THE PATTERNS OF CONSTRUCTION INVESTMENT AND ECONOMIC DEVELOPMENT : INTERNATIONAL CROSS SECTIONAL ANALYSIS

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Introduction

The construction sector plays a crucial role in economy by initiating, promoting, and fostering economic growth. It provides means of production and services, transport facilities, and housing and leisure facilities. It also contributes to the accumulation of capital which is one of the pre-requites for economic growth and an improved standard of living.

However, one of the characteristics of construction sector is that it, as a policy tool, influences general economic stability heavily especially in short-run perspectives. Due to the very nature, it is very sensitive to economic fluctuation in counter-business cycle manner.

Though ups-and-downs of construction sector are severer than other sector in short run, a country has its own capacity to execute construction investment. Therefore, long-term projections and perspective plans should be prepared to control short-tern fluctuations and to achieve long-run economic stability. For these purposes, it is crucial to decide overall level of construction investment, where to invest, and for what purpose as a policy guideline. For these objectives, the share of investment of national income and the distribution of various investment purpose should be estimated. It is known

that the level and the distribution of investment depend upon each country's social and economic situations, i. e., the level of GNP, the level of capital accumulation, social values.

Considering such divergency of levels of construction investment, the purpose of this study is to examine whether there exists any regular pattern in construction investment in relation with the level of economic development, and a step further to suggest a guideline for the level of construction investment which can be applicable for all countries.

Previous Studies

Studies on the pattern of construction investment are scanty. Wells (1986) analysed the construction investment patterns of developing countries by matching share of construction sector's value-added in GDP with the level of economic growth. The study found that the level of construction investment increases as income level rises. However, the analysis is limited to the case of developing countries. It is not applicable to all countries. Furthermore, the results can be interpreted in many ways. The poor goodness of fit (though the study did not show the regression results in details) can be explained in terms of the characteristics of developing countries. Most of developing countries are agrarian societies with low levels of income.

Many countries have experienced social-political unstability which brings about policy inconsistency. Consequently, the construction investment in LDCs reveals wide variation with respect to income level, and the goodness of fit is poor. However, Wells' analysis on individual country shows that the growth rate of construction output is greater and faster than that of GDP in the case of developing countries. This invites a question on the global investment pattern. The question is whether the construction investment trend of developing countries follow that of developed countries. In other words, patterns of construction investment has any regularity which can be applicable to all countries. Furthermore, according to Wells' study, construction output grows at an even faster rate as income rises, and the rate

of growth of construction output is the fastest as countries pass through middle-income range.

By extending this trend, we can expect that the growth rate becomes lower in the case of developed countries. Such relationship was derived by many development economists. According to Chenery and Tayor (1968), there exists uniform patterns of change in the structure of production as income rises. The question to be answered is that whether the pattern is equally applicable to construction sector.

Model

Assumption

This study is based on the assumption that the relationships of construction investment as percentage of GDP and income level observed between countries at different income levels at a fixed point of time, also occur within any one country, over a period of time. This assumption is quite plausible because it reflects reality. In fact it is an usual assumption in development economics including the Wells' study.

Hypotheses

There are two hypotheses to be examed by this study as follows.

Hypothesis 1: There are uniform patterns of change in the structure of construction investment as income levels rise. In particular, the share of construction investment in GDP increases during the early stage of economic development and decreases after certain level of economic maturity. Therefore, the relationship between the share of construction investment and the levels of income is expected to be negative hyperbolic (bell-shaped)

Hypothesis 2: Investment patterns on residential building and other construction (non-residential building and civil engineering investment) have similar patterns with total construction investment. However, investment on other construction reaches its peak earlier that investment of residential buildings. This hypothesis stems from the nature of sectoral investment in construction. Since investment on non-residential buildings and civil engineering, as reproducible fixed capital, are prerequisites for economic growth, investment distribution decision of available fund is generally directed toward these types. On the contrary, the investment on residential buildings will be increased when an economy achieves certain level of development and demand of housing service emerges.

Approach

Based on the assumptions and hypotheses, this paper tries to generalize the construction investment patterns through historical studies of all countries. Countries can be classified by income level and treated separately, i. e., advanced and developing countries. Comparison among countries at different income levels may suggest structural differences of construction investment at different stage of development. In particular this paper classifies countries into two categories -- OECD and non-OECD countries.

Model

Data and Variables

Data

Data on the construction is available for many countries in the United Nations Yearbook of National Accounts Statistics. The book provides information on the stocks of reproducible fixed assets by type for selected countries. This data represents the level of fixed asset accumulation and presumably affects the level of construction investment. For international

comparisons, per capita income in US dollar term which is also available in the book (analysis of Main Aggregates) is employed. This paper adopts current term rather than constant term because ratio (percentage of construction investment in GDP) and per capita income of every year will be the main variables.

In this paper, construction investments consist of investment on residential buildings, non-residential buildings, and other construction and land improvement. Each item can be found in gross fixed capital formation classified by kind of activity. However, this paper treats investment on non-residential buildings as other construction considering the characteristics and roles of these types of investment.

Variables

- Dependent Variables

Dependent variables in regression equations are the shares of the three major components of construction investment in GDP.

X_i^T = share of total construction investment in GDP of ith country
X_i^H = share of housing construction investment in GDP of ith country
X_i^o = share of other construction investment in GDP of ith country

- Explanatory Variables

Since main purpose of this study is to identify uniformity of construction investment by income levels, the principle explanatory variable is GNP per capita of each country.

y_i = per capita GNP of ith country

The remaining variation in the share of construction investment is attributed to forces specific to each country.

Model

The relationship between the share of construction investment to the level of economic development can be derived by modelling following functional form.

$$X_I^T = f(yi) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

In the presence of OECD member country dummy, the equation (1) can be rewritten as

$$X_i^T = f(yi, D) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

where D=1 if a country is OECD member and D=0 if a country is non-OECD member.

In modelling procedure, various models are tested in order to derive true functional form of construction investment pattern. The investment pattern of Chennery and Taylor type which focuses on the economic structure as a whole was attempted. Their model assumed that 1) the share of investment to GDP increases until income level reaches certain level (y*), and 2) the share decreases when income level beyond y*. Therefore, their model implies a quadratic equation which is symetric of y*, i. e., the increasing rate of investment to GDP is the same as deceasing rate in terms of income levels. This is not a plausible assumption in the case of construction investment. Considering the nature of construction sector, the growth rate of construction investment in the early stage of economic growth could be accelerated in order to satisfy prerequisites of economic growth, and would be decelerated when a country accumulates such capital at certain degree at higher income. Judging from residual plots, the relationship between the share of

construction investment and per capita income level is a cubic equation, rather than a quadratic equation as expressed in equation (3).

$$X_i^T = \alpha_0 + \alpha_1 y_i + \alpha_2 y_i^2 + \alpha_3 y_i^3 + e \quad \text{.. .....(3)}$$

Where the α_i is an error term. The same functional forms are expected in the case of both investments on residential buildings and other construction. However, it is expected that the difference between the two types of investment may exist in terms of time and degree of investment. Thus, models for the two types of investment to be estimated have the same functional forms, as represented in equation (4) and (5), respectively.

$$X_i^H = \beta_0 + \beta_1 y_i + \beta_2 y_i^2 + \beta_3 y_i^3 + e \quad \text{.. ..(4)}$$

$$X_i^O = \gamma_0 + \gamma_1 y_i + \gamma_2 y_i^2 + \gamma_3 y_i^3 + e \quad \text{.. .....(5)}$$

Findings

Total Construction Investment

The relationship between total construction investment and income level using equation (1) and (2) is shown in Table 1.

