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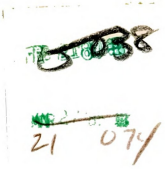
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TRANSMISSION OF INTERNATIONAL ECONOMIC FLUCTUATIONS TO A SMALL OPEN ECONOMY: THE CASE OF KOREA

By

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ABSTRACT

TRANSMISSION OF INTERNATIONAL ECONOMIC FLUCTUATIONS TO A SMALL OPEN ECONOMY: THE CASE OF KOREA

By

Soo-Yong Kim

This is a study about transmission mechanism of economic fluctuations from one country to another through commodity trade and capital flows between the countries. Two major theories explaining the transmissions are the traditional Keynesian approach and the more recently developed monetary approach. The Keynesian approach is based on income-expenditure relationships and multipliers. Current account balance is determined by the relative price of domestic and foreign goods and by income levels. The monetary approach emphasizes direct links between the overall balance of payments and the supply of money and between the money stock and the level of income.

Two simple open-economy econometric models of Korea, one based on the Keynesian approach and the other based on the monetary approach, are built in this study to investigate the effects of economic fluctuations in the U.S. and Japan, Korea's two major trading partners, on the

Korean economy. The more important purpose of the model building, however, is to compare the performances of the two competing approaches in making predictions about the Korean price levels and real GNP. Thus the comparison of the alternative theories in this study is not done by testing the validity of assumptions of the theories, as in most past studies, but by testing the performance of the system as a whole when they are applied to a particular country.

The two approaches are modified so as to have both real GNP and the price level as endogenous variables. The modification of the monetary approach is more extensive since the approach is essentially based on long run equilibrium. Quarterly data of 1963-1975 period were used to estimate the structural equations. All structural equations are specified as to be linear in parameters.

Various historical simulations of the models show that the performances of the two approaches in predicting movements in the Korean real GNP and price level with given levels of exogenous variables, which include the main economic conditions in the U.S. and Japan, are similar in terms of error and turning points detection. The Keynesian model outperforms the monetary model in real GNP predictions but the monetary model is better for predicting price level. When the models are used for forecasting outside the sample period (four quarters in 1976) the monetary

approach model is better in predicting both real GNP and price level.

The main conclusion from these comparisons is the firm establishment of the monetary approach as an alternative to the traditional Keynesian approach in explaining and predicting movements of major economic variables in a small open economy.

The effects of the high geographic concentration of Korean trade and of the pegging of Korean currency to the U.S. dollar under the floating exchange rate system after 1973 are also investigated in the study. Contrary to popular beliefs, Korean exports to the U.S. and Japan are found to be more stable over time than exports to all the other countries combined. Also the impact of the floating yen/dollar rate after 1973 is not found to depress the Korean trade with Japan nor to increase Korean trade with the U.S.

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CHAPTER 1

INTRODUCTION

In an open economy any fluctuations in external economic activity influence the domestic economy through changes in the volume, composition and terms of commodity trade and capital movements. If a country's foreign sector is large and closely linked with another country's economy, transmission of economic changes from one country to another would be achieved in a comparatively short time and have a large effect on the home country's overall economic situation. International transmission of economic activity is a subject as old as comparative advantage theory. However, recent interest in greater knowledge of the operation of transmission mechanisms is based on several new developments. Worldwide inflation in the late 1960s and 70s raised new theoretical questions regarding the causes and processes of transmission and many empirical studies of industrial countries followed (Meiselman and Laffer, 1975; Branson and Myhrman, 1976; Nordhaus, 1972). The monetary approach to the balance of payments, in particular, received much attention as an alternative to the traditional Keynesian approach to explaining worldwide inflation. Of course,

the origin of the monetary approach dates back to the price-specie-flow analysis of Hume in the 18th century. But, revival and modernization of the theory by Mundell (1968, 1971) and Johnson (1958, 1972) brought new aspects of today's highly integrated world economy into focus.

Another recent development that has contributed to new interest in the transmission mechanisms is Project Link which, established in 1968, has since produced numerous studies linking econometric models of industrial countries to generate forecasts of world trade and payments. Thus, focusing attention on international transmission of economic fluctuations (Ball, 1973; Waelbroeck, 1976).

The main purposes of this thesis are: (1) to investigate alternative transmission mechanisms of economic fluctuations; (2) to apply these mechanisms to a developing country (Korea) and build simple econometric models to discover how much a highly open developing economy is influenced by the economic activities of its trading partners and (3) to evaluate the performances of competing transmission models. Two alternative transmission mechanisms to be investigated are the Keynesian approach, which is based on income-expenditure relationships and multipliers, and the monetary approach, which emphasizes the monetary phenomenon of the overall balance of payments and its relation to other sectors of the economy.

Unlike many previous studies, which related price or income changes in an economy to foreign economic changes using single equation models that assumed full employment or fixed price levels, this study will build simple econometric models to explain simultaneous movements of price and income. Dynamic interactions among different economic variables can be properly investigated only through simultaneous systems. And only by this can comparative performances of alternative models be properly tested. As Magee (1975, p. 176) noted recently, "What is interesting about most of the empirical studies . . . is the preoccupation with testing either an individual hypothesis or a policy effect; few tests seek to evaluate alternative theories. This may explain why part of trade theory has run so long in a vacuum." This study is a step toward filling this vacuum by comparing the Keynesian approach against the monetary approach in explaining the influences of foreign economic fluctuations on price and income changes in Korea.

Korea was picked as a case study because it is a highly open economy that has been remarkably successful in export-led development strategy and because its foreign trade in both commodities and capital is mostly with the U.S. and Japan. This high geographic concentration enables us to link the U.S. and Japanese economies easily with the Korean economy without worrying about economic changes in

other parts of the world. Also, the relatively small size of the Korean economy compared with those of the U.S. and Japan explains the one-way influence the U.S. and Japan have on Korea and the absence of repercussions. In this way, our purpose is different from Project Link and the changes in economic conditions in the U.S. and Japan are regarded as exogenous to the Korean economy.

In the past when a developing country's trade with large industrialized countries was studied, a common approach was to assume either exploitation of the developing country through "enforced bilateralism" or external dependence through exports of primary commodities. Thus, deteriorating terms of trade and unstable export receipts of the developing countries were the main concerns. This study is not interested in the structure of commodity trade or any possibility of colonial type exploitation involved in trade between Korea and the U.S. and Japan. Under the given trade relations, the study is primarily concerned with the manner in which U.S. and Japanese economic fluctuations are transmitted to the Korean economy, how competing theories of transmission compare in their performances, and the kind of adverse effect, if any, that results from this trade dependence on the U.S. and Japan.

Chapter 2 will provide some background information on the Korean economy and its foreign sector since the early 1960s. In Chapter 3 the basic ideas of the Keynesian

and the monetary approaches to the balance of payments will be reviewed and some previous empirical studies will be examined. Theories of transmission of economic fluctuations are derived from theories of balance of payments adjustment. In the latter, the main emphasis is on the achievement of equilibrium in the balance of payments after an external shock; while in the former, the movements of major economic variables in relation to the shock in a particular period are more important. In the same chapter, some problems involved in applying the monetary approach to real world situations will be considered.

Simple short-term econometric models, of a small, open fixed exchange rate economy, based on the Keynesian and the monetary approaches will be presented in Chapter 4. The results of individual equation estimations, based on 1963-75 quarterly data, will be reported in Chapter 5. In Chapter 6 the two models will be "solved" and the movements of price and real income in the Korean economy will be linked to the changes in economic conditions in the U.S. and Japan. The performances of the two models will be compared through various simulations.

Chapters 7 and 8 will consider some transmission problems the Korean economy must face because of the high geographic concentration of trade and the Korean currency's tie to the dollar in the floating exchange rate system. An overall summary and conclusions will be presented in Chapter 9.

CHAPTER 2

KOREAN ECONOMY AND ITS FOREIGN SECTOR

Building a theoretical model of an open economy based on the Keynesian approach or the monetary approach does not require any specific knowledge about the economy of a particular country. However, to test the model empirically, some information about the economy chosen for the purpose is needed. The information is used for modification of the model and selection of variables to be used in it. Accordingly, a brief overview of the Korean economy and its foreign sector is presented to facilitate understanding of the structures and the estimations of the models in Chapters 4 and 5. This background information is also useful for the discussions in Chapters 7 and 8.

Growth and Structural Change

The development of the Korean economy since the end of the Korean War in 1953 may be divided for analysis into the periods 1953-1961 and 1962-present. The first period is characterized by economic reconstruction following the war damage with large amounts of foreign aid, especially from the United States and the United Nations. Two major problems

for the Korean economy during the first period were slowing down the huge inflation rate and providing consumer goods. Imports of food and raw materials with foreign aid and an overvalued exchange rate contributed to reduction of the inflation rate and provided goods necessary for consumers and producers. Total foreign aid during this period amounted to 2.28 billion dollars which was about 74 percent of total Korean imports during the same period. By 1957 or 1958 the Korean economy had reached its pre-war level. However, during the 1958-1961 period the average annual growth rate was only 4.1 percent. Slow growth during this period was attributed to poor harvests, declining imports and political instability. Declining imports resulted from new bidding systems of allocating foreign exchanges to imports after 1958 and political instability was largely due to the 1960 student revolution and the 1961 military coup.

The military government introduced many changes in economic policy, including currency reform in 1961, unification of the foreign exchange system in 1962 and an easing of import restrictions in 1962. The civilian government coming into power with the 1963 election devalued the won by 50 percent, raised interest rates on loans and deposits to realistic levels,[1] raised tax rates, increased constraints

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[1] In Korea, interest rate is one of the major instruments of monetary policy along with reserve requirements and discount rate. Government sets the legal maxima of interest rates and actual rates are determined by the Korea Bankers' Association below this maxima.

on government expenditure and introduced a variety of subsidy programs for exports.

The objectives of these policy reforms were, first, to eliminate high inflation pressure by constricting the increase in the money supply caused by large-scale government deficit spending after the military coup; secondly, to increase domestic savings to finance investment; and thirdly, to reduce the balance of trade deficit by promoting exports (Brown, 1973, pp. 51-53).

These policies were in contrast to past policies of low interest rates, high government borrowing and overvalued exchange rates in the years before 1961. The first five-year economic development plan (1962-1966) was adopted in order to "build an industrial base." This was followed by the second and third five-year plans (1967-71 and 72-76) to "promote modernization of the industrial structure" and to "promote a balanced economy by expanding regional development," respectively.

As shown in Table 2-1, the average annual growth rate of the GNP was 4.4 percent in the first period, but jumped to 9.4 percent in the second period. This acceleration was accompanied by overall changes in economic structure. The size of the foreign sector of the economy (measured by exports plus imports) grew much more rapidly than the total economy. Thus, the ratio of exports plus imports to GNP rose from 13.0 percent in the first period

Table 2-1.--Major Economic Indicators of Korea Since 1953.

	GNP (bill. won)	GNP (1970 bill. won)	GNP Growth Rate (%)	GNP Defla-tor (1970= 100)	Exports, Goods & Services (1970 bill. won)	Imports, Goods & Services (1970 (bill. won)	Ratio of (X+M)/ GNP (%)	Exchange Rate (end of year) (won/ dollar)	Indus. Prod. (1970= 100)	Money Supply (bill. won)
1953	48.2	843.5		5.7	17.0	109.4	15.0	18.00		3.0
1954	66.9	890.2	5.5	7.5	10.2	78.1	9.9	18.00		5.8
1955	116.1	938.2	5.4	12.4	12.9	104.8	12.5	50.00	11.7	9.4
1956	152.4	942.2	0.4	16.2	11.5	122.4	14.2	50.00	14.3	12.1
1957	197.8	1014.4	7.7	19.5	15.6	144.8	15.8	50.00	16.5	14.5
1958	207.2	1067.1	5.2	19.4	19.7	125.3	13.6	50.00	18.1	19.3
1959	221.0	1108.3	3.9	19.9	22.9	102.6	11.3	50.00	20.8	23.3
1960	246.3	1129.7	1.9	21.8	27.4	117.5	12.8	65.00	22.7	22.7
1961	297.1	1184.5	4.9	25.1	38.2	106.6	12.2	130.00	24.0	35.8
1962	348.9	1221.0	3.1	28.6	43.0	141.2	15.1	130.00	28.1	39.4
1963	488.5	1328.3	8.8	36.8	46.2	179.2	17.0	130.00	31.7	41.9
1964	700.2	1442.0	8.6	48.6	57.1	133.3	13.2	256.02	34.3	48.9
1965	805.3	1529.7	6.1	52.6	80.3	149.5	15.0	272.06	36.8	65.6
1966	1032.4	1719.2	12.4	60.1	122.3	237.9	21.0	271.46	45.1	85.1
1967	1269.9	1853.0	7.8	68.5	166.0	320.7	26.3	274.60	57.1	123.0
1968	1598.0	2087.1	12.6	76.6	235.0	468.0	33.7	281.50	74.8	177.9
1969	2081.5	2400.5	15.0	86.7	310.1	583.8	37.2	304.45	89.7	252.0
1970	2589.3	2589.3	7.9	100.0	381.2	642.4	39.5	316.65	100.0	307.6
1971	3151.5	2826.8	9.2	111.5	459.3	773.5	43.6	370.80	115.4	358.0
1972	3860.0	3023.6	7.0	127.7	643.3	801.2	47.8	398.90	132.2	519.4
1973	4901.6	3507.4	16.0	139.8	1034.3	1087.0	60.5	397.50	176.4	730.3
1974	6747.1	3811.3	8.7	177.0	1010.7	1120.4	55.9	484.00	225.0	945.7
1975	9080.3	4129.3	8.3	219.9	1174.2	1134.1	55.9	484.00	267.8	1181.7
Average 53-61			4.4				13.0			
Average 62-75			9.4				34.4			

Sources: Bank of Korea, Monthly Economic Statistics, Various Issues.

to 34.4 percent in the second period. Exports, in particular, expanded almost 30 times during the 1962-75 period, growing more than 40 percent on an annual basis.

The industrial composition of the GNP also shows large changes. Most prominent is the growth of manufacturing with proportionate declines in agriculture and fishing. Manufacturing's proportion of the GNP increased from 15.0 percent in 1962 to 32.1 percent in 1975, while agriculture and fishing decreased from 39.7 percent to 21.6 percent of the GNP in the same period. This rapid growth in the industrial sector is also shown by the index of industrial production in Table 2-1. Industrial output expanded almost 10 times during this 13-year period.

Foreign Trade

Special characteristics of the foreign trade of Korea since 1962 are: (1) very rapid increase in exports, (2) high geographic concentration in exports and imports and (3) a high proportion of manufactured goods exported. As we can see from Table 2-2, exports have increased more than 41 percent annually while imports have increased 24.5 percent. Because of this rapid growth, commodity exports' share in the GNP rose from 3.5 percent in 1962 to 28.4 percent in 1975.

In both the export and import markets, trade with the U.S. and Japan comprises about two-thirds of the total trade of Korea. The two countries are almost equal in

Table 2-2.--Country Composition and Growth Rates of Exports and Imports of Korea.*

	Total Exports	Exports to Japan	Exports to the U.S.	$\frac{X^J+X^{US}}{X}$	Total Imports	Imports from Japan	Imports from U.S.	$\frac{M^J+M^{US}}{M}$	Exports Growth Rate $\Delta X/X_{-1}$	Imports Growth Rate $\Delta M/M_{-1}$
	X	X^J	X^{US}	(%)	M	M^J	M^{US}	(%)	(%)	(%)
1962	54.8	23.5	12.0	64.8	421.8	109.2	220.3	78.1		
1963	86.8	24.8	24.3	56.6	560.3	159.3	284.1	79.1	58.4	32.8
1964	119.1	38.2	35.6	62.0	404.4	110.1	202.1	77.2	37.2	-27.8
1965	175.1	44.0	61.7	60.4	463.4	166.6	182.3	75.3	47.0	14.6
1966	250.3	66.3	95.8	64.8	716.4	293.8	253.7	76.4	42.9	54.6
1967	320.2	84.7	137.4	69.4	996.2	443.0	305.2	75.1	27.9	39.1
1968	455.4	99.7	237.0	73.9	1462.9	624.0	449.0	73.3	42.2	46.8
1969	622.5	133.3	315.7	72.1	1823.6	753.8	530.2	70.4	36.7	24.7
1970	835.2	234.3	395.2	75.4	1984.0	809.3	584.8	70.3	34.2	8.8
1971	1067.6	262.0	531.8	74.4	2394.3	953.8	678.3	68.2	27.8	20.7
1972	1624.1	407.9	759.0	71.8	2522.0	1031.1	647.2	66.5	52.1	5.3
1973	3225.0	1241.5	1021.2	70.2	4240.3	1726.9	1201.9	69.1	98.6	68.1
1974	4460.4	1380.2	1492.2	64.4	6851.8	2620.6	1700.8	63.1	38.3	61.6
1975	5081.0	1292.9	1536.3	55.7	7274.7	2433.6	1881.1	59.3	13.9	6.2
Average 55-61				72.2				73.9	14.7	-0.1
Average 62-75				66.9				71.5	41.7	24.5

Source: Bank of Korea, Monthly Economic Statistics, Various Issues.

*All the values are in million dollars. Exports are based on f.o.b., and imports on c.i.f. prices.

export weight and in recent years their proportion of trade has declined after a peak of 75.4 percent in 1970. Other major export markets include West Germany, Hong Kong, Canada and England. Imports from the U.S. and Japan have also declined slowly from 75 percent in 1963 to 59 percent in 1975. Other major import markets include Saudi Arabia, Kuwait, Australia and Indonesia. As the list of countries indicates, Korean exports go mostly to industrial countries while some imports originate from developing countries because of the need for raw materials, especially oil from the Mideast.

The commodity concentration of Korean exports, unlike many other developing countries, is very low with various manufactured goods being the major items of export. The ratio of manufactured goods to total exports increased from 27.6 percent in 1962 to 82.4 percent in 1975. Manufactured exports are composed mainly of labor intensive light industry products like clothing, textile, plywood, and footwear.[2]

Looking at the composition of imports, raw materials comprise about half of the total imports and capital goods about 30 percent. This proportion has been stable over the years despite large increases in total imports. The large proportion of raw materials is in part due to the

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[2]See Joen (1977) for the data on the composition of various industrial products comprising Korean exports.

high import content of exports resulting from the fact that, while Korea exports mainly manufactured goods, the country has little natural resources.

Foreign Capital

The role of foreign capital in the Korean economy may be shown by the ratio of foreign savings to gross investment. Table 2-3 indicates that during the 1962-75 period the sum of net foreign transfers and net foreign borrowing has equaled more than 40 percent of total investment in Korea during that period. Like many other developing countries, Korea's domestic savings have always been inadequate for the investments needed to promote high economic growth and the gap has had to be filled by foreign capital. Even though the ratio of foreign savings to domestic savings dropped during this period in contrast to the years 1953-61, trends show that foreign capital will remain important in the future economy of Korea.

One illustration of the importance of foreign capital in the Korean economy is the calculation by Charles Frank et al. (1975, p. 107). Assuming that the increment in output each year due to foreign capital is the same as the estimated increment in output due to total investment in that year, they estimate the 1971 GNP without the 1966 to 1970 foreign savings. The result shows that total output in 1971 would have been about 12.4 percent less than it actually was.

Table 2-3.--Total Foreign Savings in Relation to Gross Investment and GNP, 1962-75.

	Net Foreign Trans.	Net Foreign Borrow.	Total Foreign Savings	Gross Invest-ment	Foreign Savings in Gross Inv.	Foreign Savings in GNP
	(Bill. won)	(Bill. won)	(Bill. won)	(Bill. won)	(%)	(%)
1962	30.73	7.22	37.95	45.47	83.5	10.9
1963	33.73	18.63	52.36	90.26	58.0	10.7
1964	44.03	5.10	49.13	102.24	48.1	7.1
1965	53.95	-2.42	51.53	121.98	42.2	6.4
1966	59.58	28.05	87.63	224.48	39.0	8.5
1967	60.94	51.92	112.86	280.97	40.2	8.9
1968	62.54	121.79	184.33	427.87	43.1	11.5
1969	70.86	158.16	229.02	620.70	36.9	11.0
1970	55.96	193.35	249.31	704.66	35.4	9.6
1971	59.32	294.68	354.00	805.35	44.0	11.2
1972	66.71	148.32	215.03	805.48	26.7	5.6
1973	75.74	123.18	198.92	1288.89	15.4	4.1
1974	90.37	820.42	910.79	2102.06	43.3	13.5
1975	109.73	913.26	1022.99	2478.39	41.3	11.3
Average 53-61					65.8	7.3
Average 62-75					42.6	9.3

Sources: Bank of Korea, National Income Statistics Yearbook, 1972.
Economic Planning Board, Korea Statistical Yearbook, 1976.

The major sources of foreign capital are the commercial loans and direct investments from the U.S. and Japan. In addition, the U.S. and such international organizations as IBRD and ADB (Asian Development Bank) provide much in public loans. Until the early 1960s, public loans from the U.S. were the main source of foreign capital. But, beginning in the mid-1960s, commercial loans gained in importance and Japan emerged as a second largest source of foreign capital after the U.S. Increased dependence on Japan is at least partially due to a 1965 agreement on property claims and renewed diplomatic relations between Korea and Japan.

Government Policies Relating to Foreign Trade and Capital

Several government policies are responsible for the rapid increase in exports. These include customs duties exemptions on imports for export purposes, preferential interest rates and tax relief for exporters. Although the actual rates of subsidy varied with modifications made in government policies, studies on export incentives show that the total won subsidy for exports created by these policies ranged from 15 to 30 percent of the official exchange rates (Frank et al., 1975, p. 71 and Brown, 1973, p. 142).

Quantitative restrictions on imports, based on a positive-list system in which all imports not listed as

automatic approval are prohibited or restricted, were eased extensively as increasing exports improved the balance of payments situation. In 1967 the government switched to the negative-list system which enlarged the number of the automatic approval items to other than the items listed as prohibited or restricted. At the end of 1975 only 602 items were restricted and 66 items prohibited of 1,312 items in the SITC. Imports of raw materials for the production of exports are approved automatically.[3]

Since 1965, as quantitative restrictions were reduced, tariffs have played a more important role. Nominal average tariff rates have varied from 9.4 percent in 1963 to 15.3 percent in 1970 (Brown, 1973, p. 157). The tariff structure varies from commodity to commodity and the government has the authority to alter tariff rates up to 50 percentage points.

During the 1953-61 period, the exchange rate (of the won to the dollar) changed six times and in 1961 was 130 won to 1 U.S. dollar. A large devaluation in May 1964 raised the ratio again to 256 won. Since then, the won has been devalued gradually and reached 326 won in 1971. After three more devaluations in 1971, 1972, and 1974 the rate stands now at 484. Korea has maintained a fixed peg

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[3]For more institutional information regarding foreign exchange in Korea, see IMF, Annual Report of Foreign Exchange Restrictions, various issues, and Frank et al. (1975, Chapter 7).

to the dollar even though a general floating system was adopted by many other countries in March 1973. Thus, the two 10 percent devaluations of the dollar in 1972 and 1973 had the effect of devaluing the won against currencies not pegged to the dollar.

The exchange rate was grossly overvalued during the 1950s and approached realistic levels only after the 1961 devaluations. All foreign exchange earnings from exports are surrendered to the foreign exchange banks and are exchanged for the won, but exporters retain the right to buy back at the official exchange for imports. In January 1973 this restriction was amended to allow qualified exporters with a minimum export performance (at first $5 million, later $1 million per year) to retain their export proceeds as foreign currency demand deposits with Korean foreign exchange banks.

Since the early 1960s, the Korean government has encouraged the import of foreign capital with such measures as repayment guarantees and tax concessions. The Foreign Capital Inducement Law, first enacted in 1960 and largely revised in 1966, provides a guarantee of repayment and repatriation and puts no limits on amounts of conversions and dividends. In recent years, revisions of the law have given more favorable treatment to direct investments, particularly joint ventures.

CHAPTER 3

MECHANISMS OF INTERNATIONAL TRANSMISSION OF ECONOMIC FLUCTUATIONS

The purpose of this chapter is to review and modify alternative theories of international transmission before building macro models of the Korean economy based on these theories in Chapter 4. Two different theories of the balance of payments adjustment, the Keynesian and the monetary approach, necessarily imply different transmission mechanisms. The two theories will be considered individually and some past empirical studies will be reviewed.

The Keynesian Approach

The international transmission mechanism is concerned with how economic changes in foreign countries affect a home country through commodity trade and capital movements. The Keynesian theory of balance of payments adjustment originally emerged as a new approach which rejected the classical price-specie-flow mechanism's assumption of the rigid quantity theory of money and Say's law. Because it assumed full employment, the price-specie-

flow mechanism was concerned only with changes in price levels corresponding to changes in the gold flows between countries. Thus, in the classical theory, if a foreign country experiences inflation, a home country will have a surplus in balance of payments because the relative price of the home country's commodities are lowered and the quantity of money in the home country will increase. This will lead to an increase in the nominal demand for goods and services and so will raise prices and costs rather than output and employment.

The Keynesian approach, following the early contributions of Harrod (1939, Chapter 5), Robinson (1937, part III), Haberler (1941), Metzler (1942) and Machlup (1943), offered a completely different mechanism. By replacing price movements in the old theory with movements of output and employment as key variables, the new theory asserted that an increase in a country's exports caused by an external event affects the level of output and demand for all goods and increases imports, even without price changes. Based on the marginal propensity to consume and marginal propensity to import, the foreign trade multiplier is used in this approach to derive changes in income or output. An increase in exports means an increase in the multiplicand, and consequently the income level increases. This increased income will induce more imports because of the positive marginal propensity to import. The increased

imports constitute a "leakage" and prevent income from rising as high as it otherwise would. Of course, the main assumptions here are that there are unemployed resources in the economy and that the price level stays constant.

There was some early confusion about concepts in the foreign trade multiplier formula. Robertson (1939) and Haberler (1941, pp. 461-473), for example, said that the right multiplicand should be the export surplus instead of total exports, i.e.,

$$\Delta Y = \Delta(X-M)\ \frac{1}{1-c} \qquad \text{instead of}$$

$$\Delta Y = \Delta X\ \frac{1}{1-c+q}\ ,\ \text{where } c = \text{marginal propensity}$$

to consume and q = marginal propensity to import. They argued that since the second equation can be reduced to the first (since $\Delta M = q\Delta Y$) and the first equation with only one coefficient is more stable than the second, one should prefer the first equation. Therefore, Haberler argued, "Only an excess of exports over imports can be regarded as a stimulating factor whilst a parallel shift upward of both exports and imports must be assumed to be neutral" (p. 468). Later, Polak (1947) showed the fallacy of Haberler's formula and Stolper (1947) showed that a simultaneous increase in imports and exports will have an expansionary effect if it is not offset by downward changes in the average propensity to consume domestic goods.

Polak (1947, pp. 896-897) also stated that a revised form of the formula, $\Delta Y = \Delta X \frac{1}{1 - c - v + q}$ where v is the marginal propensity to invest, could be an important starting point for an explanation of the transmission of business cycles from country to country brought about by changes in trade. Export increases will raise income levels, the multiplier depending on the value of the parameters c, v, and q.

In a later study Tinbergen and Polak (1950) argued that economic conditions in small countries with relatively large foreign trade tend to be determined by conditions prevailing in the large countries. This results from prices, which tend to move jointly in all countries as a result of international competition, and from quantities of international trade. Despite these tendencies toward parallelism in cyclical fluctuations, differences in the pattern can occur because of differences in amplitude and phases of fluctuations in different countries. They listed major structural characteristics responsible for differences in cyclical patterns as: (1) the marginal propensity to consume and marginal propensity to invest; (2) the lag between income and consumption; (3) the tendency toward speculation and (4) the lifetime of capital (pp. 227-232).

An important feature of the Keynesian approach is its emphasis on trade balance instead of the overall balance of payments and its monetary consequences.

Sterilization of any balance of payments effect on money supply through monetary policy is an essential assumption of this approach. When increased exports induce a surplus in the balance of payments, it is not rising price levels but rising income that increases imports.

Later contributions modified the assumption of price rigidity by introducing the concept of demand pressure. The idea is that inflation will occur when aggregate demand exceeds the economy's aggregate productive capacity at current levels of wages and prices. Inflation can also occur in the absence of excessive aggregate demand if production costs rise more rapidly than productivity. These two causes of inflation, demand pull and cost push, have been integrated in the Phillips curve which relates the rate of increase in the money wage rate to the rate of unemployment in the labor market. Thus, in an open economy, an external event that increases the exports of a country will raise prices through increased aggregate demand compared to the production capacity. This increase in aggregate demand appears in the labor market as a decrease in the unemployment rate and higher increase in money wages. Models of price determination in the open-economy Keynesian model, which relate demand pressures and cost changes to price level, can be found in many recent studies including

Turnovsky and Kaspura (1974), Branson (1975, 1977), and Laidler (1973).[1]

Another modification of Keynesian analysis for an open economy is the inclusion of the capital account. Deficit or surplus in the short term capital account is closely related to, among other things, the domestic interest rate and changes in this interest rate affect aggregate demand through changes in investment. Long-term capital movements through direct investment or portfolio investment also influence aggregate demand level by changing prices in the domestic capital goods market. While the capital account and the trade balance in the Keynesian approach are entirely different channels of transmission, the two have in common that they ultimately affect the demand for domestic output and, consequently, the price level (Branson, 1977). But, the effect of the capital account balance on money supply is ignored, as in the case of the current account balance, by the assumption of a sterilization policy by monetary authorities. Therefore, a very important feature in the Keynesian approach is the subsidiary role assigned to money and its independence of external sectors.

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[1]The Laidler model is for a closed economy, but it can easily be extended to an open economy case.

Empirical Studies Based on the Keynesian Approach

Early empirical studies of the relationship between foreign trade and domestic economic activities were devised to estimate export and import functions and the size of the foreign trade multiplier. This line of study can be seen in Polak (1953) and Neisser and Modigliani (1953). Their main purpose was to show links between domestic and foreign economic fluctuations, with causation proceeding from foreign income to exports and from exports to domestic income and imports.

Polak estimated export equations for twenty-five countries using total world exports and relative export prices of a country in comparisons with world trade prices. Imports were estimated as a function of income and relative import prices. Then, he measured a multiplier for each country using a multiplicand dependent on the special situation in each country.

Neisser and Modigliani built a simultaneous equation system of world exports and imports under the hypothesis that a rise in the industrial countries' income produces corresponding increases in their imports of raw materials and food, thereby increasing exports from the nonindustrial countries which enables the latter, through augmented purchasing power, to increase their imports of manufactured goods which come primarily from industrial countries. Their work was an effort "to extend to the international

field the bold macroeconomic system of the General Theory" (p. 333). Using inter-war period data, they established the dependence of imports--and, indirectly, the dependence of exports--on income.

These studies tried to build a world trade model or transmission mechanism by closing the models with export prices (Polak) or incomes (Neisser-Modigliani) determined outside the models and with total world exports which is, by definition, the same as total world imports. Their results, however, did not reveal how the different countries' income (Neisser-Modigliani) or price levels would be affected by changes in international conditions.

Rhomberg (1966) and Rhomberg and Boissoneault (1964) continued building a world transmission model, but with special reference to the U.S. balance of payments. Their model has three regions--the U.S., Western Europe, and the rest of the world. Imports for the U.S. and Western Europe are a function of income and relative prices, and for the rest of the world imports are by definition equal to net foreign exchange inflow less net additions to international reserves. A rise in U.S. income increases U.S. imports from Western Europe and the rest of the world; these areas in turn increase their imports from the U.S. and from each other. The model has endogenous export prices determined by domestic prices and trade volume; the income of the rest of the world is determined by exports.

A more recent work by Rhomberg (1968) focuses on the transmission of economic fluctuations from developed countries to developing countries, and the response of the latter. Economic fluctuations in the developed countries are expressed by indices of industrial production and these fluctuations are transmitted to developing countries through changes in exports and private capital inflow to developing countries. Using annual data of 1953-65, these changes in exports and capital flow are regressed on the index of industrial production in the developed countries. The import equation of developing countries from developed countries is estimated as a function of total foreign exchange receipts from exports and capital inflows. He then solves the system for changes in the developing countries' imports, trade balance and overall balance of payments. But, changes in the income levels of the developing countries in response to economic fluctuations in the developed countries are not derived from his model. The model does not have any equation relating exports to income. Even imports are not directly related to income level.

Past empirical studies on individual countries in the Keynesian approach may be divided into two groups: one which relates the world or a particular country's economic fluctuations to changes in exports and in the capital accounts of the influenced country, and the other

approach estimates a foreign trade multiplier based on income changes and exogenously determined exports. Hinshaw (1945) and Zassenhaus (1955) belong to the first category and Robinson (1968), Schotta (1966), and Rangarajan and Sundararajan (1976) belong to the second category.

Using 1924-37 data, Hinshaw measured the effect of American income fluctuations on British exports through increases in American imports from Britain and also increases in British exports to the rest of the world that were attributable to the increase in American imports. Zassenhaus examined the impact of the 1953-54 U.S. recession on the balance of payments position of six regions of the world. He found that in spite of a sizeable and detrimental import effect, the recession produced no international payment crisis, mainly because of the stabilizing effects of U.S. private capital movements to these regions.

All three studies in the second category built simple Keynesian multiplier models including consumption, investment and imports as endogenous variables. Using a national income identities and externally determined exports, they estimated foreign trade multipliers for individual countries (Canada by Robinson, Mexico by Schotta, and fourteen countries by Rangarajan and Sundararajan). However, the systematic investigation of a country's income changes in response to external economic fluctuations, these studies should be extended to simultaneous equation

models with the foreign sectors endogenous and linked to other sectors of the economy.

Transmission of price fluctuations has only recently become a subject for empirical study by the Keynesian approach. This study has been stimulated by recent experiences with worldwide inflation and assertions by proponents of the monetary approach that the Keynesian approach could not explain this phenomenon (Johnson, 1973, Chapter 13). Nordhaus (1972) and Branson and Myhrman (1976) used a simple Phillips curve model to relate the rate of increase in money wages (or GNP deflator) to labor market (or output market) tightness in some industrial countries for 1968-71 and 1954-68, respectively. The wage rate change equation used by Nordhaus is $\Delta \ln W = b_o + b_1 \frac{1}{u}$ and the GNP deflator change equation used by Branson and Myhrman is

$$\dot{p} = b_o + b_1 \left(\frac{y - y^*}{y}\right),$$

where w = wage rate,

u = unemployment rate,

$\dot{p}$ = inflation rate,

y^* = trend value of real GNP and

y = actual value of real GNP

So, both studies use some measure of market tightness to explain wage or price inflation. Although these are only partial analyses of price behavior, the current study

will extend them in the next chapter to open economy macro models by assuming that market tightness (or excess demand) is largely influenced by external factors, especially in small, open economies.

The Monetary Approach

The monetary approach to the balance of payments and international transmission mechanism has been widely accepted as an alternative to the Keynesian approach for many balance-of-payments problems involving exchange rate changes, economic growth and inflation. This approach has its origin in the classical price-specie-flow mechanism and recent theoretical developments are due to the works of Polak (1957), Polak and Boissonneault (1960), Praise (1961), Komiya (1969), Mundell (1968, 1971) and Johnson (1958, 1972). Later contributors include Dornbush (1973), Swoboda (1973), Mussa (1974), Parkin (1974) and Frenkel and Johnson (1976).

The essence of the approach is to stress the monetary consequences of balance-of-payments surpluses or deficits and to interpret movements in the overall balance of payments of a country in terms of the excess demand for real money balance in that country. Any balance of payments surplus or deficit is linked to the money supply since international reserves are one of the components of the monetary base. In the Keynesian approach model this link is neglected because the government is

assumed to pursue a sterilization policy by selling or buying bonds in the open market and consequently, neutralizing the effects of a surplus or deficit in the country's overall balance of payments. The monetary approach assumes that deficits or surpluses cannot be sterilized (within a period relevant to policy analysis) and do influence the domestic money supply. Assuming a stable demand function for money, which is essential to this approach, variations in the total money stock associated with payment imbalances lead to disequilibrium in the money market and this stock disequilibrium should be resolved by changes in expenditure. Also, this model usually assumes that a country's price level is pegged to the world price level when translated into a common currency unit, thereby stressing the role of goods arbitrage in the world commodity markets. Another distinctive aspect of the model is its assumption of full employment output following the classical quantity theory tradition of long-run equilibrium.[2]

A typical monetary approach model following Johnson (1972) is presented in the following manner. Money supply is defined as

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[2]Although most of the monetary approach models assume the "law of one price" and the full employment output level, these are not essential parts of the approach. A model that includes these assumptions is called a strict (or global) monetary approach model. See Whitman (1975).

(1) $M_s = m(R + D)$

where, m is the money multiplier and (R + D) is the monetary base or high-powered money. R is the international reserve holdings in a country and D is the domestic component of monetary base (which is the same as the assets of monetary authority other than R, less liabilities other than the monetary base). The nominal quantity of money demanded is assumed to be a function of the price level, real income and the interest rate.

(2) $M_d = pf\ (y, r)$

where, p = price index, y = real income and r = nominal rate of interest. Setting M_s equal to M_d, assuming instantaneous adjustment of the supply of money to the demand for it:

(3) $m(R + D) = pf(y, r)$

A transformation of this is

(4) $\ln m + \ln (R + D) = \ln p + \ln f(y, r)$

Differentiating with respect to time

(5) $$\frac{1}{m}\frac{dm}{dt} + \frac{1}{R + D}\frac{d(R + D)}{dt} = \frac{1}{P}\frac{dP}{dt} + \frac{\eta_y}{y}\frac{dy}{dt} + \frac{\eta_r}{r}\frac{dr}{dt}$$

where $\eta_y = \frac{y}{f}\frac{df}{dy}$, etc.

Denoting growth rate of a variable as $g_m = \frac{1}{m}\frac{dm}{dt}$, etc., we obtain:

$$(6)\quad \frac{R}{R+D}\, g_R = g_p + \eta_y g_y + \eta_r g_r - g_m - \frac{D}{R+D}\, g_D$$

This equation expresses the change in international reserves and, therefore, the overall balance of payments as positively related to the growth of the price level and domestic economic growth (by means of the income elasticity of demand for money) and negatively related to the growth of interest rate (via the interest rate elasticity of demand for money, assuming η_r is negative), the growth rate of the money multiplier, and the domestic component of the monetary base. If we further assume, following the strict monetary approach, that the world price level, interest rate (which is the same for individual countries), and the money multiplier are constant, we have

$$(7)\quad \frac{R}{R+D}\, g_R = \eta_y g_y - \frac{D}{R+D}\, g_D$$

Simplifying still further by assuming no economic growth

$$(8)\quad \frac{R}{R+D}\, g_R = -\frac{D}{R+D}\, g_D$$

which shows that balance-of-payments surpluses or deficits are inversely related to changes in the domestic component of the monetary base.

From the above derivations we can see that the model's implications are at variance with traditional Keynesian approach conclusions. Increases in real income and the price level of a country in the Keynesian approach lead to a deterioration of the balance of trade by increasing imports relative to exports. This is because of a positive marginal propensity to import and increases in the relative prices of domestic goods compared to foreign goods. But in the monetary approach model, increases in income and price lead to excess demand for money and so decrease spending for domestic and foreign goods, thus reducing imports. An increase in the interest rate in the Keynesian approach works toward improving the balance of payments through depressing investment and income and increasing net capital inflows. However, in the monetary approach this will lead to an excess supply of money due to a decrease in demand for money. This excess supply of money will cause an increase in spending on domestic goods and imports and capital outflows. The balance of payments will deteriorate.

The linkage of a balance-of-payments deficit (surplus) to excess supply (demand) of money in the monetary approach is similar to the linkage of a deficit (surplus) to an excess (shortage) of expenditure over income in the absorption approach as first suggested by Alexander (1952). Both approaches are interested, not in

the composition of expenditure, but in the relative size of money demand to money supply (or total expenditure to total output).

Modifications of the Monetary Approach

For the monetary approach to be used to explain the transmission of price or income changes across countries, several modifications of the model are necessary. First, because the model is essentially concerned with long-run equilibrium, real income is exogenous, assuming a full employment level of income with a fixed rate of growth over time. For the purpose of a short-run transmission model, however, real income should be regarded as endogenous, not always at the full employment level and dependent on the level of aggregate expenditure. Under less than full employment, changes in expenditure will affect both the real output and the price level. This leads to rejection of the strict monetary approach assumption of one price level for the world. The domestic price level in the short-run should depend, not only on the world price level, but also on other domestic variables that determine money supply and expenditure.

Even if we accept complete arbitrage in the traded goods market, we cannot guarantee complete convergence of a domestic price with world price level unless more specific assumptions are adopted regarding, for instance, nontraded goods and compositions of traded and nontraded

goods (Swoboda, 1977, pp. 17-18). Interest rates are also different in different countries. The international capital market is not as completely integrated as the strict monetary model assumes. When real income and price levels fluctuate in the short run, interest rates must change according to changes in bond prices. As in the goods market, Boyer (1975) shows the existence of nontraded bonds makes domestic interest rates differ from foreign interest rates.

Finally, we should also consider variability of the money multiplier in the short run. A varying money multiplier is quite natural once we introduce fluctuations in income, prices and interest rates. Even a simple money multiplier formula tells us that the multiplier depends on such variables as the currency to demand deposit ratio and the time deposit to demand deposit ratio, as well as reserve requirement ratios. But, the ratios of currency and time deposit to demand deposit depend on such variables as income, prices and interest rates. Again, changes in the money multiplier affects the total money supply with a given monetary base and changes the size of excess demand or supply of money when demand for money is stable.

What these interactions lead us to is recognition of the need for a simultaneously determined economic model to investigate transmission mechanisms that is based on the monetary approach. This is true even if we are

investigating the movements of only one variable such as the balance of payments surplus or deficit. The usual formulation of the model is given as

$$\Delta R = \Delta M_d - \Delta D$$

derived from the money market equilibrium condition

$$M_d = R + D,$$

where M_d is in terms of the monetary base. This formulation implicitly assumes that determinants of demand for money are independent of the supply of money. Once we accept that short run real output and price levels are endogenous variables and affected by changes in the domestic component of money supply, the above one-equation relation or any variation of it is not appropriate for explaining the balance of payments of a country or for testing the model.

Only recently have there been attempts to build theoretical models that incorporate endogenous prices (Borts and Hanson, 1975) or interactions between output and price levels (Laidler, 1975, Chapter 9).

Empirical Studies Based on the Monetary Approach

Papers by Polak (1957), Polak and Boissonneault (1960) and Fleming and Boissonneault (1961) examine the empirical relationship existing between money supply and

imports for individual countries. The hypothesis of these tests is that, assuming a constant income velocity of money and a constant relationship between money imports and money income, imports will tend to equal the changes in money supply created by exports, net capital flow and changes in net domestic credit. Their formulation of an endogenous money supply dependent on balance of payments is the same as that in the later monetary approach models by Johnson and others.

For each of thirty-nine countries in the period 1948 or 1949 to 1958 Polak and Boissonneault (1960) calculated imports as a linear function of nominal income, and nominal income as a linear function of money supply. Also, nominal income and imports are expressed as functions of current and lagged autonomous changes in money supply (exports plus net capital inflow plus change in domestic credit). Fleming and Boissonneault (1961) compared calculated and actual imports of 36 countries for the 1950-1958 period and reached the conclusion that the correlation between imports and autonomous changes in money supply in the same year is higher than the correlation between imports and changes in autonomous money supply with a distributed time lag. Thus, they indicated a fast adjustment of imports in response to changes in money supply. However, the correlation between imports and the stock of

money is substantially poorer than either of the above correlations.

In this framework, external inflation is transmitted through increases in exports and capital inflow, both of which increase the domestic money supply and thus increase domestic income and/or prices. This approach is different from the monetary approach in that components of the balance of payments--exports, imports, and capital movements--are not differentiated in the latter and, therefore, imports are not a function of income. The monetary approach simply says that expenditure relative to income, whether on domestic or foreign goods (assets), depends on the excess money supply. Therefore, the usual empirical testing of the monetary approach model regresses the balance of payments of a country on determinants of the demand for money and changes in the domestic component of base money.

There is a long list of this type of empirical study. Among them Zecher (1976) for Australia, Genberg (1976) for Sweden, Bean (1976) for Japan, Guitian (1976) for Spain and Wilford and Wilford (1977) for Mexico and Honduras applied equation 6 above (page 32) and its variations to data on the individual countries to determine whether the signs and sizes of the coefficients are as expected from the theory. All report that balance of

payments experiences in these countries are consistent with the monetary approach.

In particular the studies show that domestic credit expansion is the major determinant of the changes in the balance of payments (Guitian, 1976) and that the close inverse relationship between reserve flows and credit expansion is not the result of sterilization policies by monetary authorities (Genberg, 1976). However, Kouri and Porter's (1974) study on the capital flows of Australia, Italy, Germany and the Netherlands and Miller and Askin's (1976) study of the behavior of the central banks in Brazil and Chile show that sterilization is achieved at least partially in all these countries. Courchene and Singh (1976) relate the balance of payments in fourteen industrial countries to excess demands for real money balances in each of the countries and in the world. Excess demand for real balance is defined as the difference between the real demand and the exogenously determined (or domestically backed) real supply. The supply of real money balance is exogenous because the current-period change in international reserves is not included in the monetary base, and the previous period's ratio of money supply to monetary base was used as the multiplier. Their results show that the balance-of-payments surplus of a country increases if the excess demand for real balance in the

country (world) increases (decreases), other things remaining constant.

Transmission of inflation in the monetary approach model is explained either by goods market arbitrage or by increased money supply from a balance of payments surplus, which is caused by monetary expansion in other countries. Empirical tests of goods market arbitrage such as Genberg (1976a,b) are actually tests of the market integration hypothesis, basic assumption of the strict monetary approach, rather than tests of how the mechanism is working. Only a few empirical studies examine the transmission of outside inflation through money supply changes. This is very strange considering the assertions of the monetary approach proponents that recent worldwide inflation was caused mainly by the U.S. monetary expansion which increased balance-of-payments surpluses in other countries.

Macro Models Based on the Monetary Approach

There exist some studies of individual countries using simple macro models based on the monetary approach in which prices and real incomes are not fixed but are determined by the behavior of other variables. For example, Khan (1974) introduced an endogenous money supply equation to a yearly macro model of Venezuela. Endogenous imports and private short-term capital flow with exogenous exports and other capital movements determine the change

in net foreign asset holdings of the central bank and thereby affect the money supply. Money stock is an argument for net private expenditure which determines income and imports. This model is similar to that of Polak and Argy (1971) in that price and real income changes are combined in nominal income and imports are assumed to be a function of nominal private expenditure and import prices. In a later study Khan (1976) uses quarterly data for the same country, but this time uses real variables and a separate price equation. Evaluating the estimates of structural equations and the model's ability to predict the behavior of key variables, Khan reports that the monetary approach explains changes in Venezuelan economy fairly accurately.

These and other studies, like Otani (1975) on the Philippines, Otani and Park (1976) on Korea and Kwack (1975) on Korea, have in common their construction of quarterly or yearly simultaneous economic models with endogenous money stock and their testing of the validity of the models in explaining the movements of key variables such as real income, the price level and the balance of payments. Considering that a major aspect of the monetary approach is its emphasis on the movement of the overall balance of payments in a country, these models fail to follow the monetary approach by including separate import (and export) functions while capital flows (or part of them)

are considered to be exogenous. Furthermore, they make import (and export) functions basically Keynesian by letting real imports depend on real income and relative prices.[3]

Because of the nature of simultaneous equation models, empirical testing must be based on the "solution" or simulation of the models except for checking the estimates of individual structural equations. Therefore, results of testing cannot be as clear-cut as results in testing single equation models where we can reject a model with a given significance level. Thus, a proper test of the validity of a model should be based on a comparison of that model's performance with the performance of other models.

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[3]Otani (1975) and Otani and Park (1976) assume exports and net capital flow are exogenous while Kwack (1975) assumes part of the capital account is exogenous.

CHAPTER 4

MODELS OF INTERNATIONAL TRANSMISSION OF ECONOMIC FLUCTUATIONS

In this chapter, two simple econometric models of the Korean economy related to U.S. and Japanese economic conditions will be presented. The first will be based on the Keynesian approach, the second on the monetary approach. The main purpose, as mentioned in the first chapter, is to explain the transmission of economic fluctuations in major foreign countries (the U.S. and Japan) to the Korean economy. By building two different models the performances of the above approaches can be compared in an economy-wide situation. Accepting that a partial equilibrium approach is inadequate for testing a theory's power to explain real movements in an economy, the value of this comparison can be appreciated despite the shortcomings of using simplified models and studying only one country.

General Structure of the Models

The two models are built with the quarterly data of 1963-75 in mind. The sample size of 52 observations is adequate for the various types of lags or number of

variables used in any equation. All behavioral equations are linear in parameters to facilitate easier interpretation and consistent estimation of parameters by the two stage least squares procedure.

The models are formulated so that the transmission of economic changes from the U.S. and Japan to Korea is achieved through commodity trade and capital movements. Attention is focused on the movements of Korean GNP and price levels in relation to fluctuations in such variables as GNP, price levels, interest rates and money supplies in the U.S. and Japan.

Each equation in the model is specified to conform with the basic ideas of the approach adopted and also with particular situations of the Korean economy in terms of institutional restraints or data availability. These constraints will be explained in the following sections when each specification is discussed individually.

Since the Korean data used are not seasonally adjusted, quarterly dummies are included in some equations as seasonal variables. Seasonal variation is important in the Korean economy mainly because agriculture is still an important sector. Therefore, seasonality is most obvious in private expenditures. In other cases seasonality was tested by including seasonal dummies in each equation and checking their levels of significance. If seasonality was not significant the seasonal dummies were deleted in the final equation. Seasonality is assumed to influence only

the intercept, leaving other coefficients unaffected. Our typical equation with seasonal dummies may be written

$$y = b_0 + b_1X + b_2D1 + b_3D2 + b_4D3 + \mu$$

where D1, D2 and D3 are predetermined variables defined as

$$D_i = \begin{cases} 1 \text{ if quarter } i \\ 0 \text{ otherwise} \end{cases} \quad i = 1, 2, 3$$

Lag structure of an equation should be determined by the individual equation to be specified. Our general assumption is that the current quarterly level of dependent variable is affected not only by the current level but also by the past level of the independent variables. Also the effects of independent variables are assumed to decline as they extend further into the past. A rationalization of this geometric lag distribution is provided by the partial adjustment model. But in some cases where the geometrically declining weights of the past are not appropriate, a polynomial lag structure was used.

The Keynesian Approach

We have seven behavioral equations in this model, five of them are related to the foreign sector. There is no equation explaining the money market or supply side of the economy. The reason for the omission of the money market is because it is assumed that the monetary authority can adjust the money stocks all the time to meet the

meet the public's demand for money. This can be contrasted with the monetary approach's assertion that in an open economy the money supply is endogenous and plays an important role in determining key economic variables, such as prices, output, and balance of payments. In the usual Keynesian approach the role of the money market is to determine the interest rate and thus the investment level. In Korea, however, interest rates are determined by the monetary authority as indicated in Chapter 2 and treated in our model as exogenous.

Functions explaining the supply of real output are not included in our models because of the lack of appropriate data such as the total capital stock. Furthermore, in a short run model like ours the usual neoclassical type of supply function is not suitable for explaining the output fluctuations. The only variable related to supply and included in this study is the capacity level of output which is derived from a longer run trends of output growth.

The level of real output (GNP) is determined by demands for private expenditure, government expenditure and by the trade balance. Thus, the GNP is defined by the identity

$$(1)\quad Y = E + (X - M + S) + G$$

where E is private expenditure (i.e., private consumption and gross investment), (X - M + S) is the current account

balance, and G is government expenditure, all in real terms. S (service balance) and G are treated exogenous.

O. Private Expenditure

Real private expenditure is assumed to be a function of real income, real rate of interest, real amount of capital import, and the real money balance.

$$(2)\quad E_t^* = \beta_0 + \beta_1 Y_t + \beta_2 RR_t + \beta_3 RK_t + \beta_4 RMO_t + \mu_t.$$

RR denotes the real interest rate, which is equal to the nominal interest rate less the expected rate of inflation. Following the extrapolative expectations hypothesis, it is assumed that the expected rate of inflation depends on the actual rates of inflation in the past: $\dot{p}_t^e = \sum_{i=1}^{m} \alpha_i \dot{p}_{t-i}$ where $\dot{p}_t^e$ is the expected rate of inflation for period (t + 1), expressed at period t, $\dot{p}_{t-i}$ is the actual rate of inflation in period (t-i), and α_i is the expectations coefficient. In our model it is further assumed that $\dot{p}_t^e \sim \sum_{i=1}^{4} \frac{1}{4} \dot{p}_{t-i}$ so that the real annual rate of interest is determined by subtracting the inflation rate during the previous four quarters from the nominal annual rate of interest.

Net capital import (RK) is included as an argument because private expenditure, especially private investment, increases as more loans or direct investments are available from abroad. Real money balance's (RMO) role of augmenting expenditures is through the wealth effects. Real money

balances provide the link between the money market and expenditure. In the usual Keynesian model, a change in money supply affects aggregate demand by shifting the LM curve and changing the interest rate. Since in our model the interest rate does not respond to the change in the money supply real money balances are included as a variable determining private expenditure. Even if the interest rate is determined in a model real money balance or real wealth is often included as a determinant of consumption in Keynesian models such as by Patinkin (1965, ch. 9) and Modigliani (1963).

The real private expenditure equation specifies the desired level and not the actual level of expenditure at time (t). By assuming that the desired level is only partially achieved during any period, we have

$$(3)\quad E_t - E_{t-1} = \alpha(E_t^* - E_{t-1}) + \mu_{t1}$$

where α is the adjustment coefficient and $o < \alpha \leq 1$. Solving equation (3) for E_t^* and substituting this into equation (2) gives

$$(4)\quad E_t = b_0 + b_1 Y + b_2 RR + b_3 RK + b_4 RMO + b_5 E_{t-1} + \mu_{t2}.$$

where $b_i = \alpha\beta_i$ for i = 0 through 4 and $b_5 = (1-\alpha)$. Adding quarterly dummies to reflect seasonal fluctuations the final equation for estimation is given as

$$(5)\quad E_t = b_0 + b_1 Y + b_2 RR + b_3 RK + b_4 RMO + b_5 E_{t-1} + b_6 D_1 + b_7 D_2 + b_8 D_3.$$

O. Exports

Total Korean commodity exports to the world are divided into three groups: exports to the U.S., to Japan, and to the rest of the world. Exports to the rest of the world are treated as exogenous. Exports to the U.S. and Japan are expressed as functions of the relative prices of Korean exports to the domestic prices and income levels of importing countries.

$$(6)\quad \left(\frac{XUS}{PX}\right)^*_t = \alpha_0 + \alpha_1 \left(\frac{PX}{USWPI}\right)_t + \alpha_2 USY_t + v_t \text{ and}$$

$$(7)\quad \left(\frac{XJ}{PX}\right)^*_t = \beta_0 + \beta_1 \left(\frac{PX}{JWPI/JEXRIN}\right)_t + \beta_2 JY_t + \omega_t$$

By taking the same transformation as in the private expenditure equation, we have

$$(8)\quad \left(\frac{XUS}{PX}\right) = a_0 + a_1 \left(\frac{PX}{USWPI}\right) + a_2\, USY + a_3 \left(\frac{XUS}{PX}\right)_{-1}$$

$$(9)\quad \left(\frac{XJ}{PX}\right) = b_0 + b_1 \left(\frac{PX}{JWPI/JEXRIN}\right) + b_2 JY + b_3 \left(\frac{XJ}{PX}\right)_{-1}$$

as estimating equations.

XUS and XJ are exports to the U.S. and Japan respectively, in current U.S. dollars, and PX is the index of Korean export prices in dollars. For relative prices, wholesale price indexes (WPI) are used rather than the GNP

deflators of importing countries since the latter include much more than the goods prices competitive with Korean exports. In the case of exports to Japan, Japanese WPI is adjusted by changes in the exchange rate of Japanese yen to the dollar (JEXRIN) in order to compare both PX and JWPI in dollar terms. USY and JY are real GNP in dollars of the U.S. and Japan. Since the Japanese real GNP in dollars is the same as the real GNP in yen divided by a constant number (annual conversion factor), it does not matter in which currency the GNP is expressed.

O. Imports

Korean imports are expressed in one equation.

$$(10)\quad \left(\frac{M}{PM}\right) = c_0 + c_1\left(\frac{EXRIN \cdot PM}{P}\right) + c_2 Y + c_3\left(\frac{M}{PM}\right)_{-1}$$

There is no differentiation of imports by country because import price indices for different countries are not available. The use of the export price indices of these countries, instead of the Korean import price index, is not justified because the commodity structure of Korean imports is different from that of exports of the U.S. or Japan. Actual total imports are a function of the relative price of imports to overall Korean price level, income and imports during the previous period. Again, M is in dollar terms and PM is an index of dollar prices of imports. Thus, the dollar price index must be adjusted by the exchange rates index (EXRIN) to convert the former to a

won index and compare it with GNP deflator P. Import price is determined by the world market in which Korea is a very small purchaser. Therefore import price is treated exogenous. Since the exchange rate is determined by government policy, the won import price index (EXPIN·PM) is an exogenous variable.

O. Export Price

The export price index is treated as endogenous. It is determined by the general domestic price level (P) and export price indices of countries which are close competitors with Korea in the export markets (PXC). Therefore, by the same transformation as in above equations,

$$(11)\quad PX = d_0 + d_1 P + d_2 PXC + d_3 PX_{-1}$$

O. Capital Imports

From the balance of payments identity, $\Delta IR = X-M + S + K$, total net capital inflow is derived as $K = \Delta IR - (X-M + S)$ where K is net capital imports, ΔIR is changes in international reserves held by Korea, and $(X-M + S)$ is the current account balance, all in dollar terms. Thus, this K includes net short- and long-term borrowings, direct investments, official grants and also net errors and omissions. Any specification, including all these items in one variable may hardly be satisfactory. Unfortunately, data for Korea to separate the short-run from the long-run capital or commercial from government

capital is not available. It is realized, however, that most foreign capital inflow are from the U.S. and Japan, and that capital inflow based on profit motives are playing a more and more important role as time passes. Thus, unlike most other studies, which consider the capital account exogenous,[1] it is included here as an endogenous variable.

The basic hypothesis is that the main determinants of capital inflow are income levels and the changes in interest rate differential between Korea and the U.S. and Japan. Current and past levels of Korean income reveal the strength and the size of the market for potential foreign investors and lenders. Changes in interest rate differentials, based on the stock approaches of capital movement by Branson (1968, Chap. 2), are assumed to influence capital flow in general and short-term capital flow in particular. Real interest rates are not a concern here because the same expected inflation rate in one country is subtracted from both domestic and foreign interest rates depending on borrowing or lending. Thus, the relationship can be expressed as

$$(12)\quad K = g_0 + g_1 \sum_{i=0}^{n} w_i Y_{t-1} + g_2 \left(\sum_{i=0}^{n} w_i \, \Delta (R - R^{US,J})_{t-i} \right) + \mu_t$$

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[1] See footnote 3 in Chap. 3.

which states that present and past incomes and interest rate differentials are affecting the net capital inflows with the weights w_i which lie along an N^{th} polynomial curve,

$$w_i = \lambda_0 + \lambda_1 i + \lambda_2 i^2 + \lambda_3 i^3 + \ldots + \lambda_n i^n$$

$$(i = -1, 0, 1, 2 \ldots n, n+1)$$

The reason for using this polynomial lag formation is that geometric lags, of which the partial adjustment model is a part, generally assumes a declining lag weight.[2]

In their role in determining capital flows, however, it is very hard to accept that recent variables are more important and distant variables are less important. For instance, the flow of long-run capital may be determined two or three quarters earlier than its actual movement into Korea, and thus will not be affected by independent variables in the current quarter or in the quarter before. There is also difficulty inherent in using the polynomial lags because we have to specify the degree of the polynomial and the length of the lag before estimation. Our estimating equation reduces to

$$(13)\quad K = h_o + \sum_{i=o}^{n} h_{1i} Y_{t-i} + \sum_{i=0}^{n} h_{2i} \Delta(R-R^{US,J})_{t-i}$$

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[2]We can see this easily from the formulation of a geometric lag $Y_t = \alpha + \beta(X_t + \lambda X_{t-1} + \lambda^2 X_{t-2} + \ldots) + \mu_t$ where $0 < \lambda \leq 1$.

where R is the interest rate in Korea and $R^{US,J}$ is the geometric average of interest rates in the U.S. and Japan. It should be noted that in this model, since interest rate and money supply are exogenous, capital movements are influenced by the interest rates but are not allowed to change the interest rate or money supply. Thus, it is assumed that monetary authorities have adopted sterilization policies to counteract the effects of capital flows.[3]

O. Price Level

The price level chosen is the GNP deflator because it is the most general price and in a simple model like ours this can be used both for overall price changes and for deflating nominal variables into real terms. We assume that price level is determined by current demand pressure in the economy, import price and previous levels of the price.

$$(14)\quad P_t = j_0 + j_1 DPRES_t + j_2 IP_t + j_3 P_{t-1}$$

where DPRES = demand pressure in the Korean economy, IP = index of import price in won. Demand pressure is defined as the ratio of actual output to potential output as in Laidler (1975, Chap. 6) and others. The basic idea is that when an economy's demand increases in comparison to

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[3]For a brief review of Keynesian approach models which incorporate capital movements as part of a macro-economic system, see Hodjera (1973, pp. 708-713).

growing potential output levels in the economy, producers will be given incentive to raise prices. Other usual variables such as wage rates and unit labor costs are lacking because our model does not have a labor sector. Demand pressure, however, may also be interpreted as Philips curve relations since the higher the demand pressure is the lower the unemployment rate will be and consequently, the higher the inflation rate.

Import price index enters the model primarily as a materials cost index since most Korean imports are raw materials or intermediate goods and production is highly dependent on these imports. Previous price level is included as the result of Koyck transformation and because our dependent variable is the level of price indices and not the percent changes. Thus, the equation is similar to one by Eckstein and Fromm (1968, pp. 1172, 1176) except that unit labor costs and unfilled orders are omitted in our model.

The Monetary Approach Model

The monetary approach model contains six behavioral equations. The essence of the monetary approach is that the balance of payments is a monetary phenomenon. The role of money supply is emphasized with a stable function of demand for money. The viewpoint of monetary approach proponents is that the balance of payments is the difference between aggregate payments and aggregate receipts and

that the balance of payments relates to the overall operation of the economy through the money supply and the money demand (Johnson, 1958). This means the approach does not need separate equations for commodity exports and imports, service balances or capital flow. It needs only one equation that explains the overall balance of payments. It has been formulated exactly this way in the past for both the theory and for empirical testing.

This study departs from the usual monetary approach presentation by dividing the overall balance of payments of Korea into two equations, one for the current account and one for the capital account. This is necessary in economies such as Korea's in which the foreign exchange market is so undeveloped that residents cannot dispose of their excess money holdings, for instance, through the purchase of foreign bonds. Government control of the foreign capital market usually does not allow capital outflow but encourages inflow. Therefore, separate equation is needed for capital inflow which should be distinct from the current account balance equation determined simultaneously by domestic and foreign demand for goods and services. Limitations of the capital market and necessary division of the balance of payments into two components, however, should not be interpreted as a large departure from the monetary approach because an overall balance of payments equation still results from combining the two components. This overall balance of payments is directly linked to the money supply

through the foreign component of the base money and the money multiplier.[4]

The money multiplier is usually assumed constant in monetary approach models allowing base money to be used as money supply itself. However, the multiplier is introduced which changes with other key variables for the reasons explained in Chapter 3. The money supply will be linked to the price level, the private expenditure and the current account balance specifications of the model.

O. Private Expenditures

As in the Keynesian approach model, private expenditure is a function of income and real interest rate. In the monetary approach model, however, excess supply of real money balance is added as another variable instead of dropping the variables of net capital inflow and real money balances.[5] In the usual monetary approach model, since the full employment is assumed all the time, excess supply of real money is the only variable that explains the excess

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[4]Still, there is some departure from the monetary approach because demand and supply relations in the money market are not directly influencing net capital flows as can be seen in the following specifications.

[5]In the Keynesian approach model net capital inflows and real money balance affects private expenditure mainly through investment and consumption expenditures, respectively. In the monetary approach model, net capital inflows affect money supply and the relative size of real money supply and demand influences the level of private expenditures.

of expenditure over income. Our model, however, does not assume full employment and therefore expenditure is not independent of income and interest rate. An excess supply of real money balance is defined as the real money supply less the real money demand. The money supply is determined by

$$MO^S = m\ (DB + FB)$$

where m is the money multiplier, DB is the domestic component of the base money which is treated as exogenous, and FB is the foreign component of the base money in won. Change in FB is the same as change in the overall balance of payments.[6]

Thus,

$$\Delta FB = X - M + K$$

$$FB = FB_{-1} + \Delta FB$$

$$FB_{-1} = \sum_{i=0}^{t-1} \Delta FB_i$$

With a stable demand function for real money balance and real money supply, we can derive the excess supply (or demand) of real money balance in the short run and this excess supply will affect the real expenditure in private sectors. This is one crucial difference between this model and previous models of the monetary approach.

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[6]The concept of the balance of payments used here is the official reserve transactions balance.

The monetary approach stresses the link between the nominal money stock and the level of money income, not real income (Swoboda, 1977, p. 12). This proceeds from an implicit assumption of long-run equilibrium with real income treated as exogeneous and growing at a fixed rate. Another implicit assumption in the monetary approach is that money supply is instantaneously adjusted to the demand for money (Johnson, 1973). Neither of these assumptions are valid for short-run, real world application of the theory. Many empirical tests of the theory, however, have accepted these assumptions and treated real income as exogenous and/or allowed no excess supply of money in their model formulations.[7] It is unrealistic to assume that two endogenous variables, the demand for money and the supply of money, with different determinants should be always equal in size.

Thus, real private expenditure takes an excess supply of real money balance as an independent variable. The inclusion of real interest rate as another variable is appropriate in working with the Korean economy because the nominal interest rate is not determined in the money market

[7] Zecher (1976) and Connolly and Taylor (1976) accept instantaneous $MO^d = MO^s$. Courchene and Singh (1976) test excess demand for real money balance as a variable that affects balance of payments, but they assume that real income is independent of nominal money supply. With a further assumption of exogenous price level determined by the world price level, this means that real income is independent of real money supply.

and is therefore independent of the excess supply of real money balance.

Following the partial adjustment model of actual level to desired level, the equation is specified as

$$(15)\quad E = a_0 + a_1 Y + a_2 RR + a_3 REXM + a_4 E_{-1} + a_5 D1 + a_6 D2 + a_7 D3$$

where Ds again stand for seasonal dummies and REXM is the excess supply of money defined as $MO^s/P - MO^d/P$.

One problem with REXM is that it is not observed. In theory, it is the difference between the real supply of money stock and the real money stock that people desire to hold. With money supply function as $MO^s = m\ (DB + FB)$ and money demand function $MO^d = f(Y, R)$, REXM is derived from the model. But the measurement of REXM is required before the solution of the model since REXM is one of the determinant of real GNP through real private expenditure and money supply and demand depend on real GNP as will be shown in the specifications of these equations.

The procedure taken in this study to measure REXM is to assume the existing money stock as the supply of money and subtract the estimated demand for money from this. A difficulty with this method is taking the actual money stock as the supply of money although it is actually the result of interactions between supply and demand for money. A way out of this problem would be using the long run

equilibrium level of money supply instead of actual money stock and subtract the estimated demand for money from it. In other words, we can first estimate the long run money multiplier m*, from an endogenous money multiplier equation. Then $MO_s^* = m^*$ (DB + FB) is interpreted as a long run desired level of money supply and REXM can be estimated as $\frac{MO_s^*}{P} - \frac{MO_d}{P}$. Another possible method to estimate REXM is the one used by Courchene and Singh (1976) in their testing the relationship between the balance of payments and excess demand for real balance (see page 39). But in their case the supply of real money balance is exogenous.

The reason for using our procedure in this study is that it is simple and it provides a zero REXM when computed over the whole period. Also we do not have to assume an exogenous money supply. Thus this method is consistent with the monetary approach of zero REXM in the long run while in the short run nonzero REXM is possible as claimed by this study.

O. Current Account Balance

As mentioned above, the current account is separated from the capital account because the latter is under government restrictions regarding capital outflow. According to the monetary approach formulation, an overall balance of payments is a change in the foreign component of the base money. If we look at demand and supply of the base money,

assuming constant money multiplier, equilibrium in the money market requires

$$FB = MO^d - DB$$

$$\dot{FB} = \frac{MO^d}{FB} \dot{MO}^d - \frac{DB}{FB} \dot{DB}$$

But $\dot{MO}^d = \dot{p} + \eta_y \dot{Y} + \eta_R \dot{R}$ from $MO^d = P \cdot f(Y, R)$

where the dot above a variable denotes the growth rate of the variable (e.g., $\dot{FB} = \frac{dFB}{dt} \frac{1}{FB}$) and η_y and η_R denote the elasticity of the demand for money with respect to income and interest rate, respectively.

Substituting this into $\dot{FB}$ equation above,

$$\dot{FB} = \frac{MO^d}{FB} (\dot{P} + \eta_y \dot{Y} + \eta_R \dot{R}) - \frac{DB}{FB} \dot{DB}$$

In other words,

$$\Delta FB = MO^d (\dot{P} + \eta_y \dot{Y} + \eta_R \dot{R}) - DB \cdot \dot{DB}$$ [8]

This means that a country's balance of payments depends on the growth rates of domestic price, real income, the interest rate and the domestic component of the base money when initial money demand and the domestic component of the base money are given, and the income and interest rate elasticities are constant. If the U.S. and Japan are

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[8] This result is the same as equation (6) in Chap. 3 without the money multiplier and in terms of changes in FB rather than growth rate.

introduced as Korea's trading partners and if the interest rate variation is eliminated as $\dot{R} = 0$ in most cases, we can formulate our current account balance dependent on the relative growth rates of income, price, and the domestic component of the base money in Korea and the U.S.-Japan.

Guitian (1976) used several concepts of domestic credit expansion to test the relationship between current account balance and domestic credit expansion in Spain. He also used income and price variables in addition to domestic credit expansion for separate tests. But, in a case where there are major trading partners, the foreign countries' credit expansion or their income and prices should be included as determining variables for the current account balance. Furthermore, growth rates, rather than the absolute values of these variables, are more appropriate when the economies are quite different in size as is the case of Korea and the U.S.-Japan.

DeGrauwe (1975) examined seven countries and related changes in the stock of a country's international reserves to changes in the domestic component of its monetary base and the monetary bases of other countries in order to investigate the reserve flow between countries and the effect of sterilization policies on the stability of the reserve flows.

Examining the situation given the U.S. and Japan as Korea's only trading partners, the model indicates it is the difference in the growth rates of the variables that

determines the current account balance of Korea vis-a-vis these partner countries.[9]

In this case the current account balance of Korea will be higher: (1) the higher the relative growth of its real income; (2) the higher the relative inflation rate and (3) the lower the relative growth rate of the domestic component of the base money.[10] Therefore, we specify our current account balance as

$$CB = b_0 + \sum_i b_{1i} (\dot{DB} - \dot{DB}^{US,J})_{t-i} + \sum_i b_{2i} (\dot{Y} - \dot{Y}^{US,J})_{t-i}$$

$$+ \sum_i b_{3i} (\dot{P} - \dot{P}^{US,J})_{t-i}$$

where $\dot{DB}^{US,J}$ is the growth rate of the geometric average of the domestic components of base money in the U.S. and Japan. $\dot{Y}^{US,J}$ and $\dot{P}^{US,J}$ are the growth rates of geometric averages of income and price in the U.S. and Japan. Polynomial lag structure is used because it is not conceivable that lag weights are simply declining at the same weight for all independent variables.

O. Net Capital Inflow

The equation form used for net capital inflow is the same as that used in the Keynesian approach model.

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[9] In the two-country case, one country's deficit is the other country's surplus so that the ΔFB equation on page 62 tells this when the stock of international reserves is held constant and the elasticities are constant in both countries.

[10] See Johnson (1973) and Swoboda (1977, p. 23) for similar results.

Since individual behavior regarding capital outflow is restricted by the government and so cannot be assumed to follow the pattern explained by the monetary approach, it is not realistic to differentiate the two models with respect to net capital flow.[11] Thus

$$(16)\quad K = h_0 + \sum_i h_{1i} Y_{t-1} + \sum_i h_{2i} \Delta(R - R^{US,J})_{t-i}$$

O. Money Multiplier

The current account balance and net capital inflow combine to form the overall balance of payments. This accounts for changes in the foreign component of the base money. Adding it to the previous level of the foreign component of the base money and then to the domestic component of the base money, we arrive at the total base money. Money supply is thus determined by this base money and the money multiplier.

$$\Delta FB = CB + K$$

$$FB = FB_{-1} + \Delta FB$$

$$MO_s = m\ (FB + DB)$$

The money multiplier equation is derived from the following relationship between the money supply and the monetary base

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[11] Thus the difference between the two models is not in the specifications of the equation but in the roles of capital inflow in the two models.

(or base money). The monetary base in terms of its uses is defined as

$$MB = BR + CP$$

where BR = member bank reserve

CP = currency held by the public

Then $$m = \frac{MO_s}{MB} = \frac{DD + CP}{BR + CP}$$

(17) $$m = \frac{DD + CP}{r^d DD + r^t TD + CP} = \frac{1 + c}{r^d + r^t T + c}$$

Where $c = \frac{CP}{DD}$, denotes the ratio of currency held by public to demand deposits

r^d = reserve requirement ratio of demand deposits

r^t = reserve requirement ratio of time deposits

$T = \frac{TD}{DD}$, denotes the ratio of time to demand deposits.

As has been noted, r^d and r^t are determined by the monetary authorities. We assume c is a decreasing function of income level because we expect that, as the economy grows, the public will hold larger portions of money in demand deposits than in currency. T is assumed to depend on the interest rate and the inflation rate because people will hold more time deposits than demand deposits, the higher the interest rate and the lower the inflation rate.

Accordingly, the money multiplier equation is a linearized version of equation (17).

$$(18)\quad m = \beta_0 + \beta_1 Y + \beta_2 R + \beta_3 \dot{P} + \beta_4 r^d + \beta_5 r^t + \mu_t$$

We expect $\beta_3 > 0$, and β_2, β_4, $\beta_5 < 0$

The sign of the income term is not clear a priori. The expected sign is $\beta_1 \lesseqgtr 0$ depending on $r^d + r^t{}_T \lesseqgtr 1$.[12]

By assuming that people's adjustment to the desired levels is achieved with lags, we specify the equation as

$$(19)\quad m = b_0 + b_1 Y + b_2 R + b_3 \dot{P} + b_4 r^d + b_5 r^t + b_6 m_{-1}.$$

O. Demand for Money

Demand for real money balance (not including time deposits) is assumed to be a function of real income and the interest rate, the latter representing the cost of holding money. It is further assumed that the function is homogeneous of degree zero in price level. Thus

$$(20)\quad \frac{MO_d}{P} = d_0 + d_1 Y + d_2 R + d_3 D1 + d_4 D2 + d_5 D3$$

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[12] If $r^d + r^t{}_T > 1$, then the denominator is larger than the numerator in eq. (17), thus m is less than one. If $m < 1$ and c is decreasing by increasing income level, then m will increase.

O. Price Level

The equation for price level in the Keynesian approach model included demand pressure as an independent variable. In the monetary approach model, we use the rate of change in money supply instead of demand pressure in accord with the basic idea of this approach. Many empirical studies based on the strict monetary approach accept the one-price assumption made by Johnson (1973) that

$$P = ep^{*}$$

or

$$\dot{P} = \dot{e} + \dot{P}^{*}$$

where e is the exchange rate and p* is the world price level.

With a fixed exchange rate domestic inflation rates converge to the foreign (world) inflation rate. However, this is an oversimplification and even in theory the relationship would be valid only under very restrictive assumptions (Swoboda, 1977, pp. 17-18).

We assume that price levels depend on current and lagged changes in the domestic money stock and on import price levels which are a combination of the foreign price level and the exchange rate. Thus, foreign inflation is transmitted indirectly through the balance of payments and directly through the price levels of imported goods. As long as increased money supply (caused by increases in the foreign component of the base money) increases the excess

supply of the real money balance and so raises private expenditure, the price mechanism is similar to demand pressure in the Keynesian approach model. But, pressure in the Keynesian approach comes directly from exports and investments which depend on capital imports, while in the monetary approach model it arises from the pressure on the domestic goods market through an excess supply of real money balance.

To put it another way, when income and prices in the U.S. and Japan are boosted by expansionary policies, according to Keynesian approach, Korean exports and demand pressure will increase. According to the monetary approach, however, the same expansionary policies will result in deterioration of Korea's current account balance if the policies were not accompanied by increases in money supply. Thus demand pressure in the domestic goods market may not increase unless capital inflow from the U.S. and Japan (induced by lowered interest rates in these countries) more than compensates for the current account deficits.

Our price level equation is

$$(21)\quad P = g_0 + g_1 \dot{MO}_s + g_2 IP + g_3 P_{-1}$$

Where $\dot{MO}_s$ is the money supply growth rate and IP is the import price index (in terms of won derived by the exchange rate index times the import price index in dollar terms). This can also be interpreted as a modified version of

$P = ep^*$ above by including the domestic monety supply growth rate and allowing for adjustment over time.[13]

Complete Models

Complete systems of structural equations and identities that comprise the two models may be written as follows:

O. Keynesian Approach Model

$$(1)\quad E = a_0 + a_1 Y + a_2 RR + a_3 RK + a_4 RMO + a_5 E_{-1} + a_6 D1 + a_7 D2 + a_p D_3$$

$$(2)\quad \left(\frac{XUS}{PX}\right) = b_0 + b_1\left(\frac{PX}{USWPI}\right) + b_2 USY + b_3\left(\frac{XUS}{PX}\right)_{-1}$$

$$(3)\quad \left(\frac{XJ}{PX}\right) = c_0 + c_1\left(\frac{PX}{JWPI/JEXRIN}\right) + c_2 JY + c_3\left(\frac{XJ}{PX}\right)_{-1}$$

$$(4)\quad \frac{M}{PM} = d_0 + d_1\left(\frac{EXRIN \cdot PM}{P}\right) + d_2 Y + d_3\left(\frac{M}{PM}\right)_{-1}$$

$$(5)\quad \left(\frac{KNET}{USWPI}\right) = e_o + \sum_{i=o}^{n} e_{1i} Y_{t-i} + \sum_{i=0}^{n} e_{2i}\, \Delta(R - \sqrt{USR \cdot JR})_{t-i}$$

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[13]The inclusion of the growth rate of money stock in the equation is not based on domestic monetarism, but on the short-run modification of the monetary approach which says that in the long run, a change in domestic money supply would influence domestic price level only to the extent that the change in money supply influenced the rate of change in the world money supply and, hence, the level of world prices.

(6) $PX = f_0 + f_1 P + f_2 PXC + f_3 PX_{-1}$

(7) $P = g_0 + g_1 (DEPRES) + g_2 (IP) + g_3 P_{-1}$

(8) $Y = E + EXR (X-M+S)/P \cdot 1000 + G$

(9) $X = XUS + XJ + XW$

(10) $K = KNET + AID$

(11) $RK = (K \cdot EXR)/P.1000$

(12) $RMO = MO/P$

O. Monetary Approach Model

(1) $E = a_0 + a_1 Y + a_2 RR + a_3 REXM + a_4 E_{-1} + a_5 D1 + a_6 D2 +$

$+ a_7 D3$

(2) $CB = b_0 + \sum_i b_{1i} DBDF_{t-1} + \sum_i b_{2i} YDF_{t-i} + \sum b_{3i} PDF_{t-i}$

(3) $\left(\frac{KNET}{USWPI}\right) = c_0 + \sum_i c_{1i} Y_{t-i} + \sum_i c_{2i} \Delta(R - \sqrt{USR \cdot JR})_{t-i}$

(4) $\left(\frac{MO_d}{P}\right) = d_0 + d_1 Y + d_2 R + d_3 D1 + d_4 D2 + d_5 D3$

(5) $m = e_0 + e_1 Y + e_2 R + e_3 PDOT + e_4 RRD + e_5 RRT + e_6 m_{-1}$

(6) $P = g_0 + g_1 MODOT + g_2 (IP) + g_3 P_{-1}$

(7) $REXM = \frac{MO_s}{P} - \frac{MO_d}{P}$

(8) $MO_s = m(FB+DB)$

(9) $FB = FB_{-1} + \Delta FB$

(10) $\Delta FB = EXR\ (CB+K)/1000$

(11) $K = KNET + AID$

(12) $Y = E + (CB \cdot EXR) / (P \cdot 1000) + G$

(13) $YDF = YDOT - YDOT^{US,J}$

(14) $PDF = PDOT - PDOT^{US,J}$

(15) $MODOT = \dfrac{MO_s - MO_{s\,-1}}{MO_{s\,-1}}$

(16) $PDOT = \dfrac{P-P_{-1}}{P_{-1}}$

(17) $YDOT = \dfrac{Y-Y_{-1}}{Y_{-1}}$

O. List of Variables (Predetermined variables are marked with asterisk. Derivations of variables are explained in the appendix of Chap. 5)

AID* = foreign aid in million dollars

CB = current account balance in million dollars

DBDF = difference in the growth rates of the domestic components of the base monies in Korea and in the U.S.-Japan

DEPRES = demand pressure in Korea measured as the ratio of actual real GNP to capacity real GNP

E = real private expenditure in 1970-billicn won

EXR* = exchange rate of won per dollar

EXRIN* = Korean exchange rate index, won/dollar 1970 = 1.0

FB = foreign component of base money in billion won

ΔFB = change in the foreign component of base money in billion won

G* = real government expenditure in 1970-billion won

JEXRIN* = Japanese foreign exchange rate index, yen/dollar, 1970 = 1.0

JR* = Japanese interest rate (60 days Treasurey Bill rate)

JWPI* = wholesale price index in Japan, 1970 = 1.0

JY* = real income of Japan in 1970 billion dollars

K = net capital imports in million dollars

KNET = net capital imports less foreign aid in million dollars

m = money multiplier

M = commodity imports in million dollars

MO* = money supply in billion won (in the Keynesian model)

MO_s = money supply in billion won

MO_d = demand for money in billion won

P = GNP deflator, 1970 = 1.0

$PDOT^{US,J*}$ = growth rate of the U.S.-Japanese wholesale price indicies

PM* = import price index in dollars, 1970 = 1.0

PX = export price index in dollars, 1970 = 1.0

PXC* = Korea's competitor countries' export price indices, 1970 = 1.0

R* = interest rate, annual rate of 3-month time deposit interest

REXM = excess supply of real money in 1970 billion won

RK = net capital imports in 1970-billion won

RMO = real money balance in 1970-billion won

RR* = real interest rate, annual interest rate less previous four quarter's inflation rates

S* = service balance in million dollars

USR* = U.S. interesr rate (3-month Treasurey Bill rate)

USWPI* = wholesale price index in the U.S., 1970 = 1.0

USY* = real income of the U.S. in 1970 billion dollars

X = commodity exports in million dollars

XJ = commodity exports to Japan in million dollars

XUS = commodity exports to the U.S. in million dollars

XW* = exports to countries other than the U.S. and Japan in million dollars

Y = real income in 1970-billion won

$YDOT^{US,J*}$ = growth rate of U.S.-Japanese real income

CHAPTER 5

ESTIMATION OF THE MODELS

General Methods of Estimation

The structural equations formulated in the previous chapter are estimated using the 1963-1975 quarterly series data. Some data, such as export and import price indices, are not available for periods before 1963. But, the primary reason for choosing this period is the structural differences in the Korean economy before and after 1963. As explained in Chapter 2, shifts in government policy to emphasize export-led development after the military coup made the foreign sector of the economy much more important than before.

The Keynesian model consists of twelve equations for twelve endogenous variables and the monetary model consists of seventeen equations for seventeen endogenous variables. The number of exogenous variables is twelve and fourteen for the Keynesian model and the monetary model, respectively. Each structural equation satisfies the order condition of identification.[1]

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[1]This is a necessary condition for identification. It says that if an equation is to be identified, the

Since the equations are simultaneous, the ordinary least squares estimator of regression coefficients is inconsistent. This problem arises because endogenous variables appear as explanatory variables in some equations and these endogenous variables are correlated with the disturbance of the equation in which they appear. To cope with the inconsistency the two stage least squares method was used for all the behavioral equations except for two in which polynomial lag structures were used.

When serial correlation is indicated in an equation,[2] the equation is reestimated using the Cochrane-Orcutt iterative method. This is necessary because, when the disturbances are serially correlated, the conventional formulas for testing the significance of the regression coefficients lead to incorrect statements. For testing the significance, we require unbiasedness of estimators and their estimated variances. The existence of serial correlation, however, causes inefficient estimators and leads to bias in the estimated variances of the estimators (see Kmenta, 1971, Chap. 8).

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number of predetermined variables (exogenous variables plus lagged endogenous variables) excluded from the equation must be greater than or equal to the number of included endogenous variables minus one. For derivation, see Kmenta (1971, Chap. 13).

[2] A large sample (say $N > 30$) test for serial correlation, when lagged dependent variables are present as explanatory variables, is explained in Durbin (1970). Also see Johnston (1972, Chap. 10).

In a simultaneous equation system any lagged endogenous variable, included as an explanatory variable, is correlated with the structural disturbances thus leading to inconsistent estimates of coefficients. As a way out of this difficulty, the method of instrumental variables was used for estimation of simultaneous equation models with lagged endogenous variables and first order serially correlated errors as described by Fair (1970). This suggests that to insure consistent estimates, predetermined variables, predetermined variables lagged once, endogenous variables lagged once and dependent variables lagged once must be included as instrumental variables for the first stage regression.

Results of Estimation

Table 5-1 and 5-2 show the resulting estimations of the behavioral equations of the two models. In this section each equation will be discussed briefly. Sources for the data used and derivations will be presented in appendix to this chapter.

All the estimated coefficients in the private expenditure equations of both models have expected signs. Although income influences expenditure level strongly, the effect of real interest rate is insignificant. So is the effect of real money balance in the Keynesian model. Coefficients of lagged private expenditure show that the speed of adjustment is much faster in the Keynesian model

Table 5-1.--Keynesian Approach Regression Results.

(K1)	$E = 187.765 + 0.54268Y - 0.32098RR + 0.67670RK$ (2.89) (4.28) (0.84) (2.23) $+ 0.13837RMO + 0.26350E_{-1} - 346.36D1 - 143.43D2$ (0.83) (1.49) (2.63) (3.31) $- 220.89D3$ (3.28)	TS $R^2 = 0.995$ DW = 2.04
(K2)	$\frac{XUS}{PX} = -181.89 - 112.33 \frac{PX}{USWPI} + 0.34690USY$ (1.70) (1.47) (2.77) $+ 0.62066 \left(\frac{XUS}{PX}\right)_{-1}$	TS $R^2 = 0.905$ DW = 1.77
(K3)	$\frac{XJ}{PX} = 196.339 - 226.56 \frac{PX}{JWPI/JEXRIN} + 0.27358JY$ (1.76) (2.47) (1.35) $+ 0.65345 \left(\frac{XJ}{PX}\right)_{-1}$ (6.79)	TSCORC $R^2 = 0.960$ DW = 1.82 $\hat{\rho} = 0.49$ (3.81)
(K4)	$\frac{M}{PM} = 44.122 - 34.198 \frac{EXRIN \cdot PM}{P} + 0.09740Y$ (1.03) (1.14) (1.79) $+ 0.90002 \left(\frac{M}{PM}\right)_{-1}$ (16.71)	TSCORC $R^2 = 0.931$ DW = 2.25 $\hat{\rho} = -0.42$ (3.13)
(K5)	$\frac{KNET}{USWPI} = -.126.96 + 0.0677Y + 0.0752Y_{-1}$ (1.84) (1.43) (1.46) $+ 0.2343Y_{-2} + 0.1196Y_{-3} + 7.053 \Delta(R - \sqrt{USR.JR})$ (4.59) (2.40) (1.05) $+ 4.491 \Delta(R - \sqrt{USR.JR})_{-1} + 7.852 \Delta(R - \sqrt{USR.JR})_{-2}$ (0.62) (1.06) $- 4.093 \Delta(R - \sqrt{USR.JR})_{-3}$ (0.59)	PDLCORC $R^2 = 0.694$ DW = 2.04 $\hat{\rho} = 0.42$ (3.11)

Table 5-1.-- Continued.

(K6) $PX = \underset{(3.35)}{0.26050} + \underset{(2.04)}{0.08405}P + \underset{(3.22)}{0.31439}PXC + \underset{(2.27)}{0.3583}PX_{-1}$	TSCORC $R^2 = 0.979$ DW = 1.84 $\hat{\rho} = \underset{(5.43)}{0.63}$
(K7) $P = -\underset{(1.07)}{0.19046} + \underset{(1.01)}{0.24007}$ (DEPRES) $+ \underset{(2.09)}{0.04971}$ (EXRIN·PM) $+ \underset{(15.37)}{0.94876}P_{-1}$	TSCORC $R^2 = 0.983$ DW = 2.13 $\hat{\rho} = \underset{(4.89)}{-0.59}$

NOTE: Numbers in parentheses are absolute values of t statistics.

TS stands for two-stage least squares.

TSCORC stands for two-stage least squares with Cochrane-Orcutt iteration method.

PDLCORC stands for polynomial lag with Cochrane-Orcutt interaction method.

DW is Durvin-Watson statistics.

$\hat{\rho}$ is the estimate of the first-order serial correlation coefficient by Cochrane-Orcutt procedure. Numbers in parentheses are absolute values of t statistics.

Corrected R^2 ($\bar{R}^2$) for each equation can be obtained by the relationship $\bar{R}^2 = 1 - (1-R^2)\frac{N-1}{d.f}$. Since the ratio of N(number of observations) to d.f (degree of freedom) is not much different from one in our case the discrepancies of $\bar{R}^2$ from R^2 should be small.

Table 5-2.--Monetary Approach Regression Results.

(M1) $E = 276.395 + 0.37276Y - 0.35299RR + 0.28855REXM$
(5.17) (0.73) (1.88)

$+ 0.61349E_{-1} - 599.96D1 - 180.37D2 - 325.77D3$
(7.89) (7.80) (6.75) (7.00)

TSCORC
$R^2 = 0.991$
DW = 1.77
$\hat{\rho} = -0.61$
(5.21)

(M2) $CB = -334.42 - 67.87DBDF - 192.8DBDF_{-1} - 296.3DBDF_{-2} - 314.6DBDF_{-3}$
(2.64) (0.51) (1.20) (1.76) (2.30)

$+ 326.2YDF + 282.3YDF_{-1} + 287.3YDF + 317.7YDF_{-3}$
(1.93) (1.71) (1.79) (2.02)

$- 223.3PDF - 982.4PDF_{-1} - 1024.0PDF_{-2} - 169.6PDF_{-3}$
(0.52) (1.88) (2.13) (0.47)

PDLCORC
$R^2 = 0.728$
DW = 1.61
$\hat{\rho} = 0.67$
(6.00)

(M3) $\frac{KNET}{USWPI} = -126.96 + 0.0677Y + 0.0752Y + 0.2343Y_{-2}$
(1.84) (1.43) (1.46) (4.59)

$+ 0.1196Y_{-3} + 7.053\ \Delta(R - \sqrt{USR.JR})$
(2.40) (1.05)

$+ 4.491\ \Delta(R - \sqrt{USR.JR})_{-1} + 7.852\ \Delta(R - \sqrt{USR.JR})_{-2}$
(0.62) (1.06)

$- 4.093\ \Delta(R - \sqrt{USR.JR})_{-3}$
(0.59)

PDLCORC
$R^2 = 0.694$
DW = 2.04
$\hat{\rho} = 0.42$
(3.11)

(M4) $\frac{MO}{P} = -217.11 + 0.5469Y - 3.6875R + 280.35D1$
(4.15) (15.20) (2.03) (12.95)

$+ 202.97D2 + 261.01D3$
(10.60) (13.58)

TSCORC
$R^2 = 0.959$
DW = 2.03
$\hat{\rho} = 0.40$
(2.91)

(M5) $m = 0.8963 - 0.00016Y + 0.0022R + 0.3194PDOT$
(4.37) (2.48) (0.53) (0.90)

$- 0.0087RRD - 0.0044RRT + 0.5547m_{-1}$
(2.47) (0.56) (5.78)

TSCORC
$R^2 = 0.783$
DW = 2.07
$\hat{\rho} = -0.33$
(2.36)

Table 5-2.--Continued.

(M6) $P = -0.03039 + 0.27696MODOT + 0.04687IP + 0.98507P_{-1}$ (1.46) (1.60) (2.23) (25.89)	TSCORC $R^2 = 0.984$ DW = 2.13 $\hat{\rho} = -0.64$ (5.55)

NOTE: See the note for Table 5.1.

than in the monetary model, where it can be said that a large portion of expenditure depends on the previous sizes of variables. If nominal instead of real interest rate is used, the coefficient becomes insignificant and shows positive signs. This may be due to chronic inflation in Korea, which results in public awareness of its effects on actual interest. What is more important is the fact that the nominal interest rate, as determined by the monetary authority, fails to move in accord with the money market conditions. All of the quarterly dummies are very significant which implies large seasonal fluctuations in the expenditure level.

All of the signs in the export and import functions of the Keynesian model (Eqs. K2 - K4) are as expected. In each case the lagged dependent variables are highly significant showing, particularly in the import equation, that most of the imports are dependent on lagged variables. This is not so unusual, however, in a quarterly model. Comparing the income coefficients of exports to the U.S. and Japan, we can see that, other things being equal, when income in the two countries increases by 1-billion (constant) dollars, exports to the U.S. increase by 0.35-million dollars while exports to Japan increase by only 0.27-million dollars. The difference between the effects that growth in these countries have on Korea's exports must be much greater than this because the U.S. GNP is much larger than the Japanese GNP.

In terms of the effects of relative prices, exports to Japan proved more responsive to price changes than exports to the U.S. Relative price elasticity of exports to the U.S. is -0.97 at the mean compared with price elasticity of -2.36 of exports to Japan. Price elasticity in imports is only -0.08 at the mean. The low price elasticity of imports is to be expected since most Korean imports are raw materials and intermediate goods. Also, this result is consistent with import studies of other developing countries.

We tried an import function, which includes the size of international reserve holdings as a variable, in accord with the familiar argument that a development country imports more freely with more foreign exchange reserves. The basis for this argument is the restrictions placed on imports due to chronic foreign exchange shortages, and also the importance of imports as a tool of external adjustment policy (Rhomberg, 1968; Hemphill, 1974). The variable used was international reserve holdings at the end of the previous quarter divided by the amount of imports in the previous four quarters. The results showed that the coefficient of this term is very insignificant or of the wrong sign. Thus, we cannot deduce that Korean imports are heavily constrained by the availability of international reserves, or that import changes are an important policy tool in attaining short-run balances.

The current account balance equation in the monetary model (Equation (M2)) is equivalent in effect to combining the three export and import equations, exports to the rest of the world, and the service balance in the Keynesian model. Combining all these into one equation would be, of course, to follow the monetary approach's assertion that what matters and what is affected by other key variables is the overall balance of payments. The equation is, of course, a modified version, since the capital account is excluded. The emphasis on U.S. and Japanese economic conditions and the lack of proper data representing the whole outside world justify using this formulation of the equation to represent the monetary approach. The estimation result gives a strong support to the general monetary approach position. All the coefficients, except those of price terms, have expected signs and the equation explains almost three-quarters of the variation in current account balance. For the domestic component of the base money and price, the influence of lagged differences in growth rates is greater than the influence of current differences. On the other hand, current and lagged differences in income growth rates have almost the same effect. The equation was estimated using a third-degree polynomial with a four-period lag and no endpoint restrictions.[7] The result is consistent, not only with the

[7]A problem in using a polynomial lag structure is that the length of the lag should be determined before

monetary approach theory, but also with the goods market integration hypothesis applied to Korea and the U.S.-Japan.

In the net capital inflow equation common to both models, foreign aid, which usually is not dependent on economic variables, is excluded and it is deflated by the U.S. wholesale price index for conversion into real value. The difficulty of using the nominal capital inflow and the nominal income in dollars or wons is that differences in price changes and the effects of devaluation are not accounted for. The U.S. wholesale price index was chosen as a deflator, because it represents the purchasing power of foreign capital most accurately, whether in the form of loans or direct investments. Also, real income, rather than nominal income, is the best indicator of profitability or the level of foreign capital need and loan repayment capability. This equation, too, was estimated for a four-period lag with third-degree polynomial weights and without endpoint restrictions. The coefficients of real income indicate that income levels lagged by two and three quarters are significant and do affect current capital inflow. Changes in interest rate differentials show the correct signs, but none are significant at even the 10 percent level. The overall fit is rather good ($R^2 = 0.68$)

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estimation. The "search" for the best length, in terms of minimizing the standard error of estimate or increasing R^2, also causes other problems. See Schmidt (1974) for a modified polynomial lag model with a lag of infinite length.

considering that varied capital movements are combined into one.

Equations for the price level (GNP deflator) indicate that import prices have an equal effect on domestic price levels in either model. Coefficients of approximately 0.05 may be thought too small for a country like Korea, whose economy depends so much on imports. Really they are not small at all, considering they represent only the current quarter's impact. As the coefficients of lagged dependent variables show, most of the variation in current price levels is explained by the past levels of independent variables.[8] Demand pressure in the Keynesian model and the growth rate of the money supply in the monetary model show the expected positive signs but fail to be significant.

The export price equation in the Keynesian model show all the coefficients to be significant and all the signs to be correct. It shows that Korean export prices are sensitive to domestic price levels and also respond to export prices in other countries whose export markets and commodities are similar to those of Korea.

Money demand function in the monetary model indicates that most variation in real money demand is explained by real income and seasonal dummies even though the

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[8]The long run response of prive level to import prices, which is defined as $\beta/(1-\gamma)$, where γ is the coefficient of the lagged price level and β is the coefficient of the import prices, is about 0.97.

interest rate coefficient is of the correct sign and is significant at a 5 percent level. Considering the importance of a stable demand for money function in the monetary approach, all significant coefficients and the very good fit of the equation is strong support for the approach.

The money multiplier equation reveals that the signs are wrong for income and inflation rate. The sign of the income coefficient can be either positive or negative as explained in the previous chapter. But, if we assume that $(RRD + T \cdot RRT) < 1$, or $m > 1$, then we expect a positive sign for the income coefficient. Other coefficients have the expected signs but only those of the required reserve ratio for demand deposits and the lagged money multiplier are significant.

Appendix, Data Sources and Derivations

Data Sources

The data for variables listed at the end of Chapter 4 and used for the estimations in this chapter were obtained mostly from the following sources:

A. Bank of Korea, Monthly Economic Statistics
B. Bank of Korea, Economic Statistics Yearbook
C. Economic Planning Board of Korea, Monthly Statistics of Korea
D. International Monetary Fund, International Financial Statistics
E. OECD, