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ABSTRACT

FLUCTUATIONS IN FOREIGN EXCHANGE RESERVES AND IN THE VOLUME OF CONSTRUCTION: THE SIMILARITY BETWEEN INDUSTRIALIZED AND NON-INDUSTRIALIZED COUNTRIES IN 1870-1914 AND THEIR DIVERGENCE IN 1955-1968

By

Thomas C. Edens

This thesis examines the relationship between building cycles of industrialized and non-industrialized nations. Two time periods are analyzed. During the 1870-1914 period the building cycles of the industrialized and non-industrialized countries were inversely related. This relationship was reversed by the time of the Korean War; the building cycles of the developed and less developed countries were in phase after this period. During the pre-World War I period, domestic construction activity in both the industrialized and non-industrialized nations was not well protected from foreign exchange reserve fluctuations. By 1955, the developed countries had managed to keep their total domestic construction from fluctuating passively with foreign exchange levels. However, the construction of dwellings in these countries was still strongly influenced by external shocks. This sensitivity is due primarily to the nature of financial institutions which affect the private sector.

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In the less developed countries, the opposite pattern is observed for the 1955-68 period. Total construction is not protected from external movements in exchange reserves while the construction of dwellings is less affected on balance. This pattern is due to the inability of governments in the less developed countries to maintain construction spending when fluctuations in the foreign exchange reserve positions force changes in fiscal and monetary policy. The construction of dwellings is protected rather well because most of the funds needed for home building are not public or secured in private financial markets. In most cases, the purchaser must rely on his own accumulated wealth for the purchase of a home. Thus this sector is less affected by domestic interest rates and the availability of credit.

A cross-sectional-time-series pooled statistical test is used to evaluate the model. The basic hypothesis that construction in non-industrialized countries is positively more sensitive to foreign exchange reserve fluctuations than construction in the industrialized countries is supported.

The development of more sophisticated financial intermediaries especially designed to supply funds for housing construction appears promising for employment and better living conditions in the developing countries but may raise the instability of the construction sector. More frequent

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adjustment of exchange rates will help to lessen exchange reserve and monetary fluctuations if the relative export and import elasticities are favorable. The domestic economy, especially construction, would thus be spared unnecessary contractions.

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For Mary, Russ and Chris

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CHAPTER I

INTRODUCTION

The share of construction activity in Gross National Product (GNP) varies with the level of total output of a country. According to Kuznets, in countries with per capita GNP in the \$100-\$400 range, construction accounted for 8.5 per cent of Gross Domestic Product (GDP) in the early 1950's. In countries within the range of \$650 to \$1000, the share of construction was 11 per cent.¹ In the \$1700 per capita income range it was nearly 12 per cent of GDP. For 1955-1964, Strassmann found that gross construction as a proportion of GDP averaged 8 per cent for underdeveloped countries and 11.7 per cent for the developed group. He found housing construction as a per cent of GDP to be 2.5 per cent for the underdeveloped group, 4.6 per cent for middle income countries and 4.4 per cent for developed countries.²

Residential building alone in the United States comprises

¹Kuznets, Simon, "Quantitative Aspects of the Economic Growth of Nations, Part V. Capital Formation Proportions: International Comparisons for Recent Years", Economic Development and Cultural Change, July, 1960, Part II, pp. 4, 33.

²Strassmann, W. P., "The Construction Sector in Economic Growth", Scottish Journal of Economics, November, 1970, Table II, Lines 5 and 7, p. 401.

between 20 and 30 per cent of gross investment.³

Building is one of the largest and most widespread of all industries. It ramifies from the brick-making, timber, cement, steel and other building material at the one end into the plastering, plumbing and painting trades at the other, and it sets the pace for a wide range of industries.⁴

Coupled with the overall significance of the construction industry in the economy is the fact that it is characterized by large fluctuations, especially in the housing construction sector. According to Clark and Cohen, "...fluctuations in housing expenditures represent one of the major sources of instability in the (U.S.) economy".⁵ The impact of this sector in other countries is also very important.

Until recently, construction was usually treated as dependent only on investment. Economic planners in India called housing construction 'social services'. The remainder of the construction sector falls under miscellaneous categories and is subsumed in the total cost figures of the appropriate industrial sector.⁶ The problem with this type

³O'Leary, P. J., and Lewis, W. A., "Secular Swings in Production and Trade" in Grodon and Klein (ed), AEA Readings in Business Cycles, Volume X, Irwin, Homewood, Ill., 1965, p. 550

⁴Cairncross, A. K., Home and Foreign Investment: 1870-1913, Studies in Capital Accumulation, Cambridge University Press, London, 1953, p. 12.

⁵Clark and Cohen, Business Fluctuations, Growth, and Economic Stabilization, Random House, New York, 1963, p. 60.

⁶Lewis, John P., Quiet Crisis in India, Doubleday and Company, New York, 1964, p. 87.

of classification is that it disguises the construction sector and prevents observers from viewing the interaction of construction with other important variables in the economy. Incomplete and inaccurate reporting in the less developed nations is partially to blame for the poor statistics. Only in the past two decades has the United Nations compiled reliable estimates of the disaggregated data in some of the poorer countries. In others, it is still impossible to find reliable figures.

In the 1950's and 60's, efforts were made in the more highly developed countries to list separately the main components of the construction sector in order to study the 'cyclical' trends and to ascertain the direction of causation between fluctuations in the construction sector and the general business cycle. Over the past two decades, emphasis on the construction sector as a separate entity has developed. Currie, for example, singled out the housing and construction sector as an important ingredient in development.⁷

The empirical work of Kuznets⁸ and the theoretical investigations into capital formation by Nurkse⁹ and Cairncross¹⁰

⁷Currie, Lauchlin, Accelerating Development, McGraw-Hill, New York, 1966.

⁸Kuznets, op. cit.

⁹Nurkse, Ragnar, Problems of Capital Formation in Underdeveloped Countries, Oxford Press, New York, 1953.

¹⁰Cairncross, A. K., op. cit.

have furthered this trend toward the analysis of less aggregated data and have called into question the alleged direction of causality. Certainly the rapid influx of rural residents to the center cities which has been observed in most countries provided the stimulus for deeper analysis of the construction sector. The attendant pressures of massive unemployment and the spread of sub-standard housing reinforced the need for further investigation.

In Chapter II I shall review some of the older notions concerning the nature and magnitude of building cycles and introduce some new variables which are relevant in explaining the direction of causation.

It will be shown that the building cycles experienced by the industrial nations were inversely related during the 1870-1913 period. This relationship was reversed by the time of the Korean War. The building cycles of high and low income nations are directly related in the 1955-68 period.

In Chapters III and IV a model will be introduced to analyze those factors which account for the reversal in the building cycle relationship between the rich and poor countries. Stress is placed on fluctuations in foreign exchange reserves in the high and low income countries and on policies which might allow nations to protect domestic construction from fluctuations in external reserve holdings.

Chapter V is devoted to testing the model. In Chapter VI, the empirical results will be presented. Finally, in

Chapter VII, the conclusions stemming from the empirical work will be advanced.

CHAPTER II

REVIEW OF PREVIOUS STUDIES

Introduction

There are two sections in Chapter II. In Part I we shall consider the building cycles of individual countries and review some of the previous studies which were concerned with this question.

Part II is concerned with the relationship between the building cycles of several countries. Previous work in this area will be discussed and an attempt will be made to isolate the key variables which influence international building cycles.

The focus of interest is the total construction sector and the construction of dwellings. There is reason to suspect that these two sectors do not respond the same to changes in external reserve positions. This point will be discussed in more detail later.

National Building Cycles

The uniqueness of the fluctuations or cycles in the construction industry is generally appreciated. Paldam states that there are two conspicuous factors with regard to the construction sector. First, "...the swings are indeed very considerable..." and second, "...they do not follow the

general business cycle very consistently".¹ Indeed there is considerable disagreement as to the length and severity of building cycles in the United States. Burns² and Campbell³ argue that residential construction in the United States exhibits long cycles because of the long-life, durability, and immobility which characterize this sector. Cooney has shown that "building in London between 1865 and 1914 experienced cycles in its activity of greater length than the ordinary trade cycle, and of considerably greater amplitude".⁴ Guttentag, more recently, has argued the case for shorter cycles in the United States during the 1946-59 period.⁵ Perhaps more relevant to this study is Cairncross's view that "If we are to speak of long waves....we must limit ourselves to a local fluctuation. Long waves that are not local are revolutions rather than cycles".⁶

In the passage above, Cairncross asserts that long waves

¹Paldam, Martin, "What is Known About the Housing Demand?", Swedish Journal of Economics, June, 1970, p. 133.

²Burns, Arthur, "Long Cycles in Residential Construction" in Business Fluctuations, Growth and Economic Stabilization, Edited by John J. Clark and Morris Cohen, Random House, New York, 1963.

³Campbell, Burnham O., "Long Swings In Residential Construction: The Postwar Experience, American Economic Review, May, 1963.

⁴Cooney, E. W., "Capital Exports and Investment in Building in Britain and the U.S.A., 1856-1914", Economica, November, 1949, p. 349.

⁵Guttentag, J. M., "The Short Cycle in Residential Construction", American Economic Review, June 1961, Vol. LI, No. 3, pp. 275-98.

⁶Cairncross, A. K., Home and Foreign Investment: 1870-1913, Studies in Capital Accumulation, Cambridge University Press, London, 1953, p. 11

in the construction cycle must be limited to a particular nation. When we observe cycles in several countries which continue their swing for long periods of time (e.g., more than 20 years), we are witnessing basic structural changes which accompany the development process. Since this study involves several countries, our emphasis will be on finding probabilistic causality over the relatively short time period of 15 years.

Further disagreement is found in attempting to assign causality to the fluctuations observed in the construction sector. An early attempt to link this sector to the accelerator theory was made by J. M. Clark.⁷ More recent writers have abandoned this view and have focused on variables such as the rate of interest and the institutional structures which influence the availability of funds for housing construction.⁸

Leo Grebler, for example, suggested that:

The rate of interest moves as a rule with the business cycle, showing a tendency to rise in a period of 'boom' and to fall in a period of 'slump'. This is in accordance with the fact that the demand for capital rises and falls with the

⁷Clark, J. M., "Business Acceleration and the Law of Demand: A Technical Factor in Economic Cycles", The Journal of Political Economy, Vol. XXV, No. 3, March 1917, pp. 217-235.

⁸See especially, Long, C. D., Building Cycles and the Theory of Investment, Princeton, 1940; Newman, W. H., The Building Industry and Building Cycles, Chicago, 1945; Paldam, Martin, op. cit., and Duesenberry, James S., Business Cycles and Economic Growth, McGraw Hill, New York, 1958, Chapter 3, pp. 31-48.

increase and decrease in business activity. House building, therefore, receives a special stimulus during a recession because of the low rate of interest.⁹

This implies that the income effect which accompanies an increase in Gross National Product (GNP) has less impact on the home building sector than the price effect which is reflected in the interest rate change. Grebler also found that house building was countercyclical prior to World War I and that due to government intervention in the form of public grants after the War, the trend was reversed. Duesenberry's empirical observations support this view. During the 1948-59 period, Guttentag observed a "broad countercyclical tendency of residential construction".¹⁰

Cullingsworth also points out that:

The role of government in supplying or influencing the capital market for housing in the post war period has coincided with an increased concern with national investment programmes. State intervention in the capital market for housing has been necessary in all West European countries.¹¹

Paldam further states that "In most countries in Europe the housing market is affected by political intervention

⁹Grebler, Leo, "House Building, The Business Cycle and State Intervention", The Industrial Labor Review, March 1936, Vol. XXXIII, No. 3, pp. 339.

¹⁰Guttentag, op. cit., p. 93.

¹¹Cullingsworth, R. "Housing and State", in Nevitt, A., (Ed.), Economic Problems of Housing, Proceedings of a Conference Held by the International Economic Association, MacMillan, New York, 1967.

including direct price control, which distorts the price structure...".¹²

In attempting to discern the causal factors operating in the building industry, studies focus on either the demand or supply side of the equation. On the demand side, several problems arise. In the majority of countries we must distinguish between effective demand which is the willingness and ability to purchase housing and what I shall call potential demand, which is the willingness to purchase a dwelling unaccompanied by the ability. Thus we see that demand and supply are inextricably interconnected; demographic changes may indicate an intense desire for additional housing, however financial markets (either domestic or international) might not permit the necessary flow of funds to realize this desire. In the conventional phraseology, we would say that there is a very strong demand for additional housing; however, at the same time, financial restrictions prohibit this potential demand from becoming effective.

This is not to suggest that demographic factors are unimportant. However, in most countries they act indirectly as a form of derived demand by placing pressure on the regional or federal government to initiate directly or at least to allow the necessary programs and/or funds to be made available.

Another element which further complicates the demand for housing is the variability of rents. If rents increase more rapidly than the general cost of living, we would

¹²Paldam, op. cit., p. 130.

experience an increased effective demand for owner-occupied housing, since the monthly rental payments, if they increase relative to housing construction costs, will eventually overtake the monthly payments of financing the purchase of a home.¹³ Again it must be emphasized that demand can only be effective if the various agencies which control the availability of funds make them available.

We must also allow the possibility of shifts in demand between various income classes. This question was put forward, but not specifically answered, by De Leeuw and Ekanem in a recent journal article.¹⁴

The widespread use of rent-control by many countries compounds the problem of isolating causal factors. A government or housing authority which maintains a policy of containing effective demand for dwelling construction can do so easily by administering a low rent policy or by making it more difficult for the home buyer to secure the credit needed for the purchase of a house. In the former situation, the opportunity cost of renting is artificially increased. In most cases this policy merely shifts the demand from the private sector to the public sector.

When we turn to the supply side of the analysis, we face similar problems. As usual, demand and supply are

¹³Cairncross, op. cit., p. 215-220.

¹⁴De Leeuw, F., and Ekanem, N. F., "The Supply of Rental Housing", American Economic Review, December, 1971, Vol. LXI, No. 5, p. 807.

difficult to separate. From the buyer's point of view finance is part of supply. However, if the interest rate in mortgage markets is high, it is demand that seems low to the builder. The same upswing that makes investment appear lucrative during 'boom' years keeps many potential buyers of houses from realizing their desires.

When we approach demand and supply projections on the national level and attempt to compare several countries, the problems are intensified. Elasticity concepts are difficult to employ and the evaluation of demographic changes must include a close examination of relative migration patterns.

International Building Cycles

The studies which are concerned largely with domestic fluctuations in the building cycle provide a necessary background and a logical starting point for the inquiry into the international sector. We must now turn to the main focus of this study.

We are interested in determining the similarity in timing of building cycles in several countries at different levels of development. What is the role of government in determining when resources are to flow to or be withdrawn from construction and housing? If the governments are cognizant of the role of this sector in Western European countries, certainly the planners in the less developed countries should be equally concerned, although their reasons and

policy options might be different. We must find those variables which affect government decisions in the allocation of scarce capital and foreign exchange among competing programs.

In the less developed countries, the relationship between foreign trade policy and housing policy was examined by Maisel for the 1950's. He found that "In addition to consuming large amount of scarce capital, it was found that in a majority of cases a high percentage of the materials going into houses had to be imported."¹⁵

Even if Maisel's assertion that housing construction requires large amounts of foreign exchange is not true, for many countries the construction industry is likely to be sensitive to changes in the level of exchange reserves. During the era of the gold standard, when the level of foreign exchange reserves fell, the domestic money supply was contracted. Although this mechanism did not operate as perfectly as some observers claimed, the direction of the effect was predictable.

Because the operation of the gold standard linked international and domestic monetary markets to each other, many countries attempted to manage their domestic affairs by adopting countercyclical programs of public works. In the more industrialized nations of Western Europe and North

¹⁵Maisel, A., "The Economic Problems of Housing, in Nevitt, A. (Ed.), op. cit., p. xxii.

America, the main objective prior to World War I was to provide work relief. This type of program was motivated by social considerations and regarded as a temporary measure to minimize the need for direct welfare payments.¹⁶

During the post-war period, the policy of work relief evolved into something quite different. According to Howenstine, "...after the First World War, there was a growing interest in public works policy as a means of combatting unemployment. The emergent theory about public works policy had an essentially economic, as opposed to the previous social orientation".¹⁷

Compensatory programs also differ among individual countries. Western European economies have a history of 'work postponement' policies which date back to the early 1920's.¹⁸ Under this system work on public projects is undertaken during periods when unemployment is rising and the economy is contracting. The implementation of these projects required that each country accumulate adequate financial reserves during full employment periods which could be released at the appropriate time. The need for the prior accumulation of financial reserves was especially acute during the 1920's and 30's, prior to the Keynesian revolution and the development

¹⁶Howenstine, E. Jay, Compensatory Employment Programmes, Organization for Economic Co-operation and Development, Paris, 1968, p. 32.

¹⁷Ibid., p. 33.

¹⁸Ibid., p. 35.

of more sophisticated fiscal tools.

In the less-developed nations, the ability to accumulate financial reserves for the purpose of countercyclical public work programs is limited. Furthermore, when less developed countries engage in deficit spending programs in order to maintain full employment, the effect on the economy can be damaging. Deficit spending certainly increases aggregate demand. If unemployment is the result of structural problems rather than inadequate domestic spending,¹⁹ increased government spending is also likely to result in an increase in prices. Inflation will reduce exports and threaten the foreign exchange reserve position of the country.

The advanced countries have adopted a wide variety of other countercyclical programs. Most of these programs rely on traditional monetary and fiscal policies. Sweden has developed an imaginative approach to offset fluctuations in her national product. The retained earnings of private business firms are subject to special tax rates depending upon the phase of the general business cycle. During downswings, firms are given special tax credits on funds invested. During periods of full employment and stable prices, firms which invest are penalized by a high tax.²⁰ This program,

¹⁹Ibid., p. 48.

²⁰Johnson, F. Reed, The Swedish Welfare State: A Systematic Approach, Working Paper No. 64, May, 1972, Department of Economics, State University of New York, Stony Brook, New York, p. 16.

called the 'investment reserve mechanism', is administered by the Finance Minister.

During the late 1950's, many less developed countries were faced with high levels of inflation. In 1958 and 1959, Spain and Turkey "...were compelled to adopt stabilisation programs which, inter alia, involved restrictions on public works expenditures." In 1965, Spain was forced to restrict house-building in order to ease inflationary pressures.²¹ In this respect, Spain was beginning to resemble the more developed countries.

In 1964, an Organisation for Economic Co-operation and Development (OECD) study suggested that a public works program be adopted in Turkey in order to attack the problem of disguised unemployment. One of the sectors singled out for the program was the construction of social housing.²²

Clearly, individual countries use different policies to counteract movements in their reserve positions. We are interested primarily in the results of the policies implemented. Below it will be shown that regardless of the countercyclical policies pursued, success or failure of the policies depends largely upon the ability of the country's financial institutions to direct the flow of funds into the construction sector. We shall attempt further, to show that there exists a degree of homogeneity among countries of

²¹Howenstine, op. cit., p. 430.

²²Ibid., p. 431-2.

similar per capita income levels. That is, the non-industrialized nations as a group tend to react differently to fluctuations in foreign exchange reserves than the industrialized countries. Data limitations force us to focus on a few countries during the 1870-1914 period. In Chapter IV, a larger group of countries will be examined for the 1955-68 period in order to determine whether or not there has been a change in the relationship between construction cycles in the industrialized and non-industrialized countries over the past several decades.

Building Cycles in the U.S. and U.K. - 1870-1914

Cairncross has pointed out that

...while commercial and industrial building has generally fluctuated more or less in phase with the trade cycle, the building of dwelling-houses has often shown a marked divergence.²³

Derksen has also pointed out the importance of distinguishing between aggregate construction and the construction of dwellings.²⁴ The data for the 1870-1914 period which is discussed below focuses on aggregate construction. In our examination of construction and exchange reserves for the 1955-68 period, the construction of dwellings will be examined as a separate category in order to determine the different effects of reserve fluctuations on each sector.

²³Cairncross, op. cit., p. 12.

²⁴Derksen, J. B. D., "Long Cycles in Residential Building: An Explanation", Econometrica, Vol. 8, No. 2, April 1940, p. 100.

Several studies have shown cyclical variations between the same sectors in different countries and between different sectors in the same country. O'Leary and Lewis,²⁵ among others, have shown that the building cycles of the United States and the United Kingdom during the period 1870-1910 were inversely related. This relationship is illustrated in Figure 1.

During this same period, Cairncross found that "the terms of trade of Australia and Canada tended to move in the opposite direction to those of the industrial countries."²⁶ The "industrial countries" cited by Cairncross were Britain, France, and Germany (after 1900). He points out that little capital was exported from Britain and France to the U.S. during the 1870-1913 period "due largely to banking and financial difficulties",²⁷ and not, as was the case of Australia and Canada, to a disastrous agricultural output.

This relationship bears some resemblance to the current situation where the less developed countries, largely reliant on agricultural and raw material exports, import capital from the industrialized countries. In the Cairncross study, the less developed countries of the period were Australia, Canada and the United States, while the industrialized nations

²⁵O'Leary, P. J. and Lewis, W. A., "Secular Swings in Production and Trade" in Gordon and Klein (Eds.), AEA Readings in Business Cycles, Vol. X, Irwin, Homewood, Ill., 1950.

²⁶Cairncross, op. cit., p. 190, Table 44.

²⁷Ibid., p. 190.

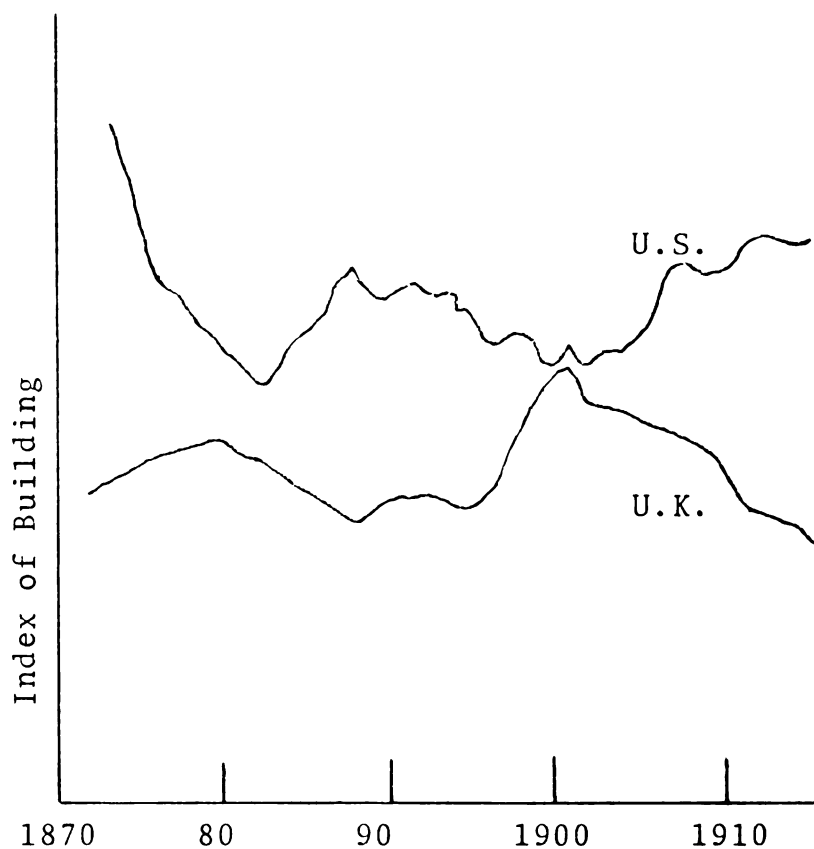


Figure 1.--Building Cycles in U.S. and U.K. (1870-1914)

Source: O'Leary and Lewis, op. cit., Chart I, p. 548 and Chart II, p. 551.

were Britain, France and Germany.

In order to explore possible intra- and inter-country relationships between international financial variables and building cycles, I have illustrated on Figure 2 the commodity terms of trade of the U.K. and the building cycles for both the U.K. and the U.S.

The relationship between U.K. building and U.K. terms of trade is positive throughout most of the period. But the correspondence between building in the U.K. and the U.S. is inverse. Also note the relationship between the U.K. terms of trade with the U.S. and the building cycle in the U.S.; the correlation between these two series is negative and very strong after the late 1880's. These findings suggest the existence of a systematic connection between the terms of trade and the building cycle of the U.S. and the U.K.

Further investigation points to the difficulty of assigning much weight to the terms of trade variable. On the surface it appears that when the U.K. terms of trade fall, there would be pressure on Britain to curtail imports and foreign investment in other countries in order to preserve a healthy balance of foreign exchange reserves. Closer examination shows that this need not be the case. Foreign exchange reserves are not directly related to the commodity terms of trade. In order to determine the sign and magnitude of such a correlation, we must first know the elasticities of U.K. imports and exports, or the change in the volume of exports and imports. The terms of trade might decrease for the U.K., while at the same time the volume sold increases. This could even result in a more liquid financial

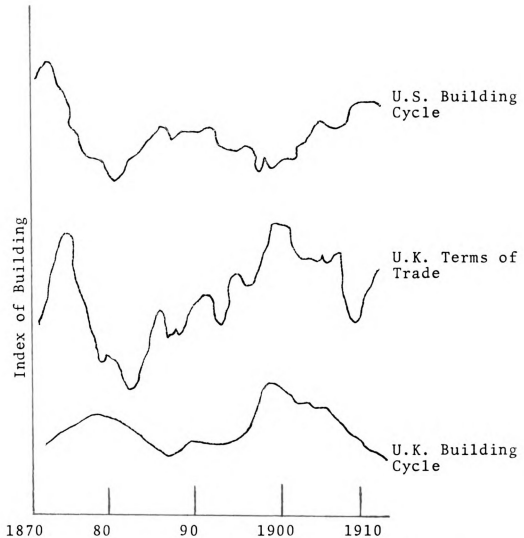


Figure 2.--Building Cycles in U.S. and U.K. (1870-1914)
and U.K. Terms of Trade

Source: U.S. Building taken from O'Leary and Lewis, Chart I,
p. 548, op. cit.
U.K. Building taken from O'Leary and Lewis, Chart II,
p. 551, ibid.
U.K. Terms of trade taken from Cairncross, Table 44,
p. 191, op. cit.

position for the U.K.²⁸

Although there is no a priori reason to assume a positive relationship between foreign exchange reserves and terms of trade, some general observations concerning the elasticities of the exports and imports of the U.K. can be noted. The primary exports of the U.K. during this period consisted of manufacturing goods and textiles. Imports consisted largely of foodstuffs and raw materials.²⁹ It is well established that the elasticities of the former group is relatively higher than the latter group.³⁰

In order to complete this argument let us assume that the price elasticity of U.K. exports is greater than one and that of her imports is less than one. If the U.K. terms of trade are falling, either the price of her exports is decreasing or the price of imports is rising, or both. If price of exports is falling, and the price elasticity is greater than one, then her total receipts for exports will increase.

If at the same time, the price of her imports is increasing and the price elasticity is less than one, then her expenditures on these items will also increase. Thus if

²⁸Maisel, A., Industrial Growth and World Trade, Cambridge University Press, 1963.

²⁹Ibid., Chapter II.

³⁰Ibid., and Watson, Donald S., Price Theory in Action, Second Edition, Houghton Mifflin, New York, 1969. Also see Prebish, Raul, "External Bottlenecks Obstructing Development", in Meier, Gerald M., Leading Issues in Economic Development Studies in International Poverty, Second Edition, Oxford University Press, London, 1970, p. 490.

worsening terms of trade are caused by price changes in both exports and imports, the effect on financial reserves is ambiguous. Yet it is likely that it was export prices which were largely responsible for the change in the terms of trade. As Cairncross pointed out, "Export prices, being the price of manufactured and of capital goods, tended to fluctuate more violently than import prices which were chiefly the prices of foodstuffs".³¹ Nurkse also points out that prices of food imported by the British were falling during the 1870-1913 period because of lower transport costs.³² Thus the correspondence which was illustrated in Figure 2 is not likely to be the result of random changes. For given the relative elasticities and the movement in the prices of imports and exports, it follows that the terms of trade must have moved in the same direction as foreign exchange reserves for the British during the 1870-1913 period.

Another investigation which supports the relationship between building cycles in the less developed and developed countries found by Cairncross and O'Leary and Lewis was conducted by Cootner in his analysis of social overhead capital and economic growth. He points out that during the 19th century the construction cycles in the United States and the United Kingdom were inversely related and further that, "...the cycles in developed countries are all

³¹Cairncross, op. cit., p. 205.

³²Nurkse, Ragnar, op. cit., p. 133.

simultaneous, while the cycles in underdeveloped areas are similarly simultaneous but out of phase".³³ In this passage he is referring to 'social-overhead capital' in general, however he points out that these cycles "coincide with similar cycles in building construction".³⁴

Further support of the inverse relationship between building cycles in the United States and the United Kingdom during the 1870-1913 period is provided by Brinley Thomas.

When the output of producer durables and construction in the United States was increasing rapidly, the United Kingdom experienced a falling rate of real investment at home, a growing surplus in the balance of payments, heavy unemployment and a large net outward flow of migrants.³⁵

Cooney, citing building fluctuations in London and several U.S. cities during the same period, notes the existence of an inverse relationship between the cycles in the two countries. He states further that "...this relationship cannot be explained by any direct connection between the constructional industries in the two countries".³⁶

What is the indirect connection between the two cycles?

³³Cootner, Paul H., "Social Overhead Capital and Economic Growth", in W. W. Rostow (Ed.), The Economics of Take-off Into Sustained Growth, St. Martins Press, New York, 1963, p. 267.

³⁴Ibid., p. 267.

³⁵Thomas, Brinley, Migration and Economic Growth, Cambridge University Press, 1954, Cambridge, p. 111.

³⁶Cooney, op. cit., p. 350

O'Leary and Lewis and Cooney understandably refrain from assigning causality. Thomas suggests that migration may have been the dynamic force and that "each major inflow of population was accompanied by (and perhaps induced) a 'widening' of the capital structure in the receiving country".³⁷ This further allowed the receiving country "...to take maximum advantage of the technical innovations of that time..."³⁸ This same shifting of population can also be observed internally.

What variable or variables might explain these empirical findings? Assuming for the moment that we are able to meaningfully separate and classify less developed countries, let us focus on those international variables which might provide the necessary link. Thomas provided empirical evidence of an important relationship. During 1840-1913, building and exports in Britain show a strong inverse relationship.³⁹ Thomas concludes his argument with the following statement:

There has been a tendency to look upon swings in building activity as if they were a kind of weather cycle external to the business cycle; if a downturn in the latter coincides with very bad weather, so much the worse for it. More promising results could be obtained

³⁷Thomas, op. cit., p. 163; See also, Colean and Newcomb, Stabilizing Construction: The Record and Potential, McGraw-Hill, New York, 1952.

³⁸Ibid., p. 174.

³⁹Ibid., p. 189.

by recognizing that there has been a fluctuation in the production of fixed capital equipment, with a span corresponding to that of the building cycle. Perhaps the 'real' type of theory now being developed would fit this kind of fluctuation best, and the short business cycle might be covered by a monetary explanation. The present inquiry, tentative though it is, suggests that theory of the rhythm of economic expansion should start with a two-country model.⁴⁰

In the 1950's and 60's, commodity fluctuations due to wars may have been important, while in the 19th century, long term capital movements led to a more fully market integrated world community.

We move now to Chapter III, where a two-country model, as suggested by Thomas above, will be developed and subsequently tested empirically. We recognize the difficulty of assigning causality to one or more of the partial derivatives selected to depict the operation of but a portion of our economic system. Therefore, this model should be viewed as an heuristic device enabling us to increase our focus on a few specific relationships.

⁴⁰Ibid.

CHAPTER III

THEORETICAL STRUCTURE

Introduction

It was shown in Chapter II that the commodity terms of trade between the United Kingdom and the overseas raw material suppliers were inversely related during the 1870-1914 period. An examination of the composition of trade between these countries and the price elasticities associated with their exports and imports showed that changes in the terms of trade between the U.K. and overseas producers were paralleled by changes in their foreign exchange reserves. During the same period, it was shown that the building cycles of the U.K. and the overseas areas and, more generally, of the industrialized and non-industrialized countries, were inversely related.

We have taken the U.K. and the U.S. in the 1870-1914 period as representative of the industrialized and non-industrialized nations in the post-Korean war period. This representation is based on the composition of goods traded in the early period by the U.K. and the U.S. and in the 1950's and 60's by the developed and less developed countries. U.K. exports in the 19th century were composed primarily of manufactured products and capital goods, while

British imports from the U.S. consisted of food-stuffs and raw materials.¹ The post-Korean War composition of trade between the industrialized and non-industrialized nations parallels that of the U.K. and the U.S. in the 19th century. Exports from the less developed to the developed countries in the later period consisted mainly of agricultural commodities, minerals, and raw materials while exports from the developed to the less developed nations were composed largely of manufactured and capital goods.²

Foreign Exchange Reserves in Industrialized
and Non-Industrialized Countries

The task of the present chapter is to construct an heuristic model which will enable us to sharpen our focus on exchange reserves and construction. We are interested in two time periods: 1870-1914 and 1955-1968. Evidence presented in Chapter II showed that there was an inverse relationship between exchange reserves in the more industrialized and the less-industrialized countries during the earlier period. This relationship is abstracted graphically in

¹Cairncross, A. K., Home and Foreign Investment: 1870-1913, Studies in Capital Accumulation, Cambridge University Press, London, 1953, p. 205.

²Maisel, Alfred, "The Economic Problems of Housing", in Nevitt, Adela A. (Ed.), Economic Problems of Housing, Proceedings of a Conference Held by the International Economic Association, MacMillan, New York, 1967, p. 19.

Figure 3.

For illustrative purposes the inverse relationship between the two groups is shown as a straight line. We know only that the slope of the line is negative; it is drawn as a straight line in order to simplify exposition of the correspondence and to facilitate the incorporation of this concept into a larger and more general geometric model.

An increase in the share of total reserves held by this group of industrialized and non-industrialized nations represented in Figure 3 would result in a shift from F to F'. This change in shares could occur with or without an increase in world reserves, because the distribution of reserves among a group of countries is variable.

We wish to construct a model which is general enough to analyze the interactions between exchange reserves and construction in both the pre-World War I and post-Korean War periods. In order to do so it must be shown that fluctuations in exchange reserves in the industrialized and non-industrialized nations were inversely related during the 1950's and 60's as well as in the earlier period depicted in Figure 3.

To establish the empirical relationship between reserve levels in developed and less developed countries, data were collected for a sample of high and low income countries for the 1955-68 period. The construction of a workable two-sector model requires that the countries chosen for inclusion



Figure 3.--Foreign Exchange Reserves in Industrialized and Non-Industrialized Countries (1870-1914)

in the sample be defined as either non-industrialized or industrialized. The former group includes 11 countries whose per capita income is less than \$500 per year, and will be designated as Group I. The latter group consists of 12 countries whose per capita income is greater than \$1000; this group will be referred to as Group III.³ Middle income countries (Group II) will be omitted at this point because the construction of the model requires two groups which are

³The specific countries selected for the sample are listed in Table 3, p. 60.

clearly separable. This point will be discussed in detail later.

The limited availability of reliable data for many countries (especially in the low income group) precluded the selection of a larger and more balanced sample.⁴ The foreign exchange reserves of the sample groups are shown in Table I and Figure 4. With the exception of the last two years we observe an inverse relationship between exchange reserves in Group I and III countries. Because of the constraints operating on our selection of countries we must admit the possibility of having chosen a biased sample.

Suppose we were to divide all countries in the world into two groups and designate them as either developed or underdeveloped on the basis of their per capita income. There is a fixed stock of international reserves for the entire system during any particular time period. Because all countries are included, there is no leakage of reserves from the system. Thus we could represent the relationship between foreign exchange reserves in the two groups as a negatively sloped, 45 degree straight line. If the industrial countries collectively hold x dollars as reserves, the the non-industrialized nations, by definition, must hold

⁴A larger group of countries could have been chosen if we were interested only in foreign exchange reserves. However, we are also examining aggregate construction and the construction of dwellings; data for these sectors are difficult to obtain for many countries.

Table I.--Foreign Exchange Reserves in Low and High Income Countries

(1) Year	(2) Group I	(3) %	(4) Million U.S. \$ Group III	(5) %	(6) Federal Exchange Reserve (Sample Total)	(7) Federal Exchange Reserve (World Total)	(8) = (6) Sample Total World Total
1955	1948.8	28	5124.3	72	7073.0	54,240	13.0%
1956	1532.5	22	5507.0	78	7039.5	55,890	12.5
1957	1489.1	21	5603.0	79	7092.1	56,310	12.5
1958	1463.2	19	6190.1	81	7653.3	57,310	13.0
1959	1431.7	19	6088.0	81	7519.7	57,060	13.0
1960	1426.5	16	7254.1	84	8680.6	59,740	14.5
1961	1242.2	14	7762.2	86	9004.3	62,360	14.5
1962	1329.8	15	7562.2	85	8892.0	63,010	14.0
1963	1466.5	14	9089.3	86	10555.8	66,440	16.0
1964	1711.9	16	9171.4	84	10883.3	68,740	16.0
1965	1887.1	19	7974.2	81	9861.3	70,520	14.0
1966	2213.9	21	8320.5	79	10534.4	71,980	14.5
1967	2582.0	21	10005.5	79	12587.5	73,600	17.0
1968	2425.8	20	9953.3	80	12379.1	76,570	16.0

Source: International Monetary Fund, International Financial Statistics, Washington, D.C., 1962, 1970.

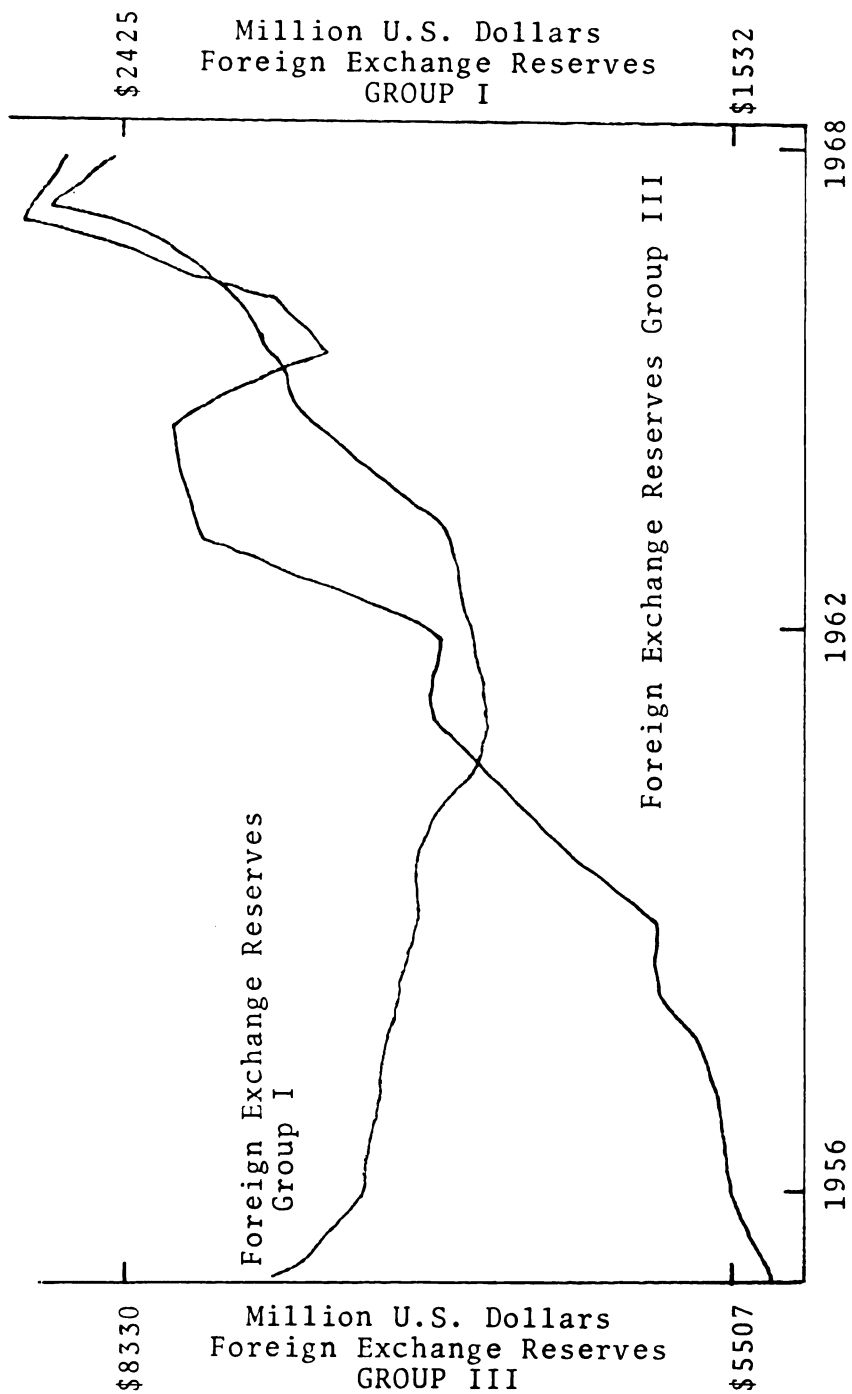


Figure 4.--The Relationship Between Foreign Exchange Reserves
in Group I and Group III Countries (1955-1968)

$T - x$ dollars, where T is the total volume of world reserves. This is simply a tautological relationship derived from the assumptions and definitions. Of course this device cannot be used for our sample groups.

Clearly, we would like to work with a sample which is representative of the universe. What happens, for example, to total reserves for sample Groups I and III when world reserves change? A close correspondence between fluctuations in the reserves of the sample and of the world would be a desirable property and could serve as a criterion for establishing confidence in the sample used.

We can establish empirically the relationship between the sample and the universe by referring again to Table I. In column seven, total world reserves are shown. The relationship between this series and total reserves for the sample (column 6) is represented by a scatter diagram in Figure 5. The approximation of the regression line indicates nearly a one-to-one relationship between the two series. If the sample groups were atypical of the universe we would observe outlying points much further above and below the regression line. On the basis of this evidence, it appears that the sample groups are a reasonably good approximation for the world which the sample is taken to represent. (For heuristic purposes, the relationship between foreign exchange reserves in the industrialized and non-industrialized countries in both the 1870-1914 period and the post-Korean War period) can be abstracted

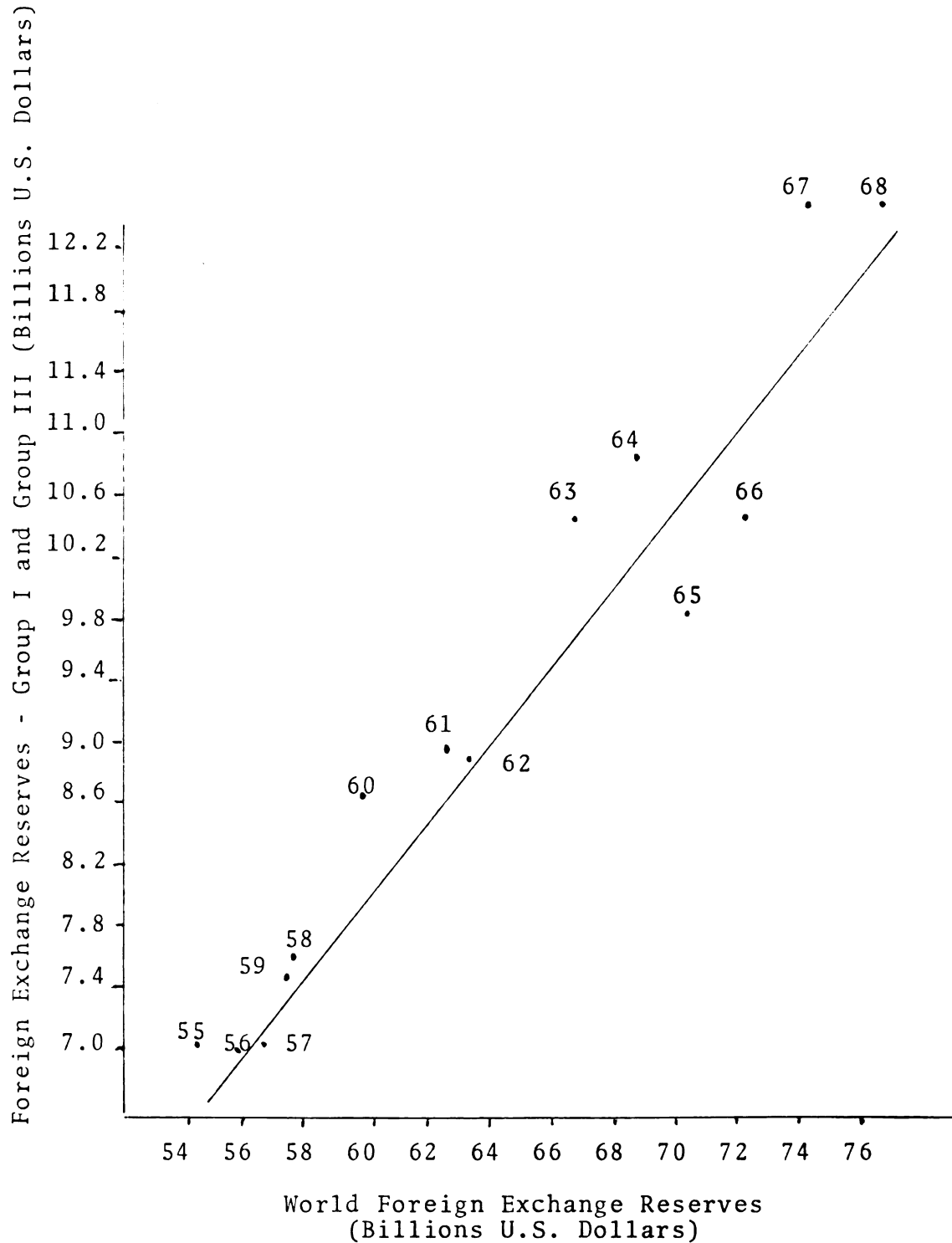


Figure 5.--The Relationship Between World Reserves and Group I and Group III Reserves (1955-1968)

graphically as a negatively sloped line as depicted in Figure 3. We move now to a discussion of foreign exchange reserves and construction during the 1870-1914 period and further specification of the model.

The Relationship Between Foreign Exchange Reserves and Construction (1870-1914)

It was illustrated earlier in Chapter II, Figure 2, that during the 1870-1913 period the terms of trade and the building cycle were positively related in the United Kingdom. Also both of these series were inversely related to building in the United States. If, as our earlier analysis suggested, the terms of trade series can be used as a rough approximation (at least in sign) for foreign exchange reserves (f), we find that an increase in F will be accompanied by an increase in domestic construction activity (C) in the same country (or group). This relationship is represented in Figure 6.

The empirical justification for this correspondence is further supported by Cairncross. He points out that in Britain, "The boom of 1900 was perhaps the only one in which it was not foreign investment and the prosperity of the export industries that set the pace for domestic construction".⁵

⁵Cairncross, A. K., Home and Foreign Investment: 1870-1913, Studies in Capital Accumulation, Cambridge University Press, London, 1953, p. 188 (emphasis mine).

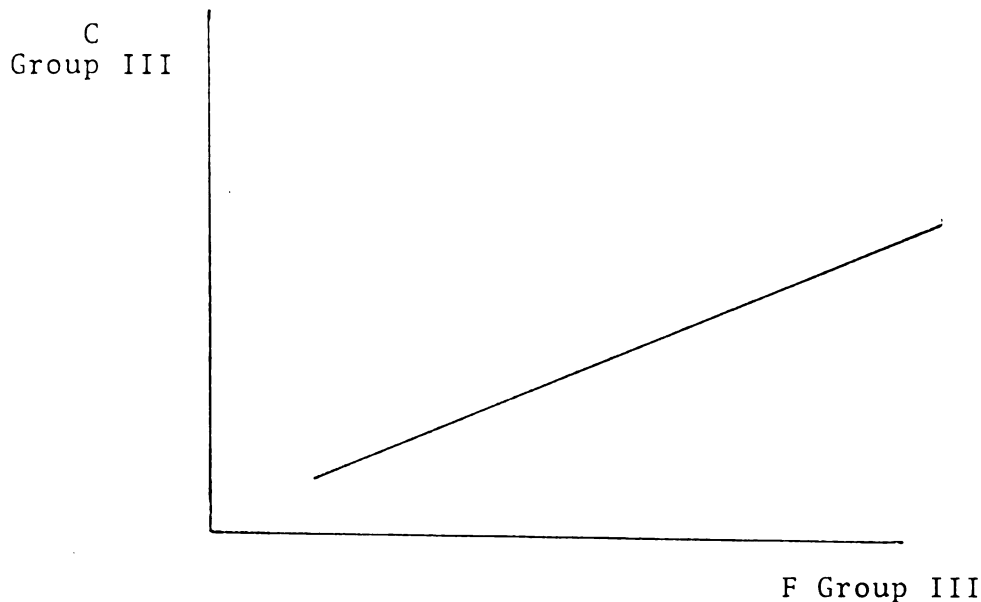


Figure 6.--Construction and Foreign Exchange Reserves
in Industrialized Countries (1870-1914)

This points to a positive relationship between prosperity in the external financial position of a country and its domestic construction sector.

In Figure 7 the relationship between F and C for the less developed countries (Group I) is illustrated. Note that the sign of the coefficient implied is positive as in Group III above, since there is no a priori reason to predict a change. A four quadrant model will be constructed below; from this it will be shown that this relationship must be the case, given the relationship in the other quadrants.

The magnitude of the coefficient (i.e., slope of the line) is assumed higher for Group I. The reason for this assumption is that Group III countries are better able to offset

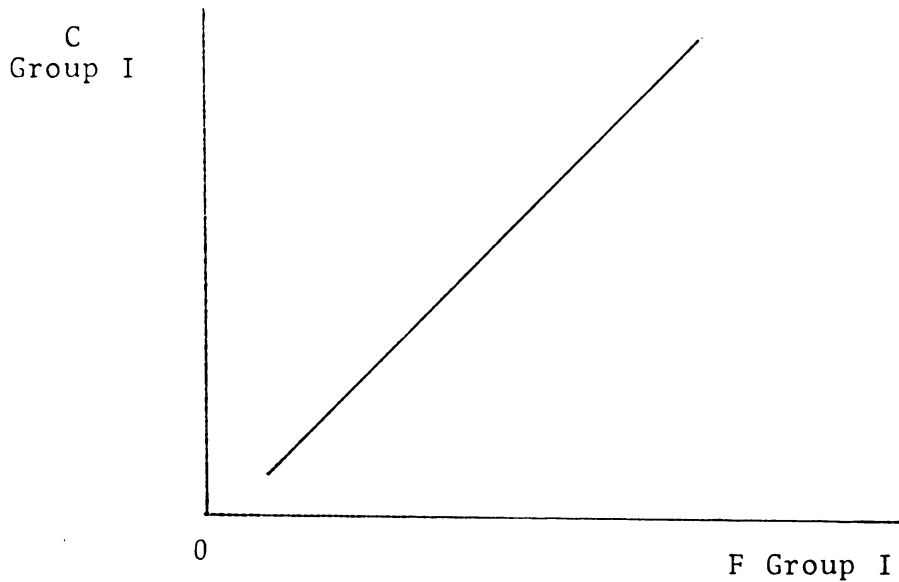


Figure 7.--Construction and Foreign Exchange
Reserves in Non-Industrialized Countries
(1870-1914)

domestic repercussions from changes in their international financial position. This is true because Group I countries lack the administrative ability and institutional structures needed to transfer and redirect domestic activity within the economy. Also the ratio of tax revenue to gross domestic product is very low for less developed countries.⁶ The difficulty of applying fiscal and monetary policy under these conditions is apparent. Fluctuations in F therefore, can be expected to affect the countries in Group I more directly and

⁶UNCTAD, "The Tax Structure of Developing Countries", In Meier, G. (Ed.), Leading Issues in Economic Development, Oxford University Press, 1970, 2nd Edition, pp. 200-203. Also see, MacBean, A., Export Instability and Economic Development, Harvard University Press, Cambridge, Mass., 1966, pp. 245-53.

and more severely. This point will be discussed more fully in Chapters V and VII.

The Basic Model (1870-1914)

In Figure 8, the three relationships presented above are consolidated. Quadrant I depicts the empirical relationship between foreign exchange reserves in Group I and Group III countries.

In quadrant II and IV, the relationship between construction (C) and foreign exchange reserve holdings (F) is depicted; note that dC/dF is greater in Group I than in Group III but is greater than zero for both. Quadrant III illustrates the interaction between C in Group I and Group III countries. This relationship is identical to the empirical findings discussed in Chapter II showing that the building cycles in industrialized and non-industrialized countries are inversely related.

It was also shown that in the industrialized country (U.K.) the level of foreign exchange reserves and the level of construction were positively related and that exchange reserves of the two countries were inversely related. The three quadrants which have been justified empirically are shown in Figure 9.

The fourth quadrant of this model is determinate. The relationship between F and the less industrialized countries must be positive. In fact, even without the information related in quadrant II, we can be quite certain that the slopes

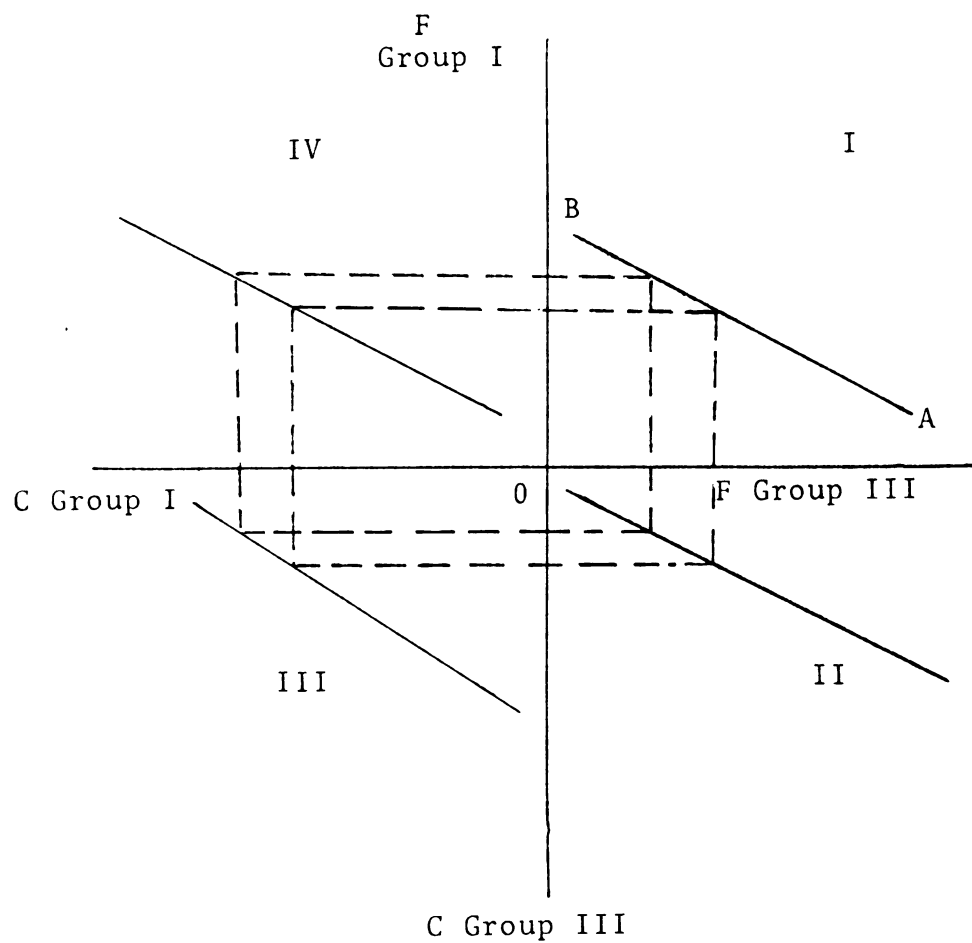


Figure 8.--Four Quadrant Model with All
Quadrants Given (1870-1914)

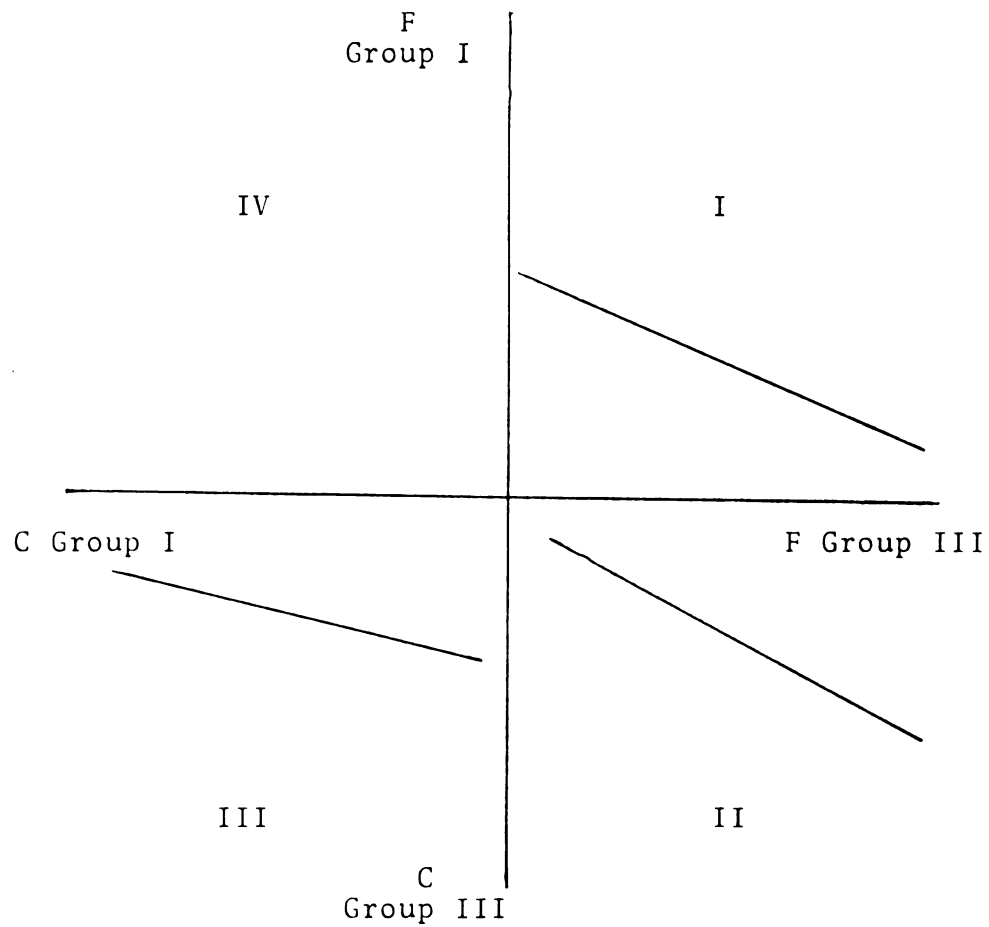


Figure 9.--Four Quadrant Model With
Three Quadrants Given

in both quadrants II and IV are positive. It can be easily demonstrated that the signs of the slopes in quadrants II and IV must be the same, given the inverse structure of quadrants I and III. Let us take the two quadrants for which the strongest argument can be advanced, I and III. Mathematically we have:

$$\text{Equation 1} \quad C_I = f(C_{III})$$

$$\text{Equation 2} \quad C_I = f(g(F_{III}))$$

$$\text{Equation 3} \quad C_I = f(g(h(F_I)))$$

$$\text{Equation 4} \quad \frac{dC_I}{dF_I} = f' \cdot g' \cdot h'$$

$$\text{Equation 5} \quad = \frac{dC_I}{dC_{III}} \cdot \frac{dC_{III}}{dF_{III}} \cdot \frac{dF_{III}}{dF_I}$$

$$\text{Since:} \quad \frac{dC_I}{dC_{III}} \text{ is less than zero}$$

$$\text{and} \quad \frac{dF_{III}}{dF_I} \text{ is less than zero}$$

$$\text{both} \quad \frac{dC_I}{dF_I} \quad \text{and} \quad \frac{dC_{III}}{dF_{III}} \text{ must be either less}$$

than zero or greater than zero. Their signs cannot differ.

If the signs for these two groups must be the same, it is apparent that they must have been positive for the 1870-1913 period. One might speculate that for the high income country it might have been possible at this early stage of industrialization to protect itself partially from external financial fluctuations. However, for the non-industrialized countries to have been able to accomplish this, they would

have required tools far beyond their reach. Even today it is difficult for the poorer countries to exercise control over their domestic monetary mechanism in order to stabilize their country.⁷

In jumping from the foreign exchange reserves directly to domestic construction in the respective groups, it might be charged that we have bypassed the machinery which acts as the transmission device for this process. However, the tendency for countries at all levels of development to maintain restrictive monetary policy in order to alleviate shortages in foreign exchange reserves is well documented.⁸ As Mundell pointed out

The money supply is...increased indirectly through the back door of exchange rate policy. Foreign Exchange reserves accumulate by the full amount of the increased cash reserves needed by the banking system to supply the increased money demanded by the public as a consequence of the increase in income.⁹

In this passage, Mundell is referring to the present gold exchange system. The mechanism he describes operated even more

⁷See for example: Tun Wai, "Interest Rates in the Organized Money Markets of Underdeveloped Countries", International Monetary Fund Staff Papers, Vol. V, No. 2, August, 1956, pp. 249-78.

⁸Meier, Gerald M., Leading Issues in Economic Development: Studies in International Poverty, 2nd Edition, Oxford University Press, Cambridge, 1970, p. 293.

⁹Mundell, Robert F. International Economics, MacMillan, New York, 1968, p. 255.

directly under the old gold standard when domestic currency was tied to gold holdings.

Domestic Ramifications of External Changes

There are several domestic ramifications of changes in a country's foreign reserve holdings. As stated earlier, when reserves are relatively high, 'easy' money policies and falling rates of interest are observed. If Mundell's policy recommendations were explicitly followed, "...monetary policy (would) be aimed at external objectives and fiscal policy at internal objectives...".¹⁰ Perhaps this is an overstatement since it implies complete domination of domestic monetary policy by balance of payments concerns. This certainly is not the case. However, the direction of changes in the money supply should hold true.

Mundell also points out that "The restrictive monetary impact of the foreign exchange sales (to foreign governments) ...are offset by further open market purchases that induce further sales of foreign exchange".¹¹ This series of events continues until explicit policy is introduced to deal with the imbalance or until the supply of reserves is exhausted. The effect of exchange sales depends upon the type of policy adopted and the vigor with which it is applied.

¹⁰Ibid., p. 233.

¹¹Ibid., p. 257.

The practice of 'sterilizing' the monetary effects of foreign exchange (or gold) purchases and sales has become widespread as countries look for means of adjusting balance of payments other than that implicit in price level (or interest rate) adjustments. Central banks may prefer to delay adjustment for a time by allowing reserves to be built up or depleted.¹²

The variability of foreign exchange reserves induces changes in the interest rate, which in turn, if not dealt with by the central bank, will affect the domestic price level. The direction of this effect is clear. When reserves are low there is upward pressure on the interest rate and the contraction of the money supply exerts a downward pressure on the price level. Conversely, when reserves are high, there is a tendency for the price level to increase.¹³

The interaction between reserve positions and domestic interest levels and prices are especially pronounced under the gold standard system of international exchange. Both the direction and the strength of the movements are predictable. Under the gold exchange standard, the fluctuations in reserves are transmitted to the domestic economy. The direction of change is predictable. The degree to which external shocks are transmitted to the internal economy is one of the central questions of this study.

A complete discussion of the transmission mechanisms and the statistical verification of the direction and

¹²Ibid., p. 233.

¹³Ibid., p. 161.

magnitude of the changes induced by external factors would entail a study as large as the present one. The characteristics of the transmission mechanism will be largely inferred in the model discussed above. The model relies on such a mechanism and its operation can be indirectly observed when the model is tested in Chapter V.

To some extent, the fluctuations set into play by reserve variations are self-correcting, unless the imbalance is induced by deficits (or surpluses) and is considered to be chronic. The fact that reserves are low leads to policies which favor a higher rate of interest which in turn stimulates capital flows and reverses the direction of reserves.

In the fixed-exchange-rate case an interest rate below its equilibrium level creates inflationary pressure and a rise in the price level, which in turn generates a balance of trade and payments deficit, prompting a rise in the interest rate.¹⁴

The direct relationship between foreign exchange reserves, the interest rate, and construction activity seems apparent. As reserves increase, domestic interest rates will be kept low for two reasons. Under the gold standard, the first effect is automatically put into play; when reserves increase, the domestic money supply increases. The result of an increased money supply is to lower interest rates.¹⁵

¹⁴Ibid.

¹⁵Petersen, Wallace C., Income, Employment, and Economic Growth, W. W. Norton & Co., New York, Revised Edition, 1967, pp. 303-340.

The second effect stems from the actions of the central bank and is a characteristic of the gold exchange standard. If reserves are regarded by the central bank as high (determined historically), they are "...more likely to allow a deficit in the current balance to continue before remedial action is taken...".¹⁶ If and when the remedial action is taken, interest rates will be pushed up in order to stop the capital outflow.

Summary

In summary, the more a country is able to mitigate the effects of external fluctuations domestically during a period which exhibits the accumulation of more reserves, the less expansionary domestic policies would be anticipated. Favorable international conditions allow a reduction of the domestic interest rate because the necessity of attracting foreign funds is lessened. The lower interest rate would in turn make domestic investment in industry and construction more profitable.

We are concerned with the ability of countries to protect their domestic building activity from the international financial sector. The relationships postulated directly above and in Figures 5 and 6 correspond to a time period prior to World War I. The direct correspondence between foreign exchange reserves and construction in both the industrialized and the less industrialized countries during

¹⁶Mundell, op. cit., p. 163.

this period was the result of national policy goals and the prevailing institutions in both groups. Not only is it likely that the policies have changed; the ability of countries to cope with fluctuations in reserve positions has been vastly altered. Howenstine has pointed out that:

As an economy grows more and more accustomed to continuing full employment and a high economic growth rate, construction activity may be expected to exhibit an increasingly greater degree of stability from year to year.¹⁷

Thus we might expect domestic construction to be better protected from external factors as countries develop. On the other hand, to obtain these policies, construction may have to do more compensatory fluctuating. At any rate, we would expect domestic construction to be affected less by external factors as the level of development increases.

Chapter IV will discuss and compare the similarities and differences between the two time periods under consideration. During the 1870-1914 period, the positive relationship between foreign exchange reserves and construction was determined empirically. For the 1955-68 period, the sign and strength of this relationship will be tested empirically. It will be shown that alterations in the model might be necessary, and that the model will still be useful under different assumptions.

¹⁷Howenstine, E. J., Compensatory Employment Programmes, Organization for Economic Co-operation and Development, Paris, 1968, p. 361.

CHAPTER IV

ADAPTABILITY OF THE BASIC MODEL

Changing International Conditions

The pre-World War I period discussed at length in Chapters II and III was characterized by a stronger financial interdependence between countries than exists today because their economies were linked together by the gold standard. "For well before 1900, the widening circle of economic development had transmuted the economies of other important countries".¹ Approximation of the gold standard during this period made it difficult for even the most highly developed nations to protect their domestic activity from the vagaries of international finance.

Karl Polanyi, in a detailed examination of the 'transformation' of the self-regulatory characteristics of the market system, states with some exaggeration:

That system developed in leaps and bounds; it engulfed space and time, and by creating bank money it produced a dynamic hitherto unknown. By the time it reached its maximum extent, around 1914, every part of the globe, all its inhabitants and yet unborn generations, physical persons as well as huge fictitious bodies called corporations, were comprised in it.

¹Supple, Barry E., The Experience of Economic Growth, Random House, New York, 1963, p. 39.

Yet simultaneously a counter movement was on foot. This was more than the usual defensive behavior of a society faced with change; it was a reaction against a dislocation which attacked the fabric of society, and which would have destroyed the very organization of production that the market had called into being.²

Clearly a dramatic change was in the making. An economic system which had previously been 'laissez-faire', at least in philosophy, was under attack as early as 1914. Events were destined to press even harder for the needed alterations in the economic order, especially in the most industrialized countries where the familiar categories of land labor and capital had gradually become monetized.

The need for positive action was widely recognized during the depression of the thirties. In 1935, J. M. Keynes stated in the General Theory that

Recently, practical bankers in London have learnt much, and one can almost hope that in Great Britain the techniques of bank rate will never be used again to protect the foreign balance in conditions in which it is likely to cause unemployment at home.³

We have since come to view governmental 'interference' designed to insulate domestic markets from international fluctuations as a necessary, if not desirable, national policy objective.

²Polanyi, Karl, The Great Transformation: The Political and Economic Origins of our Time, Beacon Press, Boston, 1957, p. 130.

³Keynes, J. M., The General Theory of Employment, Interest and Money, Harcourt, Brace and Co., New York, 1960, p. 339.

The question we shall address ourselves to in the next section is how uniformly is the practice of stabilization employed. More specifically, do the less developed countries have sufficient tools and receptive institutions which will allow the successful manipulation of their economies. We mentioned earlier that the less developed nations are less well equipped to undertake such operations. We must now ascertain the degree to which they have been successful. This will entail the relaxation of some of the assumptions introduced in the model for the 1870-1913 period.

Altering the Model

In Chapter II, Figure 1, building cycles in the United States (non-industrialized) and the United Kingdom (industrialized) were shown to be inversely related. In a more recent period (1955-68) cycles in construction in two groups of countries were analyzed. These groups were introduced earlier in the previous chapter as Group I (income less than \$500) and Group III (income greater than \$1000). The results of this inquiry are illustrated in Figure 10.

Unlike the earlier period where the cycles were shown to be inversely related, the relationship in the more recent period is direct. In fact we can observe no cycle at all. The cycles usually observed in these trends are diminished because an average of all the countries in each group is calculated. However, both series are monotonic throughout nearly the entire period under consideration. What implication does

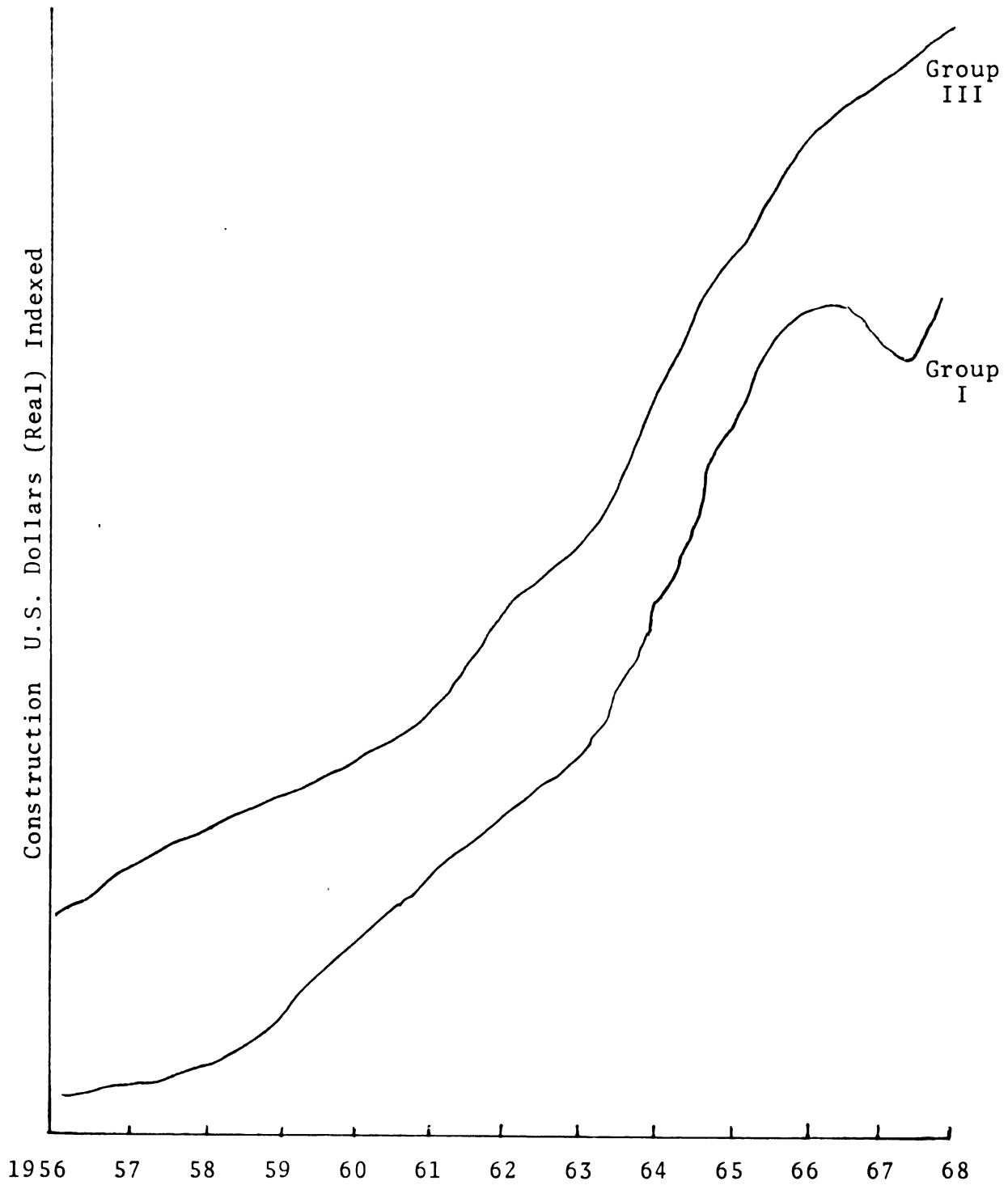


Figure 10.--Construction in Developed and Less Developed Countries: 1956-1968 (Sample Data)

this have for the model postulated earlier under somewhat different assumptions and empirical evidence? Clearly some revision is called for.

Reconstructed in Figure 11 is the four quadrant model introduced earlier. The relationships which have been established for the 1955-68 period are illustrated in quadrants I and III. In the remaining quadrants (II and IV) the outcome is, a priori, not known. We cannot determine the signs of the coefficients in these two quadrants. However, we do know that they cannot have the same sign. This can be shown by returning to our earlier mathematical argument in Equations (4) and (5) in Chapter III.

$$\text{Equation (4): } \frac{dC_I}{dF_I} = f' \cdot g' \cdot h'$$

$$\text{Equation (5): } \frac{dC_I}{dF_I} = \frac{dC_I}{dC_{III}} \cdot \frac{dC_{III}}{dF_{III}} \cdot \frac{dF_{III}}{dF_I}$$

Since $\frac{dF_{III}}{dF_I}$ is less than 0 and $\frac{dC_I}{dC_{III}}$ is greater than 0,

either $\frac{dC_I}{dF_I}$ is greater than zero and $\frac{dC_{III}}{dF_{III}} < 0$ or $\frac{dC_I}{dF_I} < 0$ and

$$\frac{dC_{III}}{dF_{III}} > 0.$$

This implies that one of the groups of countries has become less sensitive to international vibrations while the other continues to experience difficulty in insulating domestic activity from external shocks. Intuitively we suspect the more highly developed countries have not only sharpened their ability to insulate the domestic economy from outside

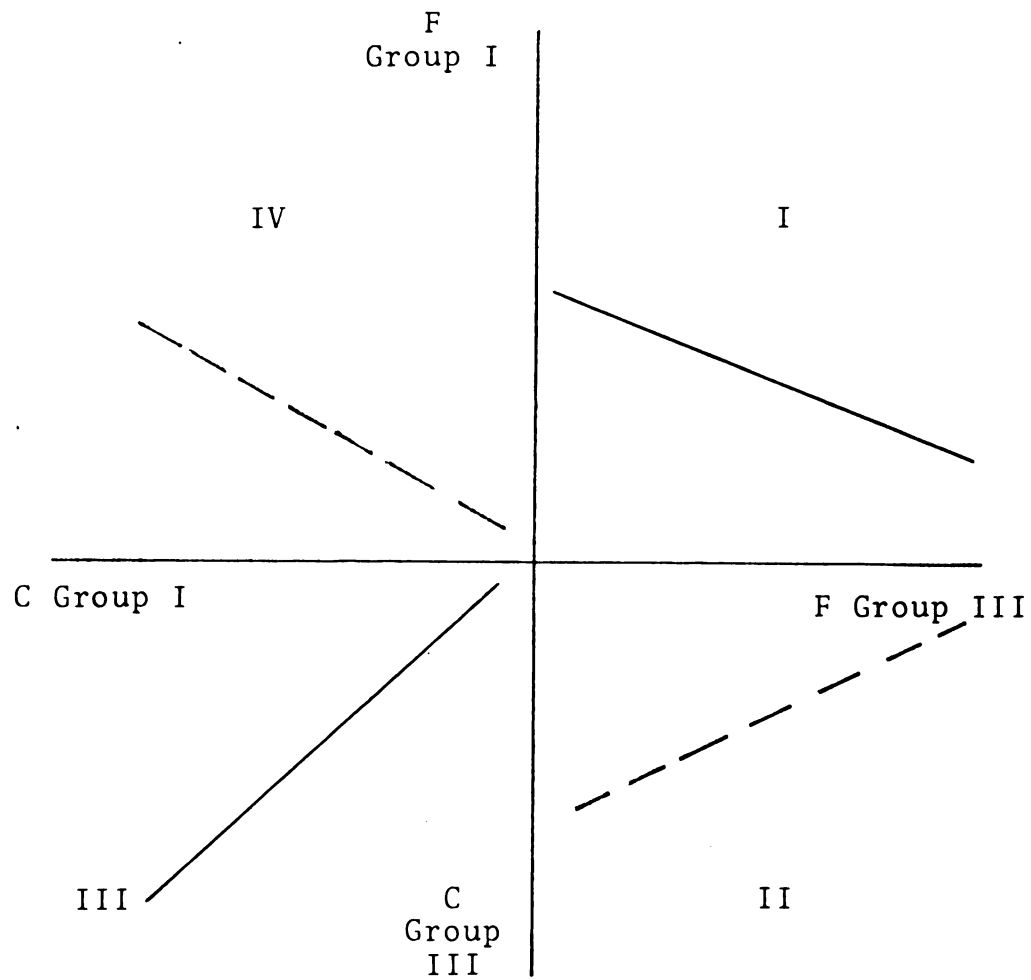


Figure 11.--Four Quadrant Model

disturbances, but perhaps some part of this insulation consists of countercyclical stimulation of the construction sector. Polanyi's thesis, presented earlier in this chapter, stated that the industrialized countries first made the transformation. And the awareness of the need for the increased intervention occurred during the period when the rapidly developing countries experienced the depersonalization of the factors of production and the monetization of nearly all productively related activities. If our reasoning is sound the relationships in quadrants II and IV should be negative and positive respectively as shown in Figure 11 by the dotted lines.

The line depicted in quadrant I of Figure 10 also shifts outward (to the northeast) over time. This movement reflects increases in world reserves. During the 1870-1914 period, this movement was primarily the result of world gold production which was rapidly though sporadically expanded.⁴

During the 1950's and 60's, there was a "...glaring inadequacy of new gold production and supplies for international reserve usage".⁵ Most of the increased reserves were held in the form of hard currencies, especially the U.S. dollar.

⁴Henderson, W. O., The Industrial Revolution in Europe, Quadrangle Books, Inc., Chicago, 1961, p. 46

⁵Kurihara, Kenneth K., "The Gold-Dollar Problem and World Monetary Reform", Journal of Economic Issues, Vol. I, No. 4, December 1967, p. 271.

The insufficient supply of monetary gold is brought into relief by the fact that during the 1958-1964 period new gold production, including sales of gold by Russia, contributed the average annual amount of \$500 million to the reserves of the Western world while the American payments deficits supplied the average annual amount of \$2 billion to those world reserves.⁶

During the post-Korean War period, reserves were held largely in dollars, made possible by the deficits incurred by the U.S.. As confidence in the dollar fell, countries cashed in their dollar reserves for gold. This precipitated the recurring crises experienced during the 1960's.

Thus the shifts observed in total reserves occurred for different reasons in the two time periods observed. In the earlier period, reserve levels provided sufficient liquidity because of increasing gold production. In the latter period, when the dollar was the primary reserve component, loss of confidence in the dollar led to speculation against the dollar.

It is difficult to assess the adequacy of reserves in the post World War II period. In Western Europe, there existed a liquidity shortage "...even after the realignment of exchange rates in 1949".⁷ However, the "...flexibility of the gold-exchange standard...enabled European reserves to be re-established in the 1950's...".⁸ In the 1960-66 period,

⁶Ibid., p. 271.

⁷Gilbert, Milton, "Problems of the International Monetary System", Essays in International Finance, No. 53, April 1966, Princeton University, New York, p. 15

⁸Ibid., p. 11.

"...the large U.S. deficit has necessarily meant that the increase in gross official reserves in the system has been large".⁹

Discussions centered around the liquidity problem in recent years are addressed primarily to expectations of insufficient liquidity because of the method of providing reserves. If speculation against the dollar occurs on a large scale, the willingness of trading partners to hold dollars as a reserve currency will be lessened. In the absence of alternate sources of liquidity (e.g., Special Drawing Rights), this would result in a sharp reduction of world reserves.

Summary

I have postulated a basic model in this chapter. Of the four functional relationships presented, empirical evidence provides the signs of the coefficients for at least three of the four relationships during the 1870-1914 period. The remaining one is deduced from these. The development of financial intermediaries over the last several decades in the more advanced countries suggests that these relationships have changed. Further investigation of data during the 1955-1968 period justified this skepticism. The building cycles were inversely related in the 1870-1913 period. During the more recent period examined, the cycles were directly related. The relationship between foreign exchange reserves of the two groups has not changed. Thus, it was determined that the

⁹Ibid., p. 12.

relationship between foreign exchange reserves and construction in one of the groups has changed.

It appears likely that the change occurred in the high income group (III). Yet intuition, however helpful in organizing ideas, is not conclusive. The next task is to determine specifically which group did in fact change. In Chapter V, the hypotheses will be formalized and methods of testing the hypothesis will be explicitly presented.

CHAPTER V

METHODOLOGY

Classification System

In the investigation of the empirical questions raised earlier, the following classification system will be employed:

Table II.--Countries Grouped According to Income

Group	Average Per Capita Income (in U.S. dollars 1966)
I	0-500
II	501-1000
III	Over 1000

The data are taken primarily from United Nations' sources and cover the period 1955 through 1968. The sample data are compiled from 36 countries which are classified according to the schedule in Table II. Table II provides the list of countries contained in the study and the group to which they are assigned.

It was noted in Chapter II that it is important to disaggregate residential building from total construction. One of the main criteria used for the selection of countries in this study was the availability of separate data for each activity. The list which appears in Table III represents

all those countries for which reliable data was available.

Table III.--The Countries in the Sample Grouped According to Income

Group I	Group II	Group III
China (Taiwan)	Argentina	Belgium
Columbia	Austria	Canada
Dominican Republic	Chile	Denmark
Ghana	Cyprus	Finland
Honduras	Greece	France
Korea	Ireland	Germany
Panama	Italy	Israel
Philippines	Japan	Netherlands
Portugal	South Africa	Norway
Thailand	Spain	Sweden
Turkey	Uruguay	Switzerland
	Venezuela	United Kingdom

The United States is omitted from the sample because no meaningful measure of foreign exchange reserves is possible. As long as U.S. dollars are acceptable as foreign exchange abroad, reserves are hard to distinguish from the domestic money supply in the United States.

In several of the sample countries, the data were taken from selected portions of the country. In China, Columbia, Thailand, and Turkey, only urban construction was included

in the sample. Ghana and Panama gathered data only in their capital cities. Argentina extrapolated data for construction from occupancy permits which were issued during the year, while Chile relied on construction statistics compiled from sixty cities.

These differences in data collection procedures are characteristic of less developed countries. This data has drawbacks for simple cross-sectional studies, but this study is interested primarily in the relationship between variables over time. Thus, if changes in the level of construction reported in selected cities are typical for the country, we may assume the data are reliable for our purposes.

Countries in Group I, with the possible exception of Ghana, have largely followed orthodox international monetary policies. Many less developed countries often resort to import and exchange controls and ad hoc arrangements to correct for imbalances in their reserve position. Thus, the sample used in this study is biased in that the group of countries analyzed may not be representative of low income countries in general.

Even if both the Group I and III countries were attempting to stabilize their construction sector through the use of similar policies, the success or failure of these policies depends ultimately on the mechanisms available for implementing them. As mentioned in Chapter II, these mechanisms differ considerably among countries. The developed countries

are characterized by relatively sophisticated and fairly well developed mortgage markets. Mortgage markets in the less developed nations are usually less efficient and poorly organized. This is especially true in the housing market where home-buyers in poor countries must rely largely on their own financial resources when purchasing a dwelling.

The basic aim of the statistical analysis is to determine the effect of foreign exchange reserves on total construction and the construction of dwellings. These relationships will be examined separately for each group of countries. We shall also determine the degree to which domestic construction in each group is associated with the following variables: Exports, exports as a percentage of gross national product, foreign exchange reserves, gross national product, the per cent of total population which resides in urban areas, and an index of currency valuation. Multiple regression techniques will be employed to discern the magnitude and direction of the influence of the various independent variables selected. All variables are in real terms.

Specification of Variables

Two general equations will be estimated, one using construction, the other using residential construction of dwellings. These systems are specified as follows:

$$\begin{aligned}
 1. \ C(1)_t = & \beta_0 + \beta_1 \alpha E_{t-1} + \beta_2 \gamma E_{t-1} + \beta_3 \delta E_{t-1} + \beta_4 \alpha F_{t-1} \\
 & + \beta_5 \gamma F_{t-1} + \beta_6 \delta F_{t-1} + \beta_7 Y_{t-1} + \beta_8 [E/Y]_{t-1} \\
 & + \beta_9 P + \beta_{10} V + U_t
 \end{aligned}$$

Where $C(1)_t$ = Domestic construction (excluding public works)

$\beta_0 \beta_N$ = Coefficients to be determined

α = 1 if per capita income is less than or equal to 500

= 0 otherwise

γ = 1 if per capita income is between 500 and 1000

= 0 otherwise

δ = 1 if per capita income is greater than or equal to 1000

= 0 otherwise

F_{t-1} = Foreign exchange reserves lagged one time period

E_{t-1} = Exports lagged one time period

Y_{t-1} = Gross national product lagged one time period

$(E/Y)_{t-1}$ = Exports as a per cent of gross national product lagged one time period

P = Per cent of population residing in urban areas (i.e., over 20,000 in 1960)

V = Exchange rate valuation

U_t = Error term

2. $C(2)_t$ = Same as Equation 1 above

Where $C(2)_t$ = Domestic construction of dwellings and all

other variables are identical to those in Equation 1.

Hypothesis

The simple null hypothesis is:

$$H_0 : \beta_4 = \beta_5 = \beta_6 = 0 \text{ (For equations (1) and (2))}$$

The alternate (composite) null hypothesis is:

$$H_A : \beta_4 > 0 ; \beta_6 < 0$$

The null hypothesis (H_0) simply states that there is no relationship between foreign exchange reserves and construction in any of the groups. If this is rejected, the alternative hypothesis (H_A) is then tested.¹ This states that foreign exchange reserves and construction are directly related in Group I countries and inversely related in Group III countries. These relationships were anticipated and illustrated in Chapter IV, Figure 2.

In Chapter III, the model presented employed only two groups (I and III). In the preparation of the statistical analysis I have added a middle group (II). There is some question as to the effectiveness of including this group. Obviously, the delineation of the countries in this group will be less distinct than the others since it includes

¹The use of two hypotheses is common. "The null hypothesis usually states that the postulated relationship does not exist, which normally means that the value of one or more of the parameters is equal to zero, while the alternative hypothesis states that the relationship does exist." Kmenta, Jan. Elements of Econometrics, MacMillan Co., N.Y., 1971, p. 115.

countries whose per capita income might be a few dollars above the low group or a few dollars below the high one. At any rate, we can utilize this group as a buffer, separating the other two.

The inclusion of Group II does not, however, affect our test of the assumptions presented in the model. In fact, its inclusion should allow us to provide additional information. As pointed out in Chapter I, Strassmann has shown recently that "Construction grows less than GDP in underdeveloped countries, more than GDP in the developed, but the positive differential is greatest in the middle group."² These results differ from earlier tests run by Kuznets.³ Since we will be regressing construction against income for the high, middle and low income groups, this study should provide additional information which might help to settle this issue.

The Selection of Dependent Variables

Two dependent variables are observed in this study:

Total construction (CI) and the construction of dwellings (C2).⁴

²Strassmann, W. P., "The Construction Sector in Economic Growth", Scottish Journal of Economics, November, 1970, p. 399.

³Kuznets, Simon, "Quantitative Aspects of the Economic Growth of Nations, Part V, Capital Formation Proportions: International Comparisons for Recent Years," Economic Development and Cultural Change, July 1960, Part II, pp. 4-33.

⁴The specific components of these categories and the sources of data will be discussed in detail later in this chapter.

It was pointed out earlier that disaggregation of the construction sector is necessary. If total construction and dwelling construction are affected differently by the independent variables, failure to separate them would result in the estimation of coefficients which would be representative of neither.

The way in which a country reacts to changes in its reserve position will influence each sector differently. In most developed countries cited in this study, the construction of dwellings depends primarily on the initiative of private building firms and their response to fluctuations in the interest level in mortgage markets.

In many less developed countries, it is nearly impossible for the average worker to secure funding for the purchase of a home. Alluding to the Philippines, Abrams states that "... for the average man, getting a mortgage was like hunting big game in Mindanao with a sling shot."⁵

In most of the developed countries, the housing shortage is also very severe. However, the methods of financing home purchases is quite different. There exists in most of the wealthier nations a well functioning mortgage market. Even when the financing of housing construction is undertaken by social housing associations, the recipient of the loan must secure additional funds from conventional mortgage sources

⁵Abrams, Charles, Man's Struggle for Shelter, Massachusetts Institute of Technology Press, Cambridge, Massachusetts, 1964, p. 151.

such as savings and loan associations.

This need for additional borrowing means that interest rate fluctuations will influence the domestic construction of dwellings in the developed countries even when a portion of the funds is secured through government agencies. Thus we found an inverse relationship between foreign exchange reserves and the construction of dwellings in the high income countries.

The strength of the influence exerted by the domestic interest rate is determined by the extent of social housing undertaken and the portion of the total cost of the dwelling and site which is covered by the social loan. In Austria, approximately one-third of the dwellings built are financed by the social housing associations.⁶ However, "...the loans granted on first mortgage are generally limited to 40% of the value of the real-estate."⁷

In France, between fifty and sixty-five per cent of the market value of the purchase can be secured through public sources. Yet "In order to finance a third of the building operations...it is then necessary to get complementary loans at higher rates of interest and with a shorter redemption

⁶International Standing Committee for Social Housing (Ed.), The Financing of Social Housing in 11 European Countries and Israel, Secretariate of the Standing Committee for Social Housing, Confederation Francaise Pour L'Habitation et L'Urbanisme, Paris, 1965, p. 253.

⁷Ibid., p. 255.

delay."⁸

According to some analysts, housing in the United States "...has been a residual user of credit market funds"⁹ since World War II. However, since 1966, "...major changes have been made in Federal housing policy designed to loosen the link between housing and credit market conditions and provide more housing for the poor."¹⁰ If funds used for home-building can be viewed as a residual, this implies that housing is elastic with respect to the interest rate. During periods of tight money and high rates of interest, housing construction should fall. In order to determine the significance of the 'residual' concept discussed above and its relevance to the model used in this study, it is necessary to examine the relationship between the rate of interest and foreign exchange reserves. Unfortunately, this effect is difficult to ascertain. In the United States, a high rate of interest is usually associated with the latter stages of a boom period. If prosperity is the result of domestic private investment and government spending in excess of domestic savings and government revenue respectively, both national income and imports should increase. The effect of increased imports is to lower exchange reserves; however, the effect of the high

⁸Ibid.

⁹The Chase Manhattan Bank, "Housing and Credit Conditions; Breaking the Link", Business in Brief, No. 104, June 1972, p. 4.

¹⁰Ibid.

interest rate on international capital flows should tend to increase foreign exchange reserves through an increase in capital flows. The relative strength of these two effects is difficult to assess a priori.

It is also possible that domestic prosperity could be the result of a boom in export markets. In this case, the increase of exports, other things equal, should increase foreign exchange reserves. If we can again associate higher rates of interest with the upward swing of the business cycle, the effect of an export induced expansion is unambiguous. Both the higher rates of interest and the increase in exports tend to increase foreign exchange reserves.

During the 1950's and 60's, the United States did not enjoy a boom in its export sector. On the contrary, exports were falling rapidly.¹¹ Thus the effect of high interest rates in this period are ambiguous. The increase in imports has the opposite effect on reserves as the increase in the rate of interest. The combined effect is uncertain, at least for the United States.

These examples cited above illustrate the different characteristics displayed by the industrialized and non-industrialized countries in this study. The developed countries rely largely on specialized mortgage institutions for the financing

¹¹MacDougall, Sir Donald, "The Dollar Problem: A Re-appraisal", Essays in International Finance, Princeton University International Finance Section, No. 35, November 1960, Princeton, New Jersey, pp. 44-47.

of housing construction. The less developed countries, on the other hand, have not yet developed these institutional structures to the extent that they can provide for the financing of a significant portion of the home building sector. Some possible policies which might be introduced to help solve the problems faced by both the low and high income countries will be discussed in Chapter VII.

Strassmann shows that housing construction as a per cent of gross national product is 2.5 per cent for under-developed countries and 4.4 per cent for developed countries.¹² Thus, even if both groups react the same way to a change in reserves (transmitted through the domestic interest rate structure), the developed countries' construction of houses would be more directly affected than the less developed countries because their construction sector is more responsive to changes in national income. The strength of these relationships will be tested in Chapter VI.

The Selection of Independent Variables

Six independent variables will be employed to estimate equations 1 and 2 above. Two of these, foreign exchange reserves and exports, were blocked according to per capita income levels and assigned dummy variables in the regression. The remaining four variables were estimated for each country, and entered into the regression as a single variable.

¹²Strassmann, W. P., op. cit., Table II, p. 407.

Foreign Exchange Reserves

The foreign exchange reserve variable (F) is basic to the model presented in Chapter III and the hypothesis stated above. The reasons for its inclusion were discussed in depth in Chapters I through IV.

Exports

Exports were selected for inclusion in the regression for several reasons. It seemed desirable to include a measure of the physical movement of goods and services as well as the financial variable (F) which includes capital movements. In the early stages of the development of this study it was decided to use the balance of payments as an independent variable. However, further inquiry suggested that exports could be more suitably employed in the context of this model. In the less developed countries "exports...tend to generate parallel fluctuations in their imports."¹³ This is true because when export proceeds fall, the weakened reserve position forces countries to reduce their imports. It is possible that the government will attempt to apply countercyclical measures. This will be discussed in Chapter VII.

In the developed countries we notice the same parallel movement. In this case, however, the reason for the correspondence is different. When exports fall there is a tendency

¹³MacBean, Alasdair, I., Export Instability and Economic Development, Harvard University Press, Cambridge, Massachusetts, 1966, p. 31.

to restrict imports in order to maintain equilibrium in the balance of payments. "...quantitative restrictions are often introduced to improve a country's balance of payments. They have an immediate visible impact on a country's imports".¹⁴

In both cases, the fluctuation in exports is followed by similar movements in imports. However, there is a lag involved in the adjustment process. The length of this lag varies among countries and depends upon the nature of the policies implemented and the speed with which they take effect.¹⁵ Some of these policies were discussed earlier in this chapter. Attempting to adjust for this effect on a country-basis would have entailed a separate study as lengthy as the present one. Since foreign exchange reserves and balance of payments tend to move together,¹⁶ it was considered unnecessary to use the balance of payments as an independent variable since it would simply reflect foreign reserve movements.

Gross National Product

Gross National Product was introduced in order to provide a country adjustment for variations in income during the period under consideration. The effect of including GNP is to

¹⁴Sodersten, Bo, International Economics, Harper and Row, Publishers, New York, 1970, p. 369.

¹⁵MacBean, op. cit., p. 259.

¹⁶Ibid., p. 84.

sort out the business cycle effect. The coefficients estimated for the remaining variables are indicative of the effect of the variables after the influence of all other variables has been accounted for.

It was noted earlier that GNP has a strong effect on construction activity.¹⁷ The exclusion of an independent variable which is statistically significant will damage the tests of significance. Thus, even though it is well known that GNP is directly related to construction activity, the strength of this correspondence must be isolated in order to test the other variables.

Exports As A Percentage Of GNP

The dependence of a large portion of national income on earnings from the export sector was recently thought to be a characteristic of less developed countries. Both Higgins¹⁸ and Singer¹⁹ have promulgated this view. Later empirical studies have not substantiated this argument. Kuznets²⁰ and Michaely²¹ report that the level of development

¹⁷cf. Chapter I above.

¹⁸Higgins, Benjamin, Economic Development, W. W. Norton, New York, 1959, p. 155.

¹⁹Singer, Hans, "The Distribution of Gains Between Investing and Borrowing Countries," American Economic Review, May 1950, p. 473.

²⁰Kuznets, Simon, Six Lectures on Economic Growth, The Free Press, Glencoe, Illinois, 1959, pp. 89-107.

²¹Michaely, Michael, Concentration in International Trade, N. Holland Publishing Company, Amsterdam, 1962, Table 12.

is not related to the share of exports in GNP generation. Thus an early attempt to link instability experienced by the less developed countries to their purportedly large volume of exports as a percentage of GNP was shown to be incorrect.

The 'engine of growth' view of trade implies that as trade becomes more prominent in the economy of a country, the rate of growth will be sustained or accelerated.²²

Cairncross states that:

The common experience in under-developed countries is not that exports are already a dangerously large element but that they are not large enough to give adequate elbow room in the financing of new investment.²³

Thus we should expect that in countries where the volume of exports relative to GNP (E/Y) is rising, domestic activity will similarly increase.

The equations which are being estimated in this study lend themselves nicely to a test of the 'engine of growth' theory. If Nurkse and Cairncross are correct in their assertions, we should find that movements in the variable E/Y are directly related to the growth of National Income. And, since we have shown earlier that there exists a strong direct relationship between the growth of income and construction,

²²Nurkse, Ragnar, "Trade Theory and Development Policy", in H. S. Ellis, (ed.), Economic Development for Latin America, MacMillan and Co., St. Martin Press, New York, 1961, pp. 236-45.

²³Cairncross, A. K., Factors in Economic Development, George Allen Unwin, London, 1962, pp. 214-20.

the inclusion of E/Y in the regression equations 1 and 2 can be accomplished with no alternation in the system.

If the coefficient estimated for E/Y is positive, the engine of growth theory is supported. If this coefficient is negative, the theory is not supported.

Per Cent of Population Residing in Urban Areas

The effect of the population variable is somewhat ambiguous. Because of data limitations, I was able to find only the per cent of population residing in urban areas in 1960. The most desirable variable to use in this context would have been the percentage change in the per cent of population living in urban areas; this data was not available for many of the countries in the sample. However, I did uncover enough data to ascertain the relationship between the absolute per cent of population and the change associated with it. Table IV lists those countries for which data was available.

In 1960, 16 countries, reported 45 per cent or more of their population residing in urban areas, while 14 countries reported urban population to be less than 45 per cent. In the former group, the percentage change in the population variable over a 10 year period averaged 11 per cent, while in the later group, a much larger change of 18 per cent was observed. On this basis, it appears that those countries which had a high percentage of people in the urban centers during 1960, experienced rapid urbanization prior to 1960,

Table IV.--Percentage Change in Urban Population, 1950-60
(Sample Countries)

Country	Per Cent Urban Population (1960)	Percentage Change in Urban Population (1950-60)
Argentina	55	7
Austria	38	0
Belgium	52	2
Canada	53	11
Chile	53	21
China	29	17
Columbia	31	32
Denmark	49	8
Finland	39	21
France	48	6
Germany	52	12
Greece	35	14
Honduras	54	0
Israel	61	5
Italy	47	13
Japan	46	17
Korea	29	28
Netherlands	60	7
Norway	35	14
Philippines	17	12
Portugal	2-	11
S. Africa	36	14
Spain	45	11
Sweden	40	18
Switzerland	30	3
Thailand	9	33
Turkey	21	33
U.K.	69	0
Uruguay	56	23
Venezuela	45	27

Source: United Nations, Statistical Yearbook, New York,
1967, pp. 78-100.

well before the effective date which this study commences with. The other group was apparently experiencing rapid rural-urban migration during the 1950's. The conclusion then is that the coefficients on the population variable in this study should be negative since on the average those countries which had the lowest percentage of population residing in urban areas in 1960 experienced the greatest rural-urban migration in the prior decade which coincides with this study. This indicates that considerable pressure was exerted in the construction industry during this period in order to house a rapidly expanding urban population and should be reflected by the negative sign on the coefficients.

Exchange Rate Valuation Index

Singh has recently hypothesized that "...over-valuation of the exchange rate introduces inefficiencies all around; and even for the same rate of investment, lowers the rate of growth".²⁴ The index used to estimate the degree of over or under-valuation is the official rate of exchange divided by the average unofficial rate for the period. Thus, if the currency is over-valued, the index will be greater than one. Unity in the index reflects perfect agreement between the official rate and the unofficial rate.

²⁴Singh, S. K., "Possibility and Implications of Employment Promotion; Aggregate Production Function, and Causes of Growth," I.B.R.D., Domestic Finance Division, Washington, D.C., unpublished paper, July 7, 1970 (Revised February 10, 1971), p. 33

Following Singh, the anticipated relationship between the exchange rate valuation index and construction is negative.

However, Gurley and Shaw state that:

Overvaluation of domestic currency on the foreign exchanges may transfer real income from an exporting sector...to an importing sector... Depending upon relevant elasticities of demand and supply, overvaluation can also appropriate foreign savings for domestic use.²⁵

In Chapter II above, I quoted Maisel's assertion that materials destined for use in home building were largely imported.²⁶ Along with the Gurley and Shaw argument above, this would suggest that the movements in exchange rate valuation and construction will be directly related. The greater the over-valuation the greater the reserves transferred to an importing sector; and since house building is an importing sector we should observe an increase in building activity.

This argument is not very convincing. If a country has an over-valued currency, domestic prices of export commodities will be relatively expensive (i.e., overpriced to the degree that the currency is over-valued). Thus, we would expect a decrease in that country's reserve position, partially

²⁵Gurley, John G. and Shaw, Edward S., "Financial Development and Economic Development," Economic Development and Cultural Change, Vol. 15, No. 3, April 1967, p. 262.

²⁶cf. Chapter II, p. 11, fn. 16.

reflecting a loss of export sales. As a result there exists pressure to maintain higher real rates of interest internally in order to facilitate capital inflows and to avoid an out-flow of foreign investment. Higher interest rates domestically tend to suppress all types of construction activity.

On the basis of the empirical results reported by Singh, which show a negative relationship between growth and the index of currency valuation and on the above argument, I would predict that the coefficient in this study will also be negative. In Chapter VI this test will be made.

Sources of Data

Data for the following variables were collected from the United Nations Yearbook of National Accounts Statistics: C(1), total construction excluding public works; C(2), the construction of dwellings; (Y), Gross National Product; (P), the per cent of population residing in urban areas.

The United Nations' description of dwellings is

All expenditure on new construction and major alterations to residential buildings, including the value of the change in work in progress but excluding the value of the land before improvement. Expenditure on all permanent fixtures such as furnaces, fixed stoves, central heating and water supply installations is included.

The description of total construction used includes that of dwellings stated above plus:

Non-residential buildings. All buildings other than dwellings. It includes industrial buildings, warehouses, office buildings, stores, restaurants, hotels,

farm buildings and buildings for religious, educational and similar purposes. Major alterations and work in progress are included. Movable equipment which is not an integral part of the structure is not included.²⁷

The currency valuation index was constructed from data presented in the Picks Currency Yearbook.²⁸ Exports, foreign exchange reserves, and price indices were taken from the International Monetary Fund International Financial Statistics.

Originally this study contained a sample of 51 countries. As the collection process proceeded, 15 countries were dropped from the sample because of insufficient data. For many of the low income countries, 1955 was the earliest year for which data was available. Attempts to extend the time period were frustrated by inadequate reporting of these countries.

In each regression, it was necessary to exclude some countries because of insufficient data. In equation (1) in which total construction (C1) is the dependent variable, Ireland was dropped from the middle group (II) and Switzerland was excluded from the high group (III).

In Equation (2), it was necessary to exclude three countries from the sample. The Philippines was dropped from

²⁷United Nations Yearbook of National Accounts Statistics, Individual Country Data, New York, 1968, p. xxiv.

²⁸Bame, Jack J. (ed.), Picks Currency Yearbook, Picks Publishing Corp., New York, 1968.

Group I, Chile from Group II and Israel from Group III. Observations for each of the variables were found for all of the remaining countries.

Estimation Techniques

The method used to estimate the coefficients in Equations (1) and (2) can be described generally as a pooled, cross-sectionally heteroskedastic and time wise non-autoregressive model.²⁹ The regression equation for this model is a generalization of (1) and (2) above and can be expressed as

$$(3) \quad Y_{it} = \beta_1 X_{it1} + \beta_2 X_{it2} + \dots + \beta_k X_{itk} + \epsilon_{it}$$

Where: $i = 1, 2, \dots, N$ (and N is the number of countries in the cross section)

and $t = 1, 2, \dots, T$ (where T is the number of years)

For this study, $N = 36$ and $T = 15$.

By pooling the data we combine cross-sectional observations over time. The total number of observations is $N \times T$. If we were to use the conventional ordinary least squares method of estimation the number of observations would be only 15 (one for each year). Thus we have gained 525 observations by the pooling procedure. This is most important since we have lagged some of the variables, resulting in a

²⁹For a general description of this model see: Johnston, J., Econometric Methods, McGraw Hill, New York, 1960, pp. 179-192 and Kmenta, Jan, Elements of Econometrics, MacMillan Co., New York, 1971, pp. 270-275.

loss of degrees of freedom. This method also increases the efficiency of the estimates.

This method of pooling the data is essentially the same as Aitken's generalized least squares estimation procedure. However, it is necessary to introduce some additional assumptions and constraints.

The assumption of heteroskedasticity is common in dealing with cross-sectional data. In this model, the assumption of heteroskedasticity means simply that we do not expect the variance of the disturbance term in each country to be of the same magnitude. This seems to be a reasonable assertion, especially since the sample being used includes countries at all levels of national income. Failure to adjust for heteroskedasticity when it is present will result in estimators which "...are unbiased and consistent but not efficient or asymptotically efficient".³⁰

A disturbance which is characterized by heteroskedasticity over cross sections and is homoskedastic over time may be represented as

$$(4) \quad E(\epsilon_{it}^2) = \sigma_i^2 \quad \text{for all } t$$

In order to increase the efficiency of the least squares estimators we must adjust the observations in order to eliminate the heteroskedasticity. If all of the variances were known, we could divide each observation used in regression equations

³⁰Kmenta, op. cit., p. 254.

(1) and (2) by σ_i^2 . This results in an error term $\epsilon_i^* = \frac{\epsilon_{it}}{\sigma_i}$ which is distributed $\epsilon_i^* \sim (0,1)$ because $E \left[\frac{\epsilon_{it}}{\sigma_i}^2 \right] = \frac{\sigma_i^2}{\sigma_i^2}$

The variances σ_i^2 are not known but consistent estimates can be obtained by using the residuals from the ordinary least squares estimation of the original data. This estimate is expressed as

$$(5) \quad \hat{\sigma}_i^2 = \left[\frac{\sum_t \epsilon_{it}^2}{N} \right]$$

where N is the number of observations for each country. The estimate was then calculated and used to weight all variables in all countries.

This model deals not only with cross-sectional data. We also are observing the variables over time within each cross-section. The classical problem usually found in time-series models is that of autoregression. If it is present, observations made in time period t will be correlated with those made in period t-1 within the same cross sectional observation.

This problem does not appear to be serious in this study. The time interval used is one year. A longer time period increases the likelihood that autoregression will not damage the model. In the words of Kmenta, "...we would be more suspicious of the presense of autoregression when dealing with monthly or quarterly observations than when the data are given at annual intervals".³¹

³¹Ibid., p. 270.

If autoregression is present, and uncorrected for, the estimates will still be unbiased. Furthermore, it is likely that the coefficient of correlation (ρ) between ε_t and ε_{t-1} will be positive (negative bias). Kmenta points out that "such a situation is fairly common with economic-time series".³² A negative bias ($\rho > 0$) means that

...in using the conventional least squares formulas the calculated acceptance regions or confidence intervals will often be narrower than they should be for the specified level of acceptance or confidence.³³

Thus the significance of the estimates found in the regression will be understated. This will be a problem only if the levels of significance are too low for acceptance.

Summary

The strength of the statistical test described above derives from the method of pooling time series and cross-sectional data. Variables F and E are assumed to have different effects on (C1) and (C2) depending upon the group which is being tested. The remaining variables are tested for their effect on the entire sample.

Equations (1) and (2) represent 6 separate equations. Thus Equation (1) becomes

³²Ibid., p. 270.

³³Ibid., p. 282.

$$\begin{aligned} \text{Group I} \quad C(1)_t &= \beta_0 + \beta_1 E_{t-1} + \beta_4 F_{t-1} + \beta_7 Y_{t-1} \\ &+ \beta_8 [E/Y]_{t-1} + \beta_9 P + \beta_{10} V + \epsilon_t \end{aligned}$$

$$\begin{aligned} \text{Group II} \quad C(1)_t &= \beta_0 + \beta_2 E_{t-1} + \beta_5 F_{t-1} + \beta_7 Y_{t-1} \\ &+ \beta_8 [E/Y]_{t-1} + \beta_9 P + \beta_{10} V + \epsilon_t \end{aligned}$$

$$\begin{aligned} \text{Group III} \quad C(1)_t &= \beta_0 + \beta_3 E_{t-1} + \beta_6 F_{t-1} + \beta_7 Y_{t-1} \\ &+ \beta_8 [E/Y]_{t-1} + \beta_9 P + \beta_{10} V + \epsilon_t \end{aligned}$$

Equation (2) can be disaggregated the same way. For operational reasons I have combined these equations by using dummy variables to place variables E and F in the correct group.

Except for the heteroskedasticity adjustment, the method used is essentially the same as Aitkin's generalized least squares. The data has been pooled over time and across countries in order to increase the degrees of freedom necessary for statistically significant estimates.

In Chapter VI the results of the statistical test will be presented and evaluated. The anticipated signs of many of the regressors was mentioned earlier. Where discrepancies occur, an attempt will be made to explain the results.

CHAPTER VI

EMPIRICAL RESULTS

Introduction

The rationale for using Aitkin's generalized least squares technique of estimation was provided in the previous chapter. Since this method is somewhat unorthodox, some introductory remarks are in order.

When cross-sectional and time series data are pooled, the efficiency of the estimates is increased. That is, the sampling distribution of the estimator has a variance smaller than that found in the ordinary least squared method. This increase in efficiency is the result of the assumption that some of the independent variables behave in the same way regardless of the income level of the country. That is, they were entered into the regression equation as a single variable without the use of dummies. This assumption was made for the variables estimated by coefficients β_7 through β_{10} in Equations (1) and (2) in Chapter V. The remaining parameters (β_0 through β_6) are estimated separately for each income group. (The real names of the coefficients are shown on the following page.) The R^2 estimates are based on the regression fit for the entire pool of data and the coefficients β_7 through β_{10} are estimated for the entire pool.

Listing of Empirical Results

The results of the regression analysis are shown in Tables V and VI.

The results are expressed in terms of the disaggregated regression equations below.

$$(6) \text{ Group I: } C(1) = .4870 - .8504 E_{t-1} + .0005 F_{t-1} + .1096 Y_{t-1}$$

$$(2.50) \quad (5.40) \quad (1.53) \quad (39.36)$$

$$+ 2.5353 E/Y_{t-1} - 1.8909 P - .3652 V$$

$$(7.98) \quad (6.34) \quad (2.53)$$

$$(7) \text{ Group II: } C(1) = .9649 - .1183 E_{t-1} - .0034 F_{t-1} + .1096 Y_{t-1}$$

$$(3.68) \quad (2.77) \quad (8.04) \quad (39.36)$$

$$+ 2.5353 E/Y_{t-1} - 1.8909 P - .3652 V$$

$$(7.98) \quad (6.34) \quad (2.53)$$

$$(8) \text{ Group III: } C(1) = .7578 - .1680 E_{t-1} - .0002 F_{t-1} + .1096 Y_{t-1}$$

$$+ 2.5353 E/Y_{t-1} - 1.8909 P - .3652 V$$

$$(7.98) \quad (6.34) \quad (2.53)$$

$$(9) \text{ Group I: } C(3) = .8708 - .3740 E_{t-1} - .0005 F_{t-1} + .0639 Y_{t-1}$$

$$(4.97) \quad (2.39) \quad (1.80) \quad (27.41)$$

$$+ 2.5455 E/Y_{t-1} - 2.9257 P - .3584 V$$

$$(8.83) \quad (10.27) \quad (2.85)$$

$$(10) \text{ Group II: } C(3) = 1.0905 + .0912 E_{t-1} - .0006 F_{t-1} + .0639 Y_{t-1}$$

$$(4.96) \quad (3.48) \quad (2.51) \quad (27.41)$$

$$+ 2.5455 E/Y_{t-1} - 2.9257 P - .3584 V$$

$$(8.83) \quad (10.27) \quad (2.85)$$

Table V.--Estimated Coefficients for Total Construction (C1)

$$R^2 = .92$$

Variable	Regression Coefficient	t Value	Significance
1 GNP (Y)	$\beta_7 = +.1096$	+ 39.36	<.0005
2 Currency Valuation Index (V)	$\beta_{10} = -.3652$	- 2.53	.0110
3 Per Cent Urban Population (P)	$\beta_9 = -1.8909$	- 6.34	<.0005
4 Exports as a Per Cent of GNP (X/Y)	$\beta_8 = +2.5353$	+ 7.98	<.0005
5 Intercept for Group (I)	$\alpha = +.4870$	+ 2.50	.0120
6 Intercept for Group (II)	$\gamma = +.9649$	+ 3.68	<.0005
7 Intercept for Group (III)	$\delta = +.7578$	+ 3.00	.0030
8 Foreign Exchange Reserves Group (I)	$\beta_4 = +.0005$	+ 1.53	.1240
9 Foreign Exchange Reserves Group (II)	$\beta_5 = -.0034$	- 8.04	<.0005
10 Foreign Exchange Reserves Group (III)	$\beta_6 = -.0002$	- 3.40	.0010
11 Exports (E) Group (I)	$\beta_1 = -.8504$	- 5.40	<.0005
12 Exports Group (II)	$\beta_2 = -.1183$	- 2.77	.0060
13 Exports Group (III)	$\beta_3 = -.1680$	- 9.73	<.0005

Table VI.--Estimated Coefficients for Dwelling Construction (C2)

$$R^2 = .92$$

Variable	Regression Coefficient	t Value	Significance
1 GNP (Y)	$\beta^*_7 = +.0639$	+ 27.41	<.0005
2 Currency Valuation Index (V)	$\beta^*_{10} = 0.3584$	- 2.85	.0050
3 Per Cent Urban Population (P)	$\beta^*_9 = -2.9257$	-10.27	<.0005
4 Exports as a Per Cent of GNP (X/Y)	$\beta^*_8 = +2.5455$	+ 8.83	<.0005
5 Intercept for Group (I)	$\alpha^* = +.8708$	+ 4.97	<.0005
6 Intercept for Group (II)	$\gamma^* = +1.0905$	+ 4.96	<.0005
7 Intercept for Group (III)	$\delta^* = +.6009$	+ 2.73	.0070
8 Foreign Exchange Reserves Group (I)	$\beta^*_4 = -.0005$	- 1.80	.0700
9 Foreign Exchange Reserves Group (II)	$\beta^*_5 = -.0006$	- 2.51	.0120
10 Foreign Exchange Reserves Group (III)	$\beta^*_6 = +.0008$	+11.44	<.0005
11 Exports (E) Group (I)	$\beta^*_1 = -.3740$	- 2.39	.0160
12 Exports Group (II)	$\beta^*_2 = +.0912$	+ 3.48	.0010
13 Exports Group (III)	$\beta^*_3 = -.0513$	- 3.16	.0020

$$\begin{aligned}
 (11) \text{ Group III: } C(3) = & \begin{matrix} .6009 \\ (2.73) \end{matrix} - \begin{matrix} .0513 \\ (3.16) \end{matrix} E_{t-1} + \begin{matrix} .0008 \\ (11.44) \end{matrix} F_{t-1} \\
 & + \begin{matrix} .0639 \\ (27.41) \end{matrix} Y_{t-1} + \begin{matrix} 2.5455 \\ (8.83) \end{matrix} E/Y_{t-1} - \begin{matrix} 2.9257 \\ (10.27) \end{matrix} P - \begin{matrix} .3584 \\ (2.85) \end{matrix} V
 \end{aligned}$$

Evaluation of the Model

In Chapter IV an alternative model was introduced in order to explain some of the changes in the building cycle relationship between countries at different levels of development. It was shown in Chapters II and III that prior to 1914, building cycles in the industrialized and non-industrialized countries were inversely related. During the 1955-68 period this was reversed. Foreign exchange reserves of the two groups now evidenced a positive correlation. Thus it was shown that the correspondence between exchange reserves and construction in either the high group or low group must have changed.

Empirical evidence and intuition suggested that the high group experienced institutional and administrative changes which increased their insulation from external financial fluctuations.

The graphical illustration of this hypothesis is reproduced in Figure 12. The solid lines indicate those relationships which were verified ex-ante. The slopes of the dotted lines represent the hypothesized signs of the unknown coefficients.

Support for the hypotheses in Figure 12 is provided in

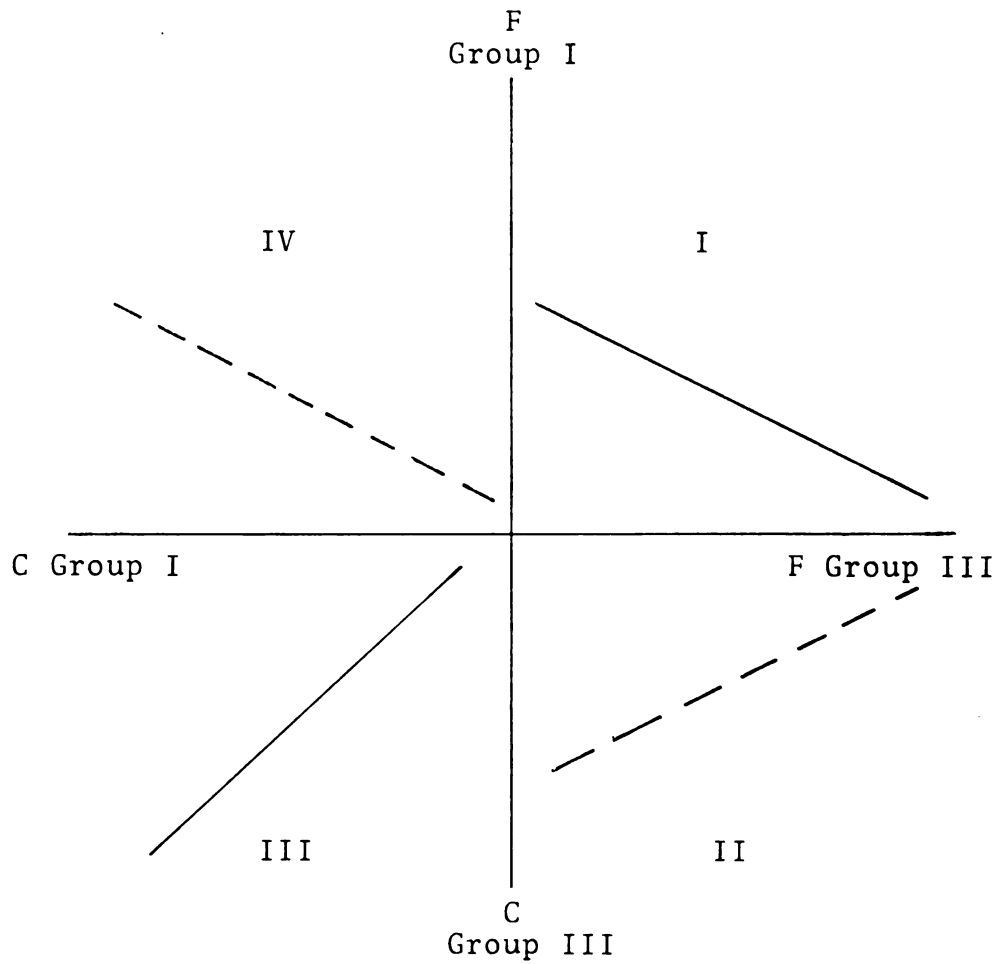


Figure 12.--The Four Quadrant Model with the Hypothesized Coefficients for Two Quadrants

equations (1) through (3). The simple set of null hypotheses are:

$$H_0 : \beta_4 = 0$$

$$H'_0 : \beta_5 = 0$$

$$H''_0 : \beta_6 = 0$$

The alternate hypotheses are:

$$H_A : \beta_4 > 0$$

$$H'_A : \beta_6 < 0$$

The null hypotheses (H_0 , H'_0 and H''_0) simply state that there is no relationship between foreign exchange reserves and construction in any of the three groups. If these are rejected, the alternative hypotheses (H_A and H'_A) are then tested.¹

This states that foreign exchange reserves and construction are directly related in Group I countries and inversely related in Group III countries. These anticipated relationships are represented in Figure 12.

The null hypotheses H'_0 and H''_0 can be formally rejected on the basis of the significance levels shown in Table I and equations (5) through (8) above. The coefficient for β_4 is

¹c.f., Kmenta, *Ibid.*, p. 115, "The null hypothesis usually states that the postulated relationship does not exist, which normally means that the value of one or more of the parameters is equal to zero, while the alternative hypothesis states that the relationship does exist."

.0005; however, the level of significance is less than 90 per cent. Thus we must formally accept the null hypothesis H_0 .

The alternative hypothesis H_A does not require testing since we have already accepted the null hypothesis for this parameter. However, the alternative hypothesis H'_A is acceptable. The regression coefficient is $-.0034$ and is significant at the 99 per cent level. Thus we would formally reject the alternative hypothesis (H_A) that $\beta_4 > 0$ and accept alternative hypothesis (H'_A) that $\beta_4 < 0$.

I have consciously used the term 'formally reject' in the previous passage. It was pointed out in Chapter IV, Figure II that quadrants I and III were (ex ante) empirically established. Thus if one of the two remaining quadrants can be constructed the other is determinate. This was demonstrated in Equations (4) and (5) in Chapter IV. The alternative hypothesis (H'_A) that construction in developed countries is inversely related with foreign exchange reserves was accepted. It follows from the model then that construction in the less developed countries must be positively related with foreign exchange reserves.

The estimated coefficient for β_4 was .0005. This is the relationship we predicted; that is, $dC/dF > 0$ for Group I. However, the level of significance is less than 90 per cent (87.6). The results of the statistical test therefore appear to be ambiguous.

One way to circumvent this contradiction formally is to use a 'one-tail' test to evaluate the alternative hypothesis.

...sometimes we are able to make assumptions that permit a somewhat less general specification of the alternative hypothesis. In particular, sometimes we are reasonably certain that the only claim that $\mu = \mu_0$ is the claim that it is greater (or smaller) than μ_0 ²

In the context of this analysis, we have shown deductively that if construction and foreign exchange reserves in the high income countries (β_6) is less than zero, the relationship between these same two variables in the low income countries must be inverse. If a one-tail test is used, the level of significance increases and falls within the acceptance range.

On the basis of the conventional two-tail test, the coefficient for β_4 falls just below the acceptance level of significance. However, the use of a one-tail test seems appropriate since we do have a priori evidence of the projected sign of the coefficient. Since the magnitude of the regression coefficient does not affect the relationships postulated in the model, I am disposed to cautiously regard the statistical evidence as supportive of the model.

²Ibid., p. 119.

The Construction of Dwellings

The construction of dwellings was also regressed against the same independent variables. It was stated earlier that the variation in this sector need not be the same as total construction. Since the data was available for most of the sample, and little effort was spent in compilation time, I thought it expeditious to test Equation (2).

In Table VI the estimated coefficients for the regressors on C(2) are shown. The null hypotheses to be tested are:

$$H_0^0 : \beta_4 = 0$$

$$H_0^1 : \beta_5 = 0$$

$$H_0^2 : \beta_6 = 0$$

No alternative hypothesis is advanced. The testing of the model does not require any specific relationship between foreign exchange reserves and dwelling construction.

All three null hypotheses are rejected; the lowest acceptance level is 93 per cent for β_4 (Group I). The signs of the coefficients are the opposite of those observed in the regression of total construction. That is, $\beta_4 < 0$ and $\beta_6 > 0$. This indicates that the construction of dwellings is inversely related to foreign exchange reserves in the less developed countries and positively related in the developed group. Apparently this sector of the construction industry

is less isolated from external fluctuations in the industrialized nations.

The plausibility of less developed countries being more isolated from external shocks because of greater government participation in the house building sector was explored in Chapter V (p.). In the industrial countries, the fiscal and monetary authorities are able to protect the domestic construction industry from external financial variables. However, the domestic house-building industry is subject to the external fluctuations indirectly through the money markets. Furthermore, the sophistication of the financial intermediaries in the wealthier nations tends to hasten the transmission of shocks generated in the external financial position of the country.

Exports

The effect of exports on the construction sector is apparently the same in all countries regardless of their income level. In Table VI, lines 11 through 13, the estimated coefficients for the export variable are listed. The parameters are negative for all groups. As exports increase, total construction activity decreases. The coefficients for the three groups are $-.8504$, $-.1183$, and $-.1680$ respectively. All are acceptable at the 99 per cent confidence level.

As exports increase, domestic output in this sector draws on the economy's productive resources. Those industries which are engaged in export activity expand their output.

Since construction is uniquely oriented to domestic markets, activity in this sector is decreased.

There are two factors which determine the strength of this effect: The percent of total productive capacity being used and the short-run elasticity of supply of the export oriented industries. If these industries are operating at capacity, any long-run increase in output must be accompanied by an increase in the scale of the plant or the building of new plants. Short-run increases in output under these conditions will be accompanied by increasing average costs. This increase in output leads to competition in the bidding for productive inputs and capital. If in response to favorable markets the export firms are able to increase supply easily, greater output might be achieved in both the short and long-run without affecting other industries in the economy. On the other hand, if the short-run supply is highly inelastic, considerable amounts of inputs destined for other industries will have to be diverted to the export firms.

High supply elasticities are usually found in those firms which are characterized by decreasing costs in the range in which they are operating. Conversely, if the short-run elasticity of supply is low and the representative firm experiences increasing costs, it is likely that any expansion of output will be the result of new firms entering the industry or established firms constructing new plants. This, of course, results in the loss of productive resources

by the non-export industries in the economy.

The negative relationship between exports and construction observed for all income groups indicates that the export firms might have been operating at less than full capacity during the time period under consideration. Increased exports did not lead to an increase in construction activity. It is also possible that the short time period being considered (15 years) was not long enough to account for construction of new plants in the export oriented industries. Under the assumption of full capacity operation, the short-run effect we would expect to observe would be an increase in average cost and product prices in the export firms. These effects are difficult to sort out and would entail a separate study of the export industry. Several possible effects have been discussed; however, a detailed examination of this question is beyond the scope of this analysis. The need for further research is apparent and will be discussed in Chapter VII.

In Groups I and III the relationship between exports and the construction of dwellings was negative; in Group II the coefficient was positive (cf. Table VI, Lines 11-13, p. 89). I can offer no convincing explanation for the sign change in the middle group. It was mentioned earlier that the delineation of the intermediate group is useful only because it separates the other two. Since this group exhibits characteristics of both the high and the low group, I do not

attach any importance to the estimated parameter for this group.

Additional Findings

The estimated signs of the remaining independent variables are shown in Tables V and VI. The coefficients for gross national product and exports as a per cent of gross national product are positive as postulated in Chapter V. Both are significant at the 99 per cent level.

The direct relationship between exports as a per cent of GNP and construction lends support to the 'engine of growth' thesis discussed in Chapter V. The estimated coefficient of 2.5353 is significant at the 99 per cent level.

The other two variables tested were the currency valuation index and the per cent of urban population. The estimated coefficients for these variables were both negative and highly significant (99 per cent level). These results were anticipated and discussed in detail in Chapter V.

Summary

The results of the regression analysis are shown in Tables I and II. These findings lend support to the model introduced earlier. All of the estimated coefficients were significant at the 90 per cent level or above with the exception of foreign exchange reserves in Group I countries. It was shown that the sign was as postulated in the model. The relationship between foreign exchange reserves and

construction in the high income countries was negative, as predicted in the model, and highly significant. It was then demonstrated that the sign of the coefficient for foreign exchange reserves regressed on construction is determinate and must be positive for the low income countries.

In the next and final chapter I shall present in summary form the nature of this study and an outline of the policy implications. Finally the limitations of the study and further suggested work in the area will be investigated.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Summary of the Thesis

A great deal has been written about the cyclical trends in the building industry. Early observers noted an inverse relationship between construction in the industrialized and non-industrialized countries. In this paper several empirical studies have been cited and incorporated in a model. The model sought to explain the relationship between international payments and domestic construction during the 1870-1913 period. It was shown that foreign exchange reserves and construction were directly related. The main implication of this correspondence is that both the industrialized and the newer raw-material-exporting nations were unable to protect their domestic construction activity during this early period; an increase in reserves was accompanied by an increase in aggregate construction.

In Chapter IV an alternate version of the basic model was presented. Some of the relationships observed during the early period had changed. After 1955 the building cycles of the industrialized and non-industrialized countries had moved into phase with one another. During this same period the relationship between exchange reserves in the high and

low income countries was the same as that observed in the 1870-1913 period; that is, when foreign reserves are high in the industrialized countries they are low in the non-industrialized nations (and vice versa). Domestic building in either the high or low income groups must have become more protected from external fluctuations in exchange reserves or construction was even used countercyclically. More integrated financial markets but greater administrative ability to protect the domestic economy with monetary and fiscal tools characterized the most industrialized countries. The implication is that the less developed countries were still strongly influenced by external shocks and unable to isolate domestic building from fluctuations in exchange reserves. These hypotheses were tested and supported in the statistical tests reported in Chapter VI.

Implications

To stabilize domestic construction, one must first ascertain the causes of instability. This study has provided evidence that fluctuations in exchange reserves are among these causes, although other variables affect construction and foreign exchange reserve fluctuations influence many other sectors of the economy.

In the less developed countries, external shocks lead to movements in aggregate construction, while the construction of dwellings appears to be effectively protected. Quite the opposite is observed in the developed countries. Here the

ability to protect domestic activity is seen in the total construction sector but not in house building.

The two groups of countries use different methods to meet changes in their balance of payments position. Government countercyclical programs can operate in different ways in the two groups. In the developed countries, the government can influence the total construction sector by changing the pace and the timing of public projects. However they do not appear to be able to affect the domestic construction of dwellings outside of the public sector. One policy would be to lower domestic interest rates. However, this action would only intensify the loss of foreign exchange reserves because funds would flow out in search of higher rates of interest.

The role of protecting domestic construction and home building against external factors appears to be reversed for the less developed countries. They are apparently unable to protect total construction from external shocks; however, the construction of dwellings moves countercyclically.

These differences in the ability to protect the construction industry might, therefore, reflect the different ways in which home buyers secure the necessary funds in the developed and less-developed countries. In the industrialized countries, the financial structures are more sophisticated. Fluctuations in reserve positions are quickly transmitted through the domestic economy by way of changes in the interest rate. If reserves are low, the central bank is likely to

raise the interest rate through restrictive monetary policy. The higher interest rate causes a reduction of loanable funds domestically and forces more stringent requirements to be placed on prospective borrowers.

Balance of payments considerations might exert similar pressures on the central banks of the non-industrialized nations. However, the transmission mechanism does not operate as effectively in these countries; furthermore, the purchase of new dwellings is largely restricted to the wealthier segment of society. When they choose to build, these individuals can raise relatively large sums of money. But even "...where the average family has small savings, a house must usually be paid for outright".¹ Thus, even if the banking system reacted to a loss of reserves by raising interest rates, the home-buyers have not been greatly affected. Therefore, it is plausible that fluctuations in foreign exchange reserves have had less effect on the dwelling sector of the construction industry in the non-industrialized countries.

Policy Recommendations

When all of the funds for housing must be provided by the same sources as other investment programs, competition for funds becomes acute. As Abrams stated, "Capital accumulations for housing should come as much as possible from sources that are non-competitive with capital from other

¹Abrams, Charles, Man's Struggle for Shelter, Massachusetts Institute of Technology Press, Cambridge, Massachusetts, 1964, p. 144.

enterprises".² This is largely the case in the developed countries. In the less developed countries, quite the opposite is true. Funds channeled through agencies which are oriented to housing construction are presently inadequate to get the job done.

It was stated earlier that the house-building in the less developed group of countries was directly influenced by fluctuations in foreign exchange reserves. The existence of a significant relationship between these two variables was attributed to the method by which individuals secured funds for the purchase of a dwelling in the developing countries. Financial institutions were found to play a very limited role in these countries.

At the same time, several studies have concluded that the non-industrialized nations should attempt to expand the role of financial intermediaries such as savings and loan associations, in order to increase the efficiency of their financial systems.³

There appears to exist a rather important trade-off if the financial institutions are developed more fully in the poorer nations. The price they have to pay for more sophisticated financial structures might well be increased instability in the house-building sector. This is not to deny

²Ibid., p. 144.

³See, for example, Gurly, John G., and Shaw, Edward S., "Financial Development and Economic Development", Economic Development and Cultural Change, Vol. 15, No. 3, April, 1967.

the importance of developing financial institutions. It does, however, serve to emphasize the need for specific stabilization programs designed to maintain stability in the house-building sector.

More generally a case might be made for the establishment of freely fluctuating exchange rates. It was mentioned earlier that under the gold standard, changes in reserve holdings are transmitted directly to the domestic economy unless specific policies are undertaken by countries to delay the adjustment process. Under the current gold exchange standard, this effect is weaker. However, the need to maintain equilibrium in both the trade and capital accounts of the balance of payments often times forces central bankers to restrict domestic activity. Since construction is one of the most durable types of investment and can easily be postponed, it is severely affected by these restrictions.

Under the freely fluctuating exchange rate system, the need for corrective expansion or contraction domestically is eliminated if the relevant elasticities are not too unfavorable. As the foreign exchange rate is altered, changes in exports and imports will be made almost automatically by the trading partners. There should be no need for a central bank to restrict the domestic money supply in order to alleviate a deficit in the payments sheet.

Other implications for future policy can be deduced from this study. Certainly there is a need for a more careful analysis of financial sources in each country. The

possibility of international agencies lending their support in the housing sector should be explored.

Limitations of This Study

The results of any empirical analysis are strictly subject to the limitations of the data. The practice of under and over-reporting by all nations is well documented.⁴ Most of the data are taken from United Nations and International Monetary Fund publications; the picks index was constructed from data published in the Picks Currency Yearbook. Although these agencies specify which data are to be included in each category, the reporting process is supervised largely by individual countries. The broadest claim that can be made is that no better data are readily available.

There are several options in techniques open to the researcher. I have chosen to use a pooled statistical test in order to increase the efficiency of the estimates. This increase in efficiency is the direct result of the assumptions made concerning the homogeneity of the variables. The cross-sectional stability of these variables can be challenged and altered. However, if all simplifying assumptions are dropped, the benefits of a pooled test are lost and the remaining degrees of freedom will not be sufficient to obtain reliable estimates.

⁴cf. Kuznets, Simon, Modern Economic Growth, Rate Structure, and Spread, Yale University Press, New Haven, Connecticut, 1966.

Like all empirical studies, this one is an initial attempt to discern some of the causal factors operating indirectly in the context of the international model employed. The heuristic model which was developed in order to focus more clearly on a few relevant variables consists of partial derivatives. Many other variables could be examined and tested for their significance. Other studies should examine the web of interactions and alternatives in more detail in specific cases, particularly to evaluate the reform of national and international financial practices.

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