.--Causal factors for West Germany

	F Value	p
Phone Causes Domestic Export	2.5392	.0688
PhoneX Causes Domestic ExportX	4.6966	.0068
Phone Causes Export	4.1657	.0116
PhoneX Causes ExportX	7.0167	.0008
Phone Causes Import	4.4000	.0092
PhoneX Causes ImportX	2.4187	.0791
Visitors (Land) Causes Phone	2.3456	.1017
PhoneX Causes Visitors (Land)X	3.7416	.0264
Visitors (Sea) Causes Phone	3.0017	.0527

USA

Of all the variables, only Visitors by Land were found to cause International Telephone traffic growth for the USA. This finding is reminiscent of Kellerman's finding that International Telephone traffic correlated with tourism for the USA (Kellerman 1990).

Table 7.7.--Causal factors for USA

	F Value	p
Visitors (Land)X Causes PhoneX	2.6522	.0744

Hong Kong

Several relationships were found to be statistically significant, as presented in Table 7.8. The most interesting

is the case of Imports, which shows feedback. The finding is consistent for both adjusted and non-adjusted data.

Similar consistency was found for Departures by Air and Visitors by Sea.

Table 7.8.--Causal factors for Hong Kong

	F Value	p
Air ArrivalX Causes PhoneX	2.3344	.0873
Air Departure Causes Phone	2.5338	.9308
Air DepartureX Causes PhoneX	2.7175	.0560
Import Causes Phone	2.8865	.0462
Phone Causes Import	3.7283	.0183
ImportX Causes PhoneX	4.8461	.0059
PhoneX Causes ImportX	2.3255	.0882
Phone Causes Visitors (Sea)	3.5215	.0323
PhoneX Causes Visitors (Sea)X	2.5613	.0815

India

There was a sharp upturn in International Telephone traffic to India from May 1983. A senior Singapore Telecom official said that this was due to the opening of a new international gateway in India around that time (Lim 1993).

Imports were found to cause International Telephone traffic growth.

Table 7.9.--Causal factors for India

	F Value	p
Import Causes Phone	3.4873	.0333
ImportX Causes PhoneX	3.4519	.0344

Japan

International Telephone traffic growth was found to cause Import growth. This was consistent for non-adjusted and adjusted data. Arrivals by Air, however, were found to cause International Telephone traffic growth.

Table 7.10.--Causal factors for Japan

	F Value	p
Air ArrivalX Causes PhoneX	2.8325	.0491
Phone Causes Import	3.3457	.0277
PhoneX Causes ImportX	3.2690	.0301

The Netherlands

The significant relationships found on The Netherlands used data that were not adjusted. These results should therefore be treated with caution. Growth of Arrival and Departure by Air and Visitors by Land were found to cause growth in International Telephone traffic.

Table 7.11.--Causal factors for Netherlands

	F Value	p
Air Arrival Causes Phone	4.9514	.0053
Air Departure Causes Phone	4.9254	.0055
Visitors (Land) Causes Phone	2.4375	.0925

United Kingdom

The data on the United Kingdom yielded the most interesting results on visitors: International Telephone

traffic growth was found to cause growth in all types of Visitor traffic. Arrivals by Air, however, were found to cause International Telephone traffic growth.

Domestic Exports were also found to cause International Telephone traffic growth.

Table 7.12.--Causal factors for United Kingdom

	F Value	p
Air Arrival Causes Phone	2.2782	.0933
Domestic ExportX Causes PhoneX	2.3127	.0996
Phone Causes Visitors (Air)	2.7187	.0696
Phone Causes Visitors (Land)	3.1915	.0439
PhoneX Causes Visitors (Land)X	3.6573	.0285
PhoneX Causes Visitors (Sea)X	5.0333	.0090
Phone Causes Visitors (Total)	3.0266	.0514
PhoneX Causes Visitors (Total)X	2.4356	.0926

No statistically significant results were found for Australia, Canada and Indonesia. The case of Indonesia is disturbing in that only data for Arrivals by Air (Air Arrivals) and Departures by Air (Air Departures) were available for analysis.

Discussion

The results of the analysis above are re-drawn and presented in Table 7.13.

Table 7.13.—Summary of Significant Relationships

Domestic Export Causes Phone	Italy (IT);
Domestic ExportX Causes PhoneX	IT; United Kingdom (UK)
Phone Causes Domestic Export	West Germany (WG)
PhoneX Causes Domestic ExportX	South Korea (SK); WG
Import Causes Phone	SK; Hongkong (HK); India
ImportX Causes PhoneX	Taiwan (TW); HK; India (IN)
Phone Causes Import	**WG; HK; Japan (JP)**
PhoneX Causes ImportX	**WG; HK; JP**
Export Causes Phone	France (FR); IT
ExportX Causes PhoneX	FR; IT
Phone Causes Export	WG; SK
PhoneX Causes ExportX	WG
Visitors (Air) Causes Phone	FR
Phone Causes Visitors (Air)	UK
Air Departure Causes Phone	HK; Netherlands (NT)
Air DepartureX Causes PhoneX	HK
Air Arrival Causes Phone	Philippines (PH); NT; UK
Air ArrivalX Causes PhoneX	HK; JP
Visitors (Land) Causes Phone	FR; TW; WG; NT
Visitors (Land)X Causes PhoneX	TW; WG
Phone Causes Visitors (Land)	UK
PhoneX Causes Visitors (Land)X	WG; UK
Visitors (Sea) Causes Phone	WG
Visitors (Sea)X Causes PhoneX	IT
Phone Causes Visitors (Sea)	IT; HK
PhoneX Causes Visitors (Sea)X	IT; HK; UK
Phone Causes Visitors (Total)	UK
PhoneX Causes Visitors (Total)X	UK

Emphasis added.

Imports, Exports, and Domestic Exports

The findings overall seem to suggest a correlation between world trade volume. The most striking finding is that International Telephone traffic growth causes growth in Imports. The result is consistent for West Germany, Hong Kong and Japan. After the United States, West Germany and

Japan are the next largest trading countries in the world. Hong Kong is the second largest trading country in Asia, after Japan.

This seems to suggest that the size of world trade by that country both reflects and is reflected by International Telephone traffic. This observation is consistent with the findings for Domestic Exports and Exports. Significant causal relationships also exist for France, United Kingdom, Italy and South Korea. During the period under study--1976 to 1985--all these countries were among the world's largest trading countries.

Conspicuously absent is the United States. The absence, however, is consistent with the finding of Kellerman (1990) that for the USA, International Telephone traffic correlated with tourism, not trade.

In the case of West Germany, the results consistently show that International Telephone traffic growth causes Imports, Exports and Domestic Exports growth. But it is the only country with a causal relationship among the three variables and International Telephone traffic.

South Korea and Italy provide interesting contrasts. In the case of South Korea, International Telephone traffic growth causes both Exports and Domestic Exports growth. The causal relationship is vice versa for Italy.

Hong Kong is interesting in that the relationship between Imports and International Telephone traffic shows feedback.

The causal relationship between Imports and International Telephone traffic for India and Taiwan is also interesting. Both these countries have low trade volume. Taiwan's trade overtook Singapore's only in 1987. India's world trade volume has yet to match Singapore's (IMF 1989).

The results suggest that International Telephone traffic and trade do have significant relationships, the direction of which depends on the importance of trade for the destination country. As Singapore is a major trading country itself, this result raises the question of the validity of the statement. Would such a relationship hold for countries that are less important trading centers?

Visitors and Air Travellers

The link between International Telephone traffic growth and foreign visitors is less clear, perhaps because the definition of Visitors and Arrivals and Departures are themselves not clear. The results should therefore be treated with caution.

The United Kingdom and Hong Kong stand out. International Telephone traffic growth causes visitors from the United Kingdom to increase across the board. The causal relationship is for Total Visitors as well as Visitors by Air, Land and Sea. Conventional wisdom would hold that International Telephone calls are more important for air travel than land or sea travel.

The findings from data on Hong Kong are more consistent

with that logic. International Telephone traffic growth causes growth in Air Arrivals from and Air Departures to Hong Kong.

It may be that the common link is the colonial heritage shared by Hong Kong and Singapore with the United Kingdom. Economic geographers argue that communication links tend to follow historical links (Castells 1989).

The results for Visitors by Sea may be spurious. Sea travel has been on the decline at least since 1980 for virtually all countries in the study.

Conclusion

There is a more consistent relationship between International Telephone traffic and trade than between International Telephone and tourism. Of course, consistency *per se* does not necessarily indicate the strength of the relationship. But the consistency is consonant with that of Kellerman's (1990) study in which international telecommunications was found to correlate with trade for all countries studied except the USA. For the exception, USA, international telecommunications was found to correlate with tourism, a finding marginally replicated here.

One possible explanation for this anomaly in the case of the USA is that telecommunications data for the financial sector was not captured. The data set above was up to 1985-- a period when telecommunications liberalization was sweeping the USA but not other parts of the world. The greater

flexibility afforded American companies meant that companies, especially in the financial sector, could move their telecommunications system to leased lines and private networks. Individuals, however, had to use the public switched networks still. As the above data set captures public switched network traffic, telecommunications is seen to have a relationship with the tourism industry, which has more individual users, than with the financial industry, which has more corporate users.

One interesting finding is that outbound International Telecommunication traffic growth was shown to cause Imports growth from West Germany, Japan and Hong Kong. After the United States of America, West Germany and Japan are second and third in total world trade volume. Hong Kong is the largest trading country in Asia after Japan. The finding suggests that International Telecommunication with the three major trading countries creates wealth. This finding, however, is the reverse of the finding at the sectoral level that Total Imports caused International Telecommunication traffic growth.

The "opposite" finding cannot be reconciled by the current data set: data for the sectoral level are current to 1992; data for international flows are only up to 1985. More data for international flows will be needed to reconcile the difference.

Overall, the absence of a universal pattern of telecommunication flows between countries suggests that the

question of causality depends on both the calling and the called parties--telephones are after all an interactive medium.

This raises the question of whether there will be a mirror image in causality should be study be replicated in the countries studied. That is, if International Telephone traffic growth causes Imports growth from West Germany, would a study from West Germany find that Exports cause International Telephone traffic growth to Singapore?

That is one of many possible areas of research from the suggestive, if tentative, findings in this chapter.

CHAPTER EIGHT

Conclusion

Tests of Hypotheses

The study began with several hypotheses (Chapter 3) the results of which are elaborated upon more fully below.

H1. International telecommunication correlates strongest with trade, tourism and financial services among all the sectors of the Singapore economy.

Result: Partly rejected and partly failed to reject.

If one were to use the conventional method of correlating economic sectors with International Telecommunication, one would find a high correlation indeed. Significance is better than .001 in all cases except the Construction sector, which is significant at .003. Table 8.1 below shows that the three sectors of trade, tourism and financial services ranked high in their correlations with International Telecommunication. If one takes GDP as the aggregate average of correlation, these three sectors are "above average." Their low and insignificant Durbin-Watson statistics, however, indicate that these relationships have extremely high autocorrelations. This means the R^2 is overestimated. Table 8.1 therefore is, in all probability, a table of spurious results.

Table 8.1.--Correlation of International Telecommunication by call volume and various economic sectors.

Sectors	Rsq-adj**	DW
Visitors (Total)	.920	1.00
Commerce	.903	.35
Manufacturing	.887	.42
Utility	.882	.10
Agriculture	.878	.47
Finance	.872	.04
GDP	.868	.07
Transport	.855	.02
Other Services	.819	.08
Construction	.108*	.06
Quarry	.047	.11

*p<0.003.
**p<0.001 level unless otherwise indicated.

The data therefore had to be transformed to minimize autocorrelation. The transformations necessary for a statistically valid conclusion were seasonal adjustments, log-transformation, and differencing. These steps transformed the data to percentage growth rates. Correlations of these growth rates are presented in Table 8.2.

Transport and GDP had statistically significant correlations. Finance, Manufacturing and Commerce (the trade sector) followed in order but were not statistically significant. Tourism, as measured by the total number of visitors, dropped to the middle of the ranking of sectors.

Table 8.2--Relationship of growth rates of International Telecommunication and various economic sectors (after seasonal adjustments).

Sectors	Rsq	Rsq-adj	p<	DW
Transport	.133	.120	.002	2.27
GDP	.082	.069	.018	1.81
Finance	.036	.021	.123	1.79
Manufacturing	.035	.020	.128	1.74
Commerce	.025	.010	.198	1.93
Utility	.021	.006	.241	1.96
Total Visitors	.007	.001	.289	2.57
Construction	.004	.000	.588	1.58
Agriculture	.003	.000	.684	2.07
Quarry	.002	.000	.741	1.60
Other Services	.000	.000	.864	1.60

A surprise inclusion among these sectors is Manufacturing, which ranks ahead of Commerce. Manufacturing is not a sector normally considered to use much of telecommunications, let alone international telecommunications. After all, as in the developed countries, the occupational structure in Singapore is moving away from manufacturing (Kuo and Chen 1984). The high correlation between International Telecommunication and Manufacturing may be attributable to the unique context of Singapore where there are many international manufacturing operations. If this is so, it would imply that there may be contextual factors to be considered in any attempt to develop a "grand" or "unifying" theory of telecommunications and economic development.

**H2. International telecommunication causes trade development
more so than vice versa in Singapore.**

Result: Rejected.

The analysis showed that Trade growth, at an aggregate
level and at constant prices, caused International
Telecommunication traffic growth. This finding was
unexepected as it the Trade sector is telecommunications
intensive. Telecommunication costs account for five to 10
percent of total costs in the Trade sector (Lim 1993).

The above finding must be qualified in that at the
subsectoral level, International Telecommunication was shown
to cause Re-Export growth.

**H3. International telecommunications causes tourism
development more so than vice versa in Singapore.**

Result: partly rejected.

No significant causal relationship was found between
tourism--whether by air, land or sea--and International
Telecommunication at the aggregate level. The analysis
showed that the relationship of International
Telecommunication is stronger with the flow of goods than
people.

At the country level, there were some causal relationships found. But the results were decidedly mixed. Sometimes International Telecommunication caused Tourism growth; at other times, it was vice versa.

It is suggested that perhaps there are contextual factors that explain the relationship at the country level.

H4. International telecommunication causes financial services development more so than vice versa in Singapore.

Result: both null and alternate hypotheses rejected.

The results of the analysis at the aggregate level were not statistically significant one way or the other. The bias is in favor of International Telecommunication growth causing Finance growth. Further tests, at the subsectoral level, were not possible because the data were absent.

Financial institutions are heavy users of telecommunications, with five to 10 percent of total costs going to telecommunications (Lim 1993). Foreign exchange dealing rooms display conspicuous batteries of telephones. So the absence of a significant causal relationship is puzzling.

Three reasons have been suggested for the lack of a significant result. The first is that the Finance industry is a heavy user of private circuits. Therefore, not all the

data for the Finance industry are captured by measurement only of the public switched network.

The second reason is that the relationship may be one of "instantaneous causality." The idea is that the impact of the telephone call is felt right at that moment in the Finance industry. The test cannot account for instantaneous causality.

The third reason is that the definition of Finance industry, at least in Singapore, includes such businesses as detective and modeling agencies. The detectives may be used as debt collectors; but the models are baffling.

H5. International telecommunication causes more growth in trade development than tourism development or financial services development in Singapore.

Result: rejected.

H6. International telecommunication causes more growth in tourism development than trade development or financial services development in Singapore.

Result: rejected.

H7. International telecommunication causes more growth in financial services development than trade development or tourism development in Singapore.

Result: rejected.

Based on previous research, which showed that
investment in telecommunications causes economic growth, it
had been assumed that International Telecommunication would
cause economic development. As the above analysis shows,
however, the various economic sectors were more frequently
the causal factor. The results do not stand alone; there is
some internal validity among them. The three sectors in
order of importance are Trade, tourism and Finance.

To recapitulate, this study has looked at the causal
link between the flow of International Telecommunications
and economic growth at three levels--at the national and
sectoral levels, specifically trade, and at the level of
international flows.

At the national aggregated level, it has been shown
that the economic activity causes international
telecommunications growth. As the measure of economic
activity is a measure of wealth, this may be termed the
"wealth effect." To paraphrase Hemingway, the rich are
different because they make more phone calls.

On hindsight, there was some evidence of the causality
of economic factors in at least one paper written earlier.
Staple and Mullins had written: "The rate of increase in the
demand for international services nevertheless generally

fluctuates *according to the business cycle* in the country where the telecommunication originates" (1989a:25; italics added for emphasis). The sentence implies that the demand in telephone traffic is caused by the business cycle. This is an implication contrary to previous findings.

The only sector whose growth was shown to be caused be International Telecommunication was Transport and Communication. This is the very sector into which telecommunications falls. It is suggested that the existence of the relationship may be attributable to double counting. If so, it could explain previous studies that found telecommunications investment to cause economic growth. In those instances, investment in telecommunications infrastructure was used to predict GDP growth. Those are cases of double counting because telecommunications investment **is** part of GDP and so telecommunications investment conceptually will contribute to GDP.

At the sub-sectoral level of trade, the wealth effect still holds. Imports and Overall Trade caused international telecommunication. There is therefore some internal validity in the results.

An interesting and unexpected finding was that international telecommunication caused Re-Exports. This activity is the entrepot trade, where goods are broken up into smaller consignments for shipment to other countries in the region. It is analogous to hubbing activity in telecommunications where several messages are sent to a

central location to be re-sent to other sites. This unexpected finding may be due to Re-Exports needing more coordination than any other type of trading activity. Conceptually, twice as much communication is needed.

Finally, at the international bilateral flows level, no consistent pattern of causality emerged save one exception. The exception was that outbound International Telecommunication traffic growth was shown to cause Imports growth from West Germany, Japan and Hong Kong. After the United States of America, West Germany and Japan are second and third in total world trade volume. Hong Kong is the largest trading country in Asia after Japan. The finding suggests that International Telecommunication with the three major trading countries creates wealth. This finding is the reverse of the finding at the sectoral level that Total Imports caused International Telecommunication traffic growth.

The "opposite" finding cannot be reconciled by the current data set: data for the sectoral level are current to 1992; data for international flows are only up to 1985. More data for international flows will be needed to reconcile the difference.

Analysis using data for the sectoral level truncated to 1985 was not performed because comparability would be limited. The conclusions from analysis of a truncated data set would only be comparable with that of another similarly truncated data set.

The lack of a pattern from the international flows data set suggests that the volume of outgoing calls depends not just on the originating country but the destination country as well. On hindsight this is obvious. Telecommunication after all is a two-way traffic.

Serendipitous Findings

The first major surprise of this study is in its methodological implications: in future time-series analysis of telecommunications-GDP correlations, the Durbin-Watson statistic must be calculated. The statistic, a measure of autocorrelation, has been extant since 1970 but not widely used. Conclusions from studies that do not use the statistic may be seriously misleading.

Another methodological implication is the use of constant prices. The study found more relationships, which also tended to be more stable and consistent, when constant prices were used. It does make some intuitive sense because if X minutes is needed to transact Y ton of goods 10 years ago, there is no reason why more calls would be needed to transact the same volume of goods today. Inflation, however, may increase the value of goods; this means that a deflator will uncover any relationship.

At the level of anlysis, there was greater consistency of results when the data were aggregated than when the data were disaggregated to the sectoral and sub-sectoral levels. It is not evident from the results of the analysis why this

should be so. If anything, the aggregated data set should contain more random "errors" than the sectoral level data set. The relationships should therefore be more evident at the sectoral and sub-sectoral levels. Comparative analysis with other countries' data is needed to determine if the result is peculiar to Singapore.

Turning to the data themselves, it would appear that International Telephone traffic is fairly insensitive to seasonal forces. Seasonal increases and decreases are in the order of 1 to 2 percent. The exceptions are February and March. Typically, February is the month when the Chinese New Year falls and the seasonal decline is about 8 percent. Some Chinese-owned businesses close for as long as two weeks. March would therefore be catchup time for these businesses.

Looking next at bilateral data turned up two countries with interesting insights into possible influences of international telecommunications flows: India and the Philippines. Indian international telecommunication ranks poorly by one yardstick of service, the answer/seizure ratio. A call is successfully answered when someone at the called number picks up the telephone. (If no person or answering machine answers, the call is considered not answered.) Seizure refers to a successful handing over to the operator of the international telecommunication service in the destination country. That is, when the call passes the halfway point. In a satellite link, a call is considered seized when the satellite picks up the call and

Figure 8.1 *International Calls to India*

(Monthly) 1976-85
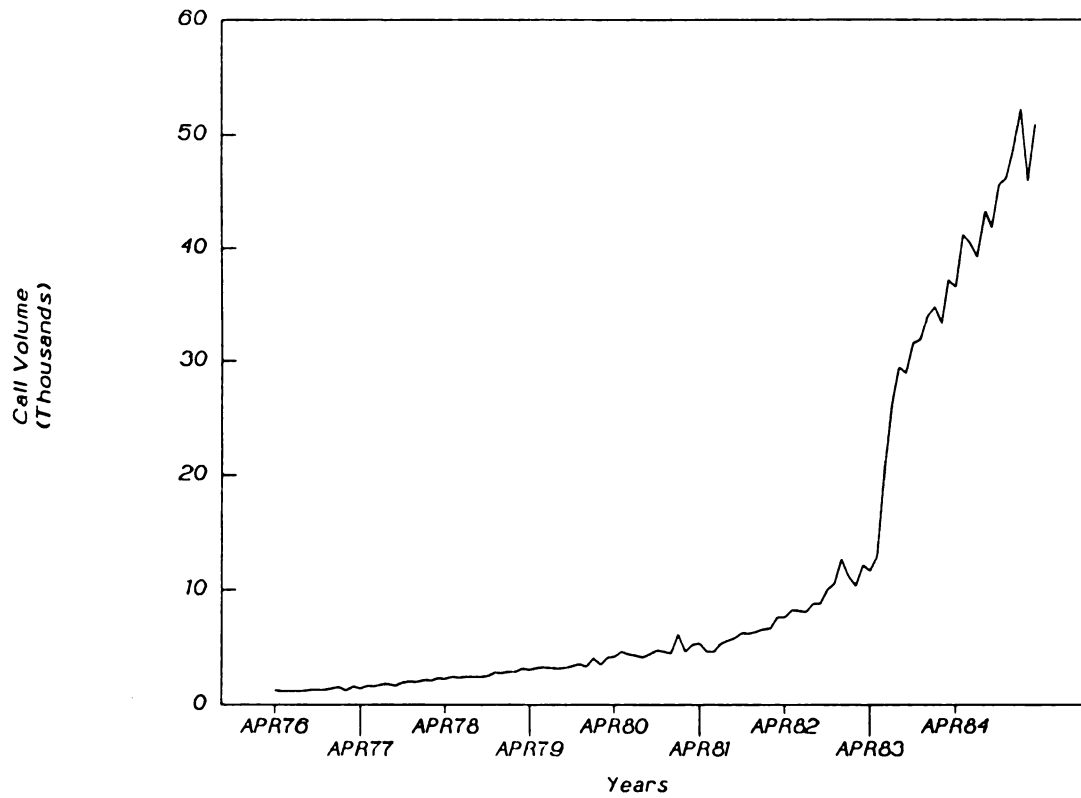
hands it over to the destination carrier. In developed countries, the answer/seizure ratio is 70 percent at best. In less developed countries, the ratio can drop to as low as 15 percent. That is, only 15 percent of the calls that go through end up with someone at the other end answering. India was one of those countries (Lim 1993).

Figure 8.1 shows international calls to India from 1976 to 1985. Between April and October 1983, call volume jumped 200 percent and has not looked back since. According to a senior official at Singapore Telecom, India opened an international gateway thereby reducing the bottleneck of calls (Lim 1993). Also, India installed more automatic exchanges and lines between 1983 and 1984 (India 1985). The data therefore suggest that Indian services for international telecommunication grew with greater availability of circuits and access. Together, the data suggest that demand for international telecommunication *from Singapore to India* was suppressed by poor service on the Indian side of the circuit. This again suggests that there are contextual factors in the destination country that could explain the flows in the originating country. Again, on hindsight, this finding should be obvious as telecommunications is an interactive medium.

The other country with interesting data is Philippines, where the data suggest travel was substituted by telecommunication. The data set covered the period of the crisis leading up to the People Power Revolution and the

overthrow of Marcos and suggests that there was a substitution effect between telecommunications and travel during the crisis. This is consonant with use of other media in a crisis. (The series, unfortunately, did not cover the actual period of the overthrow of Marcos.)

Figure 8.2 shows, among other things, international calls to the Philippines growing in an essentially exponential curve. The data set has been seasonally adjusted so spikes may be considered to be out of the ordinary. The steepest spike is at the end of the series. The next steepest spikes are in 1983, the year in which returned exile Benigno Aquino was assassinated. He was killed on 21 August.

The decline in travel to and from Singapore by Philippine nationals had begun in mid 1982. It was suggested to the author that the decline in travel may be due to a levy imposed by the Singapore government to discourage the use of foreign workers (Lim 1993). In April 1982, the Singapore government imposed a tax on employers who hired foreign workers. If, as was suggested, the levy was effective, than arrivals of Philippine nationals should decrease while departures increase. But as Figure 8.2 shows, that was not the case. Both arrivals and departures followed very similar, almost identical, paths. The decline in travel, accompanied by an increase in international telecommunication, is suggestive of substitution during the

Figure 8.2 *International Calls to Philippines*

Substitution Effect

Caption: *International Calls to Philippines — Substitution Effect.* Y-axis: Not to scale (linearly transformed) (Thousands), marked 0, 5, 10, 15, 20, 25, 30, 35, 40, 45. Curves labeled Phone, Arrivals, Departures. X-axis: Years — APR76 OCT76, APR77 OCT77, APR78 OCT78, APR79 OCT79, APR80 OCT80, APR81 OCT81, APR82 OCT82, APR83 OCT83, APR84 OCT84.
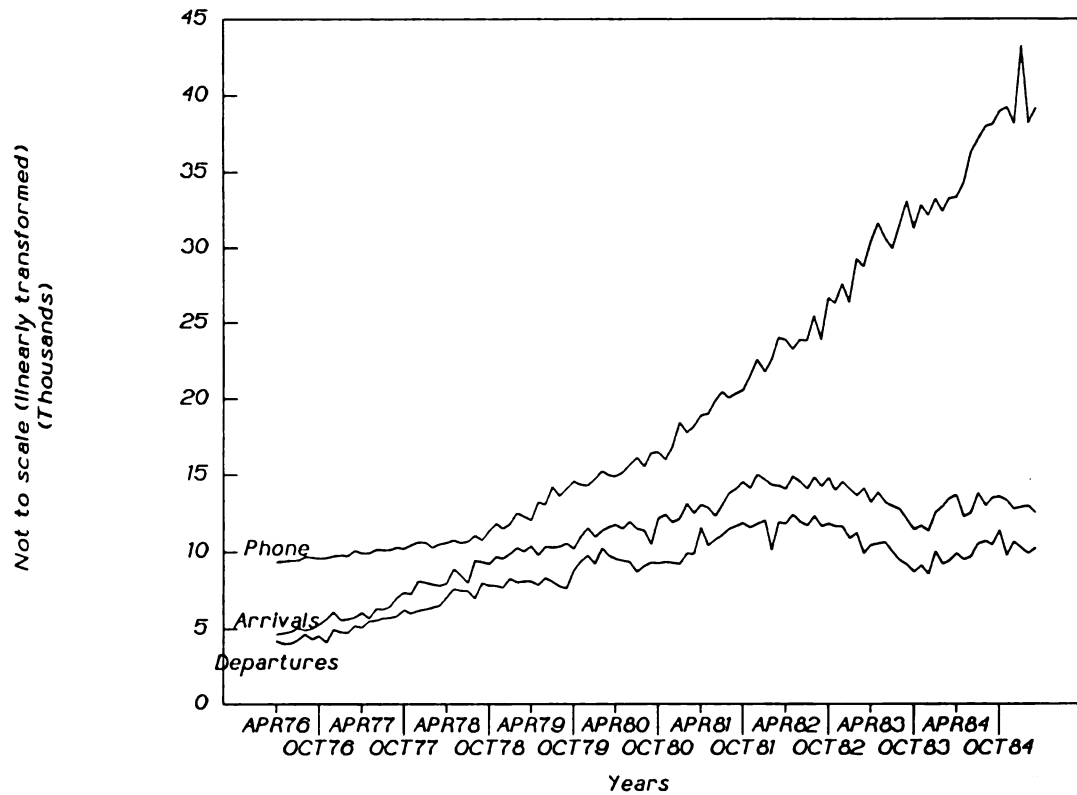
period of crisis. That is, there is a transportation-telecommunication trade-off during the period of crisis. This substitution was demonstrated during the Gulf War when international videoconferencing increased by 60 percent as companies discouraged corporate travel (Quillinan 1991).

On a related noted, the senior Singapore Telecom official interviewed said a study he had conducted during Operation Desert Storm in 1991 showed no substitution effect. That is, while travel to Singapore tailed off, there was not a jump in outbound international call volume. The official attributed this to a significant (about 10 percent) of calls being made by tourists in hotels (Lim 1993). While not large, the lack of contribution from that sector was enough to stunt growth. It should also be noted that even if there had been some substitution effect, the increase in videoconferencing would not have been captured in the current data if the videoconference originated from outside Singapore.

As noted earlier in Chapter 6, International Telecommunication continued to grow during the Gulf War while tourist arrivals fell. Growth in International Telecommunication during the period, however, was not at the pace projected. that At the time of writing, no data on the period in question was available for analysis.

One question Kellerman asks is whether international telecommunication is caused by or causes the flow of people or goods. Overall, the analysis of international flows

suggests that it is goods, which includes services.

Alternative Explanations for Findings

As this is a field study, there are influences on the data that cannot be controlled. The first group of influences are those that may have contributed to the exponential growth of International Telecommunication in Singapore.

There may be two factors behind the exponential growth. The first is that rates have fallen dramatically. The average rate at the time of writing in early 1993 is two-thirds that in 1979 (Lim 1993). The second reason may be technological. According to one study, the number of facsimile machines doubled between 1988 and 1989 while total outbound traffic increased 42 percent (Staple 1990:12). Staple seems to suggest that fax machines make it easier and cheaper to send larger amounts of information than a voice conversation. The impact of the fax machine will probably be better understood through studies of other countries that have not had these new technologies.

A more serious challenge of sorts to the above conclusions is a study completed recently by two Singapore academics. Chow and Choy, in attempting to develop indicators for the Singapore economy, found that International Telephone traffic leads GDP by three quarters (1993). There was no attempt, however, at theorizing the relationship.

In common with this study, the data had also to be transformed through statistical filters. (Otherwise, it would be impossible to explain how International Telecommunication continued to grow in the mid-1980s when Singapore had a contraction in its GDP.) It may be that different statistical filters lead to different results.

One conceptual problem with their study is that using international telecommunication as a leading indicator does not necessarily indicate it is a cause. The leading indicator concept works much in the same way as the stock market is an indicator of economic growth. One cannot say that the stock market causes economic growth or decline.

Further, Chow herself was attempting to develop a model to forecast telecommunications demand using GDP. But if international telecommunication causes economic growth, the attempt is conceptually unsound.

Strengths, Weaknesses, and Limitations

The strength of this study is that it has looked at flows, instead of investment, as a measure of the impact of telecommunications. As indicated earlier, it avoids the problem of double-counting. By avoiding double-counting, the study also suggests that some of the conclusions of previous studies may have been due to double-counting.

Also, it used a more sophisticated method to determine causality, thereby improving on Hardy's cross-lagged correlation.

On the other hand, Granger causality is not without problems. In some instances, which may not apply here, Granger causality does not equate with causality. For example, analysis using Granger causality would suggest that Christmas cards "cause" Christmas. (This critique would apply to cross-lagged correlation.) It is suggested here that because the intention is to look for contributory cause, as opposed to exclusive cause, the limitations of Granger causality are mitigated.

Another limitation is that the data are necessarily limited to Singapore and in some cases, limited--period. The data on flows between countries are especially limited--they are more than eight years old. More recent data may change the outcome. Some of the criticisms may be that Singapore is a small island with unique characteristics and not a "typical" Third World nation, as if there is a typical Third World nation. While that may be true, it should be noted that the revenue from international telecommunication accounts for more than 50 percent of the total revenue of Singapore Telecom. The findings on International Telecommunication traffic should therefore be even stronger.

If there is to be a caveat on the data, it would be on that of international flows. Singapore's economic growth rate from 1976 grew till it peaked in 1981. Then the rate began a decline from 1981 till 1985, when it hit the recession. How this may have affected the results is not clear but this may be a point worth noting should a

comparison study be performed.

Impact of Study

The major lesson from this study is that previous
studies showing telecommunications as a cause of economic
growth may have to be reanalyzed. First, there may be
statistical problems with some of the earlier studies
showing high correlations between international
telecommunication and GDP or GNP. As far as this researcher
is aware, there was no measure of the autocorrelation of the
results. The various studies on the benefits of
telecommunications originating from Stanford University in
the late 1970s and early 1980s certainly did not calculate
the Durbin-Watson statistic.

Second, although this is a study only of international
telecommunications, there is some internal validity in the
findings that suggest application to domestic
telecommunications. Earlier studies had found that
investment in telecommunications enhanced economic growth.
This study suggests that the element of double-counting may
be significant, enough to make a difference in the final
outcome.

Third and tangentially, the study questions whether it
is necessary, as conventional wisdom suggests, to lower
prices. If it is truly the wealth effect at work, it means
that the rich are able and willing to pay for International
Telecommunication services. If so, there is no need to lower

prices except perhaps to keep pace with competition from other telecommunications service suppliers. More research needs to be done before any such policy can be acted upon.

Conclusion

This study has extended research in the use of media in development to international telecommunications. Where previous studies had suggested a linear effect from telecommunications, the finding of a wealth effect suggests that the effect is not linear from telecommunications. To that extent, the result is more consistent with current thinking that development is not a linear path. There is no Magic Bullet to development, even merely economic development.

So which paradigm does the study support? None of the development paradigms mentioned above fits the bill. The paradigms suggest that communication is key in development; the study, however, shows that development, or economic development to be more precise, causes telecommunications flows. That is, telecommunications is incidental to development.

There is some hint, however, that the relationship between telecommunications and development may depend on the stage of development of a country. It was pointed out earlier that a recent study had found that in developing nations, the telecommunications sector precedes national economic growth while the situation was reversed in

developed countries (Kim 1992). The Indian case highlights the impact of a stifled infrastructure--demand is suppressed. When the infrastructure is available, international telecommunications explodes in 200 percent growth in one year. One can only guess at the amount of economic and social well-being that 200 percent growth unleashed. Investment to create an efficient telecommunications system is therefore important.

On the other hand, after this demand has been met, provided there are no chokages in the system, the telecommunications system can take care of itself.

Whether these findings are restricted to the Singapore case, or whether there is indeed some kind of threshold that Singapore crossed will have to be determined by further research.

In sum, the study has not uncovered a grand theory of development. It certainly does not support any one paradigm of development. But it does suggest that there may be differences in the impact of telecommunications depending on the stage of development of a country.

RECOMMENDATIONS

CHAPTER NINE

Recommendations

Recommendations for Policy

The major finding of this study is that, contrary to previous research and to conventional wisdom, International Telecommunication growth is not the cause of but the result of economic activity. Much of the policies to improve telecommunications and increase investment have assumed the conventional wisdom.

Clearly, there is evidence that a stifled infrastructure can hold back telecommunications as in the case of India. But there is no conclusive evidence that the Indian economy suffered *solely* because of it.

If International Telecommunication traffic does not cause economic growth, then the major implication is that lower rates will have no great impact on an economy. It may be possible to run a sound international telecommunications system simply by keeping pace with demand. That is, it may be enough to keep rates reasonable compared with that of other telecommunication operators the region, to ensure an internationally competitive answer/seizure ratio, and to keep pace with user requirements.

In countries where the telecommunication operator is a bureaucratic organization, these "requirements" may be revolutionary in themselves. But it also means that

countries such as Singapore, which is privatizing and liberalizing its telecommunication system, need not go too far in, for example, introducing competition. If economic activity causes telecommunications growth, there is no need to lower prices. The wealthy are able and willing to pay.

This policy recommendation is not unreasonable: the US has a running deficit of a few billion dollars in telecommunications accounting because of its lower prices. Developing countries may not be able to withstand the loss.

There is supporting evidence for the above policy. The senior Singapore Telecom official mentioned earlier said that an in-house study of Japan and the United Kingdom showed that lower international call prices did not increase volume over and above that projected. He said that what was noticeable was a shift in origination of the telephone call to the country with the lower rate (Lim 1993).

Recommendations for Future Research

Future research could be conducted across countries or in more detail in Singapore. Research across countries will be useful in determining the validity and strength of the relationships uncovered.

More developed countries should be compared with the less developed. Kim (1992) suggested that there may be a difference between rich and poor countries in the

suggested that the benefits from telecommunications to the richer countries reach a plateau, as it were, where the benefits are harder to derive. In contrast, the poorer countries appear to benefit more. This explanation would fit the data of India, which suggests that poor infrastructure may indeed have suppressed telecommunications demand.

Another area is the use of telecommunications during a crisis. The Philippines case is a single instance but it is strongly suggestive that some substitution of telecommunications for travel was present. It also suggests that the use of telecommunications is similar to the use of other traditional media in crisis. If so, this could add to mass communication theory.

On a technical note, more sophisticated econometric methods should be used to analyze the available monthly data. The current method could not tame the severe autocorrelation even after several months of attempts. As a result, all data had to be aggregated to a quarterly basis. The analytical methods needed to obtain meaningful results are beyond the scope of this dissertation.

APPENDICES

APPENDIX A

Appendix A: Definitions of Sectors

Introduction

Definitions of the sectors used in the research were obtained from the Singapore Standard Industrial Classification 1990 edition, a publication of the Department of Statistics, a government body under the Ministry of Trade and Industry. The Department maintains a database of statistics from which the data used in the study were obtained.

For the purposes of national accounting, the Singapore economy is divided into nine sectors with one sector for "Activities Not Adequately Defined." Data was not available for this sector. The sectors fall neatly into classic primary, secondary and tertiary categories.

Where data are in constant dollars, the base year is pegged at 1985.

Following are more detailed definitions and descriptions of the types of economic activities covered under each of the nine sectors. Establishments are classified according to their predominant activity.

Agriculture, Fishing, Forestry and Hunting--Labeled

"Agriculture" in the research. This is typically considered a primary sector. It covers traditional agricultural and farming activities, livestock production, fish and aquatic animal (such as crocodiles and turtles) farms, and offshore and deep sea fishing.

<u>Mining and Quarrying</u>--Labeled "Quarrying" in the research. This is typically considered a primary sector. It is essentially the quarrying of granite and extraction of sand, clay and gravel.

<u>Manufacturing</u> This is typically considered a secondary sector. This is the industrial sector. It covers the gamut from light industries such as the canning of food and manufacturing of beverages, textiles and apparels, to heavy industries such as chemicals (including petroleum) and the repair of ships, railroad equipment, aircraft and other transport equipment. It also includes the manufacturing of glass and metal products, and electrical and electronic equipment. Printing and publishing are also in this sector.

<u>Electricity, Gas and Water</u>--Labeled "Utilities" in the research. This is typically considered a tertiary sector. This is a self-explanatory title. Singapore has agreements with Malaysia to purchase and sell electricity, natural gas and water.

<u>Construction</u> This is typically considered a secondary sector. This is the building sector and ranges from site preparation such as soil investigation to construction of the building. It includes finishing works such as tiling, plumbing, and installation of fire alarms, awning and solar control films.

Real estate management, and architectural and related services such as landscaping and interior decoration are not covered by this sector but by Business Services.

<u>Commerce</u> This is typically considered a tertiary sector. This is essentially the trade and tourism sector. It encompasses wholesale trade at the import and export level as well as retail trade such supermarkets and pharmacies. The tourism part of the sector covers hotels, restaurants and food outlets. Related to these, ship chandlers and air transport suppliers are included too.

<u>Transport, Storage and Communication</u>--Labeled "Transport" in the research. This is typically considered a tertiary sector.

As the title indicates, there are three broad sub-headings. The first covers air, land and sea transportation.

The second covers warehousing.

The third covers postal and telecommunications.

<u>Financial, Insurance, Real Estate and Business Services</u>--Labeled "Financial Business" in the research. This is typically considered a tertiary sector.

As the title suggests, there are four sub-sectors in this head. The first, financial, covers banks, stock and money broking houses.

The second covers both general and life insurance.

The third covers real estate management, architectural and technical services but not construction.

The final sub-head encompasses a wide range of services. It is intended to cover business services not classified elsewhere. A listing will indicate the range: legal services, accounting, information technology services, engineering, advertising, management and consulting agencies, equipment rental, news agencies, detective agencies, interior decoration, auctioneering, modeling and debt collection.

Community, Social and Other services--Labeled "Other Services" in the research. This is typically considered a tertiary sector.

There are four broad areas under this head. The first consists of government and government-related agencies. The executive, legislative and judicial arm of government comes under this head. Salaries are taken as indicators of value-added. Education and medical and health services are also under this head.

Under social services are recreational and cultural services such as cinemas, radio and television broadcasting, libraries, zoos, museums and amusement parks.

The third consists of personal services run the gamut from hairdressing and laundry, to the repair and servicing of vehicles and consumer goods to escort services, massage parlors and undertaking services.

The final head are international and other extra-territorial bodies. They cover foreign embassies and trade bodies, international organizations and foreign armed forces bases.

<u>Trade</u>--This combines two components: Imports and Exports.

<u>Imports</u>--There is no separate subsector for Imports.

<u>Exports</u>--There are two subsectors: Re-Exports and Domestic Exports.

<u>Re-Exports</u>--This is the entrepot sector where goods are imported but not processed, apart from breaking them into small packages and repackaging, before being exported.

<u>Domestic Exports</u>--This subsector covers goods that are processed and exported. Hence refined oil is considered a domestic export even though Singapore does not have a single oil well.

<u>Visitors</u>--This sector is intended to cover tourists. The statistics are compiled by the Singapore Tourist Promotion Board for the <u>Total</u> number of Visitors, and the number of those who arrive by <u>Air</u> and by <u>Sea</u>.

<u>Transit</u>--This covers airline passengers who transit in Singapore.

<u>Plane Landings</u>--This captures the number of plane landings.

APPENDIX B

Appendix B: Differencing

The first difference means that the residual is subtracted from each other such that the value in an earlier period is subtracted from the latter period. Below is an example of a series that has been differenced once:

```
        C1              C2
        1               *
        3               2
        8     -->       5
       12               4
        7              -5
```

Note that the second row of C2 contains 3 minus 1 and the second row of C2 contains 8 minus 3.

The purpose of differencing is to remove trends that may be present in the series. If there is a trend, then subtracting one value from another should remove it.)

APPENDIX C

Appendix C: Analysis of Calls

From Singapore to 15 Countries

Bold text indicates statistically significant results.

Table 10.1.--Indonesia

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;	2.817;	
Air Arrival Causes Phone	.265	.230	0.2619
Phone Causes Air Arrival	.679	.667	0.2056
Air ArrivalX Causes PhoneX	.267	.201	0.4952
PhoneX Causes Air ArrivalX	.043	.034	0.0517
Air Depart Causes Phone	.269	.230	0.2934
Phone Causes Air Depart	.721	.725	0.0800
Air DepartX Causes PhoneX	.299	.201	0.7689
PhoneX Causes Air DepartX	.069	.055	0.0827

Table 10.2.--Australia

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Domestic Export Causes Phone	.152	.130	0.1427
Phone Causes Domestic Export	.132	.082	0.3168
Domestic ExportX Causes PhoneX	.191	.139	0.3535
PhoneX Causes Domestic ExportX	.324	.226	0.7973
Export Causes Phone	.196	.130	0.4515
Phone Causes Export	.121	.071	0.3129
ExportX Causes PhoneX	.272	.139	1.0048
PhoneX Causes ExportX	.265	.158	0.8007
Import Causes Phone	.150	.130	0.1294
Phone Causes Import	.315	.205	0.8832
ImportX Causes PhoneX	.229	.139	0.6420
PhoneX Causes ImportX	.343	.242	0.8455
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.224	.148	0.3673
Phone Causes Visitors (Air)	.627	.460	1.6790
Visitors (Air)X Causes PhoneX	.292	.210	0.4343
PhoneX Causes Visitors (Air)X	.256	.045	1.0635
Visitors (Land) Causes Phone	.402	.148	1.5928
Phone Causes Visitors (Land)	.859	.833	0.6915
Visitors (Land)X Causes PhoneX	.318	.210	0.5938
PhoneX Causes Visitors (Land)X	.209	.083	0.5973
Visitors (Sea) Causes Phone	.440	.148	1.9554
Phone Causes Visitors (Sea)	.687	.672	0.1797
Visitors (Sea)X Causes PhoneX	.382	.210	1.0437
PhoneX Causes Visitors (Sea)X	.659	.647	0.1320
Visitors (Total) Causes Phone	.333	.148	1.0401
Phone Causes Visitors (Total)	.365	.092	0.6389
Visitors (Total)X Causes PhoneX	.325	.210	0.6389
PhoneX Causes Visitors (Total)X	.234	.034	0.9791

Table 10.3.--Canada

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Domestic Export Causes Phone	.177	.056	0.8086
Phone Causes Domestic Export	.489	.370	1.2808
Domestic ExportX Causes PhoneX	.267	.128	1.0430
PhoneX Causes Domestic ExportX	.207	.420	2.0198
Export Causes Phone	.240	.056	1.3316
Phone Causes Export	.530	.414	1.3574
ExportX Causes PhoneX	.337	.128	1.7338
PhoneX Causes ExportX	.572	.543	0.3727
Import Causes Phone	.190	.056	0.9099
Phone Causes Import	.493	.381	1.2150
ImportX Causes PhoneX	.228	.128	0.7124
PhoneX Causes ImportX	.507	.392	1.2830
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.380	.278	0.6169
Phone Causes Visitors (Air)	.736	.696	0.5682
Visitors (Air)X Causes PhoneX	.443	.384	0.3972
PhoneX Causes Visitors (Air)X	.241	.181	0.2964
Visitors (Land) Causes Phone	.307	.278	0.1569
Phone Causes Visitors (Land)	.869	.812	1.6317
Visitors (Land)X Causes PhoneX	.416	.384	0.2055
PhoneX Causes Visitors (Land)X	.570	.500	0.6105
Visitors (Sea) Causes Phone	.382	.278	0.6311
Phone Causes Visitors (Sea)	.514	.508	0.0463
Visitors (Sea)X Causes PhoneX	.443	.384	0.3972
PhoneX Causes Visitors (Sea)X	.314	.289	0.1367
Visitors (Total) Causes Phone	.397	.278	0.7400
Phone Causes Visitors (Total)	.294	.213	0.4302
Visitors (Total)X Causes PhoneX	.483	.384	0.7181
PhoneX Causes Visitors (Total)X	.303	.230	0.3928

Table 10.4.--France

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Domestic Export Causes Phone	.751	.679	1.5904
Phone Causes Domestic Export	.476	.240	2.4771
Domestic ExportX Causes PhoneX	.420	.280	1.3276
PhoneX Causes Domestic ExportX	.367	.242	1.0861
Export Causes Phone	.679	**5.890**	(.0022)
Phone Causes Export	.397	.323	0.6750
ExportX Causes PhoneX	.280	**3.752**	(.0179)
PhoneX Causes ExportX	.303	.177	0.9943
Import Causes Phone	.741	.679	1.3166
Phone Causes Import	.489	.365	1.3346
ImportX Causes PhoneX	.384	.280	0.9286
PhoneX Causes ImportX	.441	.401	0.3936
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.859	.763	**2.5532**
Phone Causes Visitors (Air)	.927	.89	1.9007
Visitors (Air)X Causes PhoneX	.454	.398	0.3846
PhoneX Causes Visitors (Air)X	.290	.146	0.7606
Visitors (Land) Causes Phone	.891	.763	**4.4037**
Phone Causes Visitors (Land)	.967	.958	1.0227
Visitors (Land)X Causes PhoneX	.410	.398	0.0763
PhoneX Causes Visitors (Land)X	.307	.157	0.8117
Visitors (Sea) Causes Phone	.792	.763	0.5228
Phone Causes Visitors (Sea)	.410	.250	1.0169
Visitors (Sea)X Causes PhoneX	.456	.398	0.3998
PhoneX Causes Visitors (Sea)X	.317	.237	0.4392
Visitors (Total) Causes Phone	.795	.763	0.5854
Phone Causes Visitors (Total)	.258	.101	0.7935
Visitors (Total)X Causes PhoneX	.501	.398	0.7740
PhoneX Causes Visitors (Total)X	.189	.008	0.5040

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Table 10.5.--Hong Kong

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Air Arrival Causes Phone	.365	.201	1.4205
Phone Causes Air Arrival	.723	.700	0.4567
Air ArrivalX Causes PhoneX	.378	.114	**2.3344**
PhoneX Causes Air ArrivalX	.233	.060	1.2405
Air Departure Causes Phone	.453	.201	**2.5338**
Phone Causes Air Departure	.392	.282	0.9951
Air DepartureX Causes PhoneX	.407	.114	**2.7175**
PhoneX Causes Air DepartureX	.137	.258	0.8969
Domestic Export Causes Phone	.316	.201	0.9247
Phone Causes Domestic Export	.389	.223	1.4943
Domestic ExportX Causes PhoneX	.223	.114	0.7716
PhoneX Causes Domestic ExportX	.350	.286	0.5415
Export Causes Phone	.350	.201	1.2608
Phone Causes Export	.455	.279	1.7761
ExportX Causes PhoneX	.306	.114	1.5216
PhoneX Causes ExportX	.257	.162	0.7032
Import Causes Phone	.476	.201	**2.8865**
Phone Causes Import	.643	.401	**3.7283**
ImportX Causes PhoneX	.529	.114	**4.8461**
PhoneX Causes ImportX	.404	.152	**2.3255**
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.522	.438	0.6590
Phone Causes Visitors (Air)	.959	.940	1.7378
Visitors (Air)X Causes PhoneX	.579	.339	2.1378
PhoneX Causes Visitors (Air)X	.427	.204	1.4594
Visitors (Land) Causes Phone	.502	.438	0.4819
Phone Causes Visitors (Land)	.905	.877	1.1053
Visitors (Land)X Causes PhoneX	.420	.339	0.5237
PhoneX Causes Visitors (Land)X	.393	.241	0.9390

Table 10.5.--cont'd

Visitors (Sea) Causes Phone	.535	.438	0.7823
Phone Causes Visitors (Sea)	.639	.300	**3.5215**
Visitors (Sea)X Causes PhoneX	.498	.339	1.1877
PhoneX Causes Visitors (Sea)X	.694	.485	**2.5613**
Visitors (Total) Causes Phone	.553	.438	0.9648
Phone Causes Visitors (Total)	.391	.135	1.5764
Visitors (Total)X Causes PhoneX	.547	.339	1.7219
PhoneX Causes Visitors (Total)X	.476	.217	1.8535

Table 10.6.--India

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Air Arrival Causes Phone	.163	.098	0.4271
Phone Causes Air Arrival	.412	.353	0.5519
Air ArrivalX Causes PhoneX	.285	.069	1.6615
PhoneX Causes Air ArrivalX	.165	.073	0.6060
Air Departure Causes Phone	.239	.098	1.0191
Phone Causes Air Departure	.725	.707	0.3600
Air DepartureX Causes PhoneX	.256	.069	1.3824
PhoneX Causes Air DepartureX	.212	.115	0.6770
Domestic Export Causes Phone	.179	.098	0.5426
Phone Causes Domestic Export	.226	.205	0.1492
Domestic ExportX Causes PhoneX	.153	.069	0.5383
PhoneX Causes Domestic ExportX	.279	.235	0.3356
Export Causes Phone	.198	.098	0.6858
Phone Causes Export	.183	.146	0.2491
ExportX Causes PhoneX	.161	.069	0.6031
PhoneX Causes ExportX	.292	.248	0.3418
Import Causes Phone	.448	.098	**3.4873**
Phone Causes Import	.354	.221	1.1324
ImportX Causes PhoneX	.428	.069	**3.4519**
PhoneX Causes ImportX	.506	.315	2.1265
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.234	.091	0.7001
Phone Causes Visitors (Air)	.725	.692	0.4500
Visitors (Air)X Causes PhoneX	.312	.062	1.3626
PhoneX Causes Visitors (Air)X	.242	.178	0.3166
Visitors (Land) Causes Phone	.103	.091	0.0502
Phone Causes Visitors (Land)	.525	.345	1.3144
Visitors (Land)X Causes PhoneX	.209	.062	0.6969
PhoneX Causes Visitors (Land)X	.464	.197	1.8680

Table 10.6.--cont'd

Visitors (Sea) Causes Phone	.240	.091	0.7352
Phone Causes Visitors (Sea)	.321	.213	0.5965
Visitors (Sea)X Causes PhoneX	.166	.062	0.4676
PhoneX Causes Visitors (Sea)X	.313	.146	0.9166
Visitors (Total) Causes Phone	.304	.091	1.1476
Phone Causes Visitors (Total)	.248	.211	0.1845
Visitors (Total)X Causes PhoneX	.344	.062	1.6120
PhoneX Causes Visitors (Total)X	.237	.216	0.1032

Table 10.7.--Italy

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Domestic Export Causes Phone	.632	.297	**5.0068**
Phone Causes Domestic Export	.353	.297	0.4760
Domestic ExportX Causes PhoneX	.394	.078	**2.8680**
PhoneX Causes Domestic ExportX	.271	.172	0.7469
Export Causes Phone	.580	.297	**3.7060**
Phone Causes Export	.314	.261	0.4249
ExportX Causes PhoneX	.359	.078	**2.4111**
PhoneX Causes ExportX	.344	.209	1.1319
Import Causes Phone	.407	.297	1.0202
Phone Causes Import	.508	.371	1.5315
ImportX Causes PhoneX	.166	.078	0.5803
PhoneX Causes ImportX	.585	.432	2.0277
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.530	.337	1.5399
Phone Causes Visitors (Air)	.934	.909	1.4205
Visitors (Air)X Causes PhoneX	.315	.095	1.2044
PhoneX Causes Visitors (Air)X	.425	.250	1.1413
Visitors (Land) Causes Phone	.463	.337	0.8799
Phone Causes Visitors (Land)	.913	.886	1.1638
Visitors (Land)X Causes PhoneX	.325	.095	1.2778
PhoneX Causes Visitors (Land)X	.477	.441	0.2581
Visitors (Sea) Causes Phone	.448	.337	0.7541
Phone Causes Visitors (Sea)	.563	.110	**3.8873**
Visitors (Sea)X Causes PhoneX	.555	.095	**3.8764**
PhoneX Causes Visitors (Sea)X	.504	.068	**3.2964**
Visitors (Total) Causes Phone	.485	.337	1.0777
Phone Causes Visitors (Total)	.399	.311	0.5491
Visitors (Total)X Causes PhoneX	.335	.095	1.3534
PhoneX Causes Visitors (Total)X	.275	.051	1.1586

Table 10.8.--Japan

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;	2.817;	
Air Arrival Causes Phone	.280	.153	0.9701
Phone Causes Air Arrival	.725	.656	1.3800
Air ArrivalX Causes PhoneX	.433	.141	**2.8325**
PhoneX Causes Air ArrivalX	.474	.321	1.5998
Air Departure Causes Phone	.311	.153	1.2612
Phone Causes Air Departure	.710	.666	0.8345
Air DepartureX Causes PhoneX	.339	.141	1.6475
PhoneX Causes Air DepartureX	.326	.150	1.4362
Domestic Export Causes Phone	.198	.153	0.3086
Phone Causes Domestic Export	.275	.151	0.9407
Domestic ExportX Causes PhoneX	.246	.141	0.7659
PhoneX Causes Domestic ExportX	.353	.257	0.7966
Export Causes Phone	.195	.153	0.2870
Phone Causes Export	.265	.145	0.8980
ExportX Causes PhoneX	.247	.141	0.7742
PhoneX Causes ExportX	.319	.228	0.7349
Import Causes Phone	.264	.153	0.8295
Phone Causes Import	.446	.109	**3.3457**
ImportX Causes PhoneX	.334	.141	1.5938
PhoneX Causes ImportX	.433	.096	**3.2690**
Critical Values F4,15 (p<.10;p<.05)	2.3615;	3.0556	
Visitors (Air) Causes Phone	.117	.175	-0.2463
Phone Causes Visitors (Air)	.956	.935	1.7898
Visitors (Air)X Causes PhoneX	.213	.136	0.3669
PhoneX Causes Visitors (Air)X	.515	.255	2.0103
Visitors (Land) Causes Phone	.209	.175	0.1612
Phone Causes Visitors (Land)	.848	.820	0.6908
Visitors (Land)X Causes PhoneX	.182	.136	0.2109
PhoneX Causes Visitors (Land)X	.511	.433	0.5982

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Table 10.8.--cont'd

Visitors (Sea) Causes Phone	.179	.175	0.0183
Phone Causes Visitors (Sea)	.817	.748	1.4139
Visitors (Sea)X Causes PhoneX	.170	.136	0.1536
PhoneX Causes Visitors (Sea)X	.538	.457	0.6575
Visitors (Total) Causes Phone	.149	.175	-0.1146
Phone Causes Visitors (Total)	.505	.213	2.2121
Visitors (Total)X Causes PhoneX	.175	.136	0.1773
PhoneX Causes Visitors (Total)X	.564	.343	1.9008

Table 10.9.--Netherlands

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Air Arrival Causes Phone	.599	.238	**4.9514**
Phone Causes Air Arrival	.885	.866	0.9087
Air ArrivalX Causes PhoneX	.109	.125	-0.0988*
PhoneX Causes Air ArrivalX	.202	.154	0.3308
Air Departure Causes Phone	.598	.238	**4.9254**
Phone Causes Air Departure	.842	.815	0.9399
Air DepartureX Causes PhoneX	.166	.125	0.2704
PhoneX Causes Air DepartureX	.242	.147	0.6893
Domestic Export Causes Phone	.249	.238	0.0806
Phone Causes Domestic Export	.352	.237	0.9761
Domestic ExportX Causes PhoneX	.159	.125	0.2224
PhoneX Causes Domestic ExportX	.406	.389	0.1574
Export Causes Phone	.308	.238	0.5564
Phone Causes Export	.366	.145	1.9172
ExportX Causes PhoneX	.204	.125	0.5459
PhoneX Causes ExportX	.373	.211	1.4211
Import Causes Phone	.282	.238	0.3370
Phone Causes Import	.428	.247	1.7404
ImportX Causes PhoneX	.156	.125	0.2020
PhoneX Causes ImportX	.446	.340	1.0523
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.632	.175	4.6569
Phone Causes Visitors (Air)	.921	.906	0.7120
Visitors (Air)X Causes PhoneX	.313	.097	1.1790
PhoneX Causes Visitors (Air)X	.183	.114	0.3167
Visitors (Land) Causes Phone	.500	.175	**2.4375**
Phone Causes Visitors (Land)	.901	.861	1.5152
Visitors (Land)X Causes PhoneX	.314	.097	1.1862
PhoneX Causes Visitors (Land)X	.387	.286	0.6179

Table 10.9.--cont'd

Visitors (Sea) Causes Phone	.222	.175	0.2265
Phone Causes Visitors (Sea)	.304	.264	0.2155
Visitors (Sea)X Causes PhoneX	.341	.097	1.3885
PhoneX Causes Visitors (Sea)X	.463	.384	0.5517
Visitors (Total) Causes Phone	.183	.175	0.0367
Phone Causes Visitors (Total)	.201	.162	0.1830
Visitors (Total)X Causes PhoneX	.313	.097	1.1790
PhoneX Causes Visitors (Total)X	.233	.151	0.4009

* The F-value should not be negative. The negative sign is an indication of problems in the model. In this case, a positive F-value was obtained when the fourth lag was dropped but the result was in the order of smaller than 0.2, a statistically insignificant result.

Table 10.10.--Philippines

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Air Arrival Causes Phone	.427	.185	**2.3229**
Phone Causes Air Arrival	.626	.692	1.2222
Air ArrivalX Causes PhoneX	.268	.069	1.4952
PhoneX Causes Air ArrivalX	.312	.194	0.9433
Air Depart Causes Phone	.284	.185	0.7605
Phone Causes Air Depart	.842	.837	0.1741
Air DepartX Causes PhoneX	.165	.069	0.6323
PhoneX Causes Air DepartX	.080	.057	0.1375
Import Causes Phone	.255	.185	0.5168
Phone Causes Import	.412	.549	1.6707
ImportX Causes PhoneX	.147	.069	0.5029
PhoneX Causes ImportX	.513	.487	0.2936

Table 10.11.--South Korea

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Domestic Export Causes Phone	.226	.121	0.7461
Phone Causes Domestic Export	.466	.252	2.2041
Domestic ExportX Causes PhoneX	.354	.269	0.7237
PhoneX Causes Domestic ExportX	.505	.292	**2.3667**
Export Causes Phone	.201	.121	0.5507
Phone Causes Export	.379	.181	1.7536
ExportX Causes PhoneX	.302	.269	0.2600
PhoneX Causes ExportX	.181	.432	**2.4305**
Import Causes Phone	.401	.121	**2.5710**
Phone Causes Import	.473	.357	1.2106
ImportX Causes PhoneX	.424	.269	1.4800
PhoneX Causes ImportX	.363	.246	1.0102

Table 10.12.--Taiwan

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Domestic Export Causes Phone	.334	.233	0.8341
Phone Causes Domestic Export	.472	.360	1.1667
Domestic ExportX Causes PhoneX	.387	.288	0.8883
PhoneX Causes Domestic ExportX	.395	.356	0.3545
Export Causes Phone	.273	.233	0.3026
Phone Causes Export	.432	.291	1.3653
ExportX Causes PhoneX	.389	.288	0.9092
PhoneX Causes ExportX	.414	.353	0.5725
Import Causes Phone	.338	.233	0.8724
Phone Causes Import	.421	.273	1.4059
ImportX Causes PhoneX	.512	.288	**2.5246**
PhoneX Causes ImportX	.430	.287	1.3798
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.346	.139	1.1869
Phone Causes Visitors (Air)	.761	.731	0.4707
Visitors (Air)X Causes PhoneX	.258	.185	0.3689
PhoneX Causes Visitors (Air)X	.195	.024	0.7966
Visitors (Land) Causes Phone	.543	.139	**3.3151**
Phone Causes Visitors (Land)	.613	.449	1.5891
Visitors (Land)X Causes PhoneX	.509	.185	**2.4745**
PhoneX Causes Visitors (Land)X	.283	.045	1.2448
Visitors (Sea) Causes Phone	.333	.139	1.0907
Phone Causes Visitors (Sea)	.409	.307	0.6472
Visitors (Sea)X Causes PhoneX	.397	.185	1.3184
PhoneX Causes Visitors (Sea)X	.595	.547	0.4444
Visitors (Total) Causes Phone	.349	.139	1.2097
Phone Causes Visitors (Total)	.247	.137	0.5478
Visitors (Total)X Causes PhoneX	.267	.185	0.4195
PhoneX Causes Visitors (Total)X	.240	.061	0.8832

Table 10.13.--West Germany

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Domestic Export Causes Phone	.386	.259	1.1376
Phone Causes Domestic Export	.426	.161	**2.5392**
Domestic ExportX Causes PhoneX	.278	.252	0.1981
PhoneX Causes Domestic ExportX	.733	.505	**4.6966**
Export Causes Phone	.448	.259	1.8832
Phone Causes Export	.493	.109	**4.1657**
ExportX Causes PhoneX	.261	.252	0.0670
PhoneX Causes ExportX	.670	.249	**7.0167**
Import Causes Phone	.419	.259	1.5146
Phone Causes Import	.530	.154	**4.4000**
ImportX Causes PhoneX	.308	.252	0.4451
PhoneX Causes ImportX	.502	.283	**2.4187**
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.480	.197	2.0409
Phone Causes Visitors (Air)	.691	.680	0.1335
Visitors (Air)X Causes PhoneX	.383	.094	1.7565
PhoneX Causes Visitors (Air)X	.260	.184	0.3851
Visitors (Land) Causes Phone	.506	.197	**2.3456**
Phone Causes Visitors (Land)	.949	.920	2.1324
Visitors (Land)X Causes PhoneX	.300	.094	1.1036
PhoneX Causes Visitors (Land)X	.554	.109	**3.7416**
Visitors (Sea) Causes Phone	.554	.197	**3.0017**
Phone Causes Visitors (Sea)	.671	.645	0.2964
Visitors (Sea)X Causes PhoneX	.242	.094	0.7322
PhoneX Causes Visitors (Sea)X	.414	.280	0.8575
Visitors (Total) Causes Phone	.425	.197	1.4870
Phone Causes Visitors (Total)	.291	.165	0.6664
Visitors (Total)X Causes PhoneX	.292	.094	1.0487
PhoneX Causes Visitors (Total)X	.281	.209	0.3755

Table 10.14.--United Kingdom

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;	2.817;	
Air Arrival Causes Phone	.353	.085	**2.2782**
Phone Causes Air Arrival	.970	.968	0.3667
Air ArrivalX Causes PhoneX	.306	.071	1.8624
PhoneX Causes Air ArrivalX	.249	.202	0.3442
Air Departure Causes Phone	.266	.085	1.3563
Phone Causes Air Departure	.872	.859	0.5586
Air DepartureX Causes PhoneX	.173	.071	0.6784
PhoneX Causes Air DepartureX	.184	.061	0.8290
Domestic Export Causes Phone	.278	.085	1.4702
Phone Causes Domestic Export	.213	.095	0.8247
Domestic ExportX Causes PhoneX	.346	.071	**2.3127**
PhoneX Causes Domestic ExportX	.157	.083	0.4828
Export Causes Phone	.178	.085	0.6223
Phone Causes Export	.360	.217	1.2289
ExportX Causes PhoneX	.239	.071	1.2142
PhoneX Causes ExportX	.372	.247	1.0947
Import Causes Phone	.189	.085	0.7053
Phone Causes Import	.418	.267	1.4270
ImportX Causes PhoneX	.157	.071	0.5611
PhoneX Causes ImportX	.449	.484	0.3731
Critical Values F4,15 (p<.10;p<.05)	2.3615;	3.0556	
Visitors (Air) Causes Phone	.193	.172	0.0976
Phone Causes Visitors (Air)	.960	.931	**2.7187**
Visitors (Air)X Causes PhoneX	.287	.184	0.5417
PhoneX Causes Visitors (Air)X	.087	.426	2.2147
Visitors (Land) Causes Phone	.425	.172	1.6500
Phone Causes Visitors (Land)	.953	.913	**3.1915**
Visitors (Land)X Causes PhoneX	.443	.184	1.7437
PhoneX Causes Visitors (Land)X	.555	.121	**3.6573**

Table 10.14.--cont'd

Visitors (Sea) Causes Phone	.475	.172	2.1643
Phone Causes Visitors (Sea)	.530	.267	2.0984
Visitors (Sea)X Causes PhoneX	.396	.184	1.3162
PhoneX Causes Visitors (Sea)X	.775	.473	**5.0333**
Visitors (Total) Causes Phone	.254	.172	0.4122
Phone Causes Visitors (Total)	.492	.082	**3.0266**
Visitors (Total)X Causes PhoneX	.280	.184	0.5000
PhoneX Causes Visitors (Total)X	.418	.040	**2.4356**

Table 10.15.--USA

	Unrestr R-Sq	Restr R-Sq	F Value
Critical Values F4,22 (p<.10;p<.05)	2.219;2.817;		
Domestic Export Causes Phone	.230	.108	0.8714
Phone Causes Domestic Export	.289	.229	0.4641
Domestic ExportX Causes PhoneX	.331	.248	0.6824
PhoneX Causes Domestic ExportX	.253	.220	0.2430
Export Causes Phone	.236	.108	0.9215
Phone Causes Export	.254	.175	0.5824
ExportX Causes PhoneX	.335	.248	0.7195
PhoneX Causes ExportX	.182	.164	0.1210
Import Causes Phone	.235	.108	0.9131
Phone Causes Import	.558	.384	2.2025
ImportX Causes PhoneX	.300	.248	0.4086
PhoneX Causes ImportX	.530	.392	1.6149
Critical Values F4,15 (p<.10;p<.05)	2.3615;3.0556		
Visitors (Air) Causes Phone	.547	.387	1.3245
Phone Causes Visitors (Air)	.927	.889	1.9521
Visitors (Air)X Causes PhoneX	.532	.341	1.5304
PhoneX Causes Visitors (Air)X	.223	.346	0.7053
Visitors (Land) Causes Phone	.548	.387	1.3357
Phone Causes Visitors (Land)	.443	.299	0.9695
Visitors (Land)X Causes PhoneX	.614	.341	**2.6522**
PhoneX Causes Visitors (Land)X	.437	.304	0.8859
Visitors (Sea) Causes Phone	.536	.387	1.2042
Phone Causes Visitors (Sea)	.754	.729	0.3811
Visitors (Sea)X Causes PhoneX	.504	.341	1.2324
PhoneX Causes Visitors (Sea)X	.539	.326	1.7326
Visitors (Total) Causes Phone	.562	.387	1.4983
Phone Causes Visitors (Total)	.260	.214	0.2331
Visitors (Total)X Causes PhoneX	.545	.341	1.6813
PhoneX Causes Visitors (Total)X	.280	.197	0.4323

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