Table 1. The Total Construction Investment

	Model 1-A		Model 1-B	
Variable	Coefficient	p-value	coefficient	p-value
constant	0.067847	0.0001	0.059639	0.0001
yi	0.010626	0.0002	0.008668	0.0001
y^2	-0.000810	0.0023	-0.000824	0.0001
y^3	0.000018	0.0080	0.000019	0.0001
OECD			0.036624	0.0001

	R^2=0.0595	R^2=0.6811

The shape of estimated function shows that construction investment grows explosively in the early stage of economic development. The result tells us that all coefficients in the model 1-A and Model 1-B are statistically significant at any significant level. Especially, the R-square value of the Model 1-B is significantly higher than that of Model 1-A. This finding implies that there exists a structural difference between OECD member countries and non-member countries. Since in this case the coefficients measure the deviation from the omitted category, it can be said that the OECD countries invest more to construction sector.

The share of construction investment to GDP in relation with income levels show wide variations, especially in developing countries. This may be due to the structural characteristics of developing countries. Two examples may suffice; 1) high proportion of informal sector (self-help, unpaid labor) which is not included in official statistics, and 2) unstable socio-political environment which causes policy inconsistency. The result is fairly consist with Wells' findings. Despite the wide range of fluctuation, rapid expansion of construction investment share implies the need to put more resources to construction sector in the early stage of development. This tendency can be explained be two aspects of construction investment; growth-initiating and growth dependent construction investment. The growth-initiating construction means investment which is essential for economic development, such as investment for industrialization and basic infrastructure. The growth-dependent construction means investment which satisfies people's demand for living, such as housing. These two factors together accelerate construction investment in this stage of growth.

Housing Investment

The relationship between investment on residential buildings and income level using equation (3) comes out to be as shown in Table 2.

Table 2. Housing Investment

	Model 1-A		Model 1-B	
Variable	coefficient	p-value	coefficient	p-value
constant	0.033218	0.0001	0.03312	0.0001
yi	0.005774	0.0001	0.00575	0.0001
y^2	-0.000429	0.0001	-0.000430	0.0001
y^3	0.000009	0.0001	0.000009	0.0001
OECD			0.000446	0.5523
	R^2=0.1536		R^2=0.1545	

As is shown, the dummy variable does not affect results in terms of coefficient values and R-square value. The overall pattern is similar with total construction investment. However, the maximum share appears at income level US$9,000-10,000 which is later than the peak of the total construction investment.

This pattern stems from the nature of housing demand in relation with income levels. The housing service is known as normal goods, and housing demand is not a direct demand but a derived demand. The investment priority tend to be given to this sector when a country achieves certain level of income. The share of housing investment is fairly stable at around 5% when economies are matured. The stability may be maintained partly because population growth rate keep stable and partly because economy itself keep stable.

Other Construction Investment

The relationship between investment on other construction (non-residential buildings and land improvement) income level using equation (3) comes out to be as shown in Table 3.

Table 3. Other Construction Investment

	Model 1-A		Model 1-B	
Variable	coefficient	p-value	coefficient	p-value
constant	0.024061	0.0001	0.023277	0.0001
yi	0.008021	0.0001	0.007834	0.0001
y^2	-0.000618	0.0001	-0.000619	0.0001
y^3	0.000014	0.0001	0.000014	0.0001
OECD			0.003497	0.0001
	R^2=0.2282		R^2=0.2643	

The overall pattern is similar with total and residential investment. However, the maximum share appears at income level lower than the peak of total and housing investment. This is due to the nature of other construction -- growth-initiating investment.

Summary

This study begs further examination and analysis for better fit. However following results are important enough to emphasize again.

First, there exists uniform pattern of construction investment in accordance with the level of economic development. Furthermore, construction investments are accelerated during the early stage of economic development and slowed down as countries pass certain level of income.

Second, similar investment patterns are identified for the residential buildings and other constructions. More importantly, construction investment for the residential buildings reaches its highest level later than total construction investment.

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Source of Data

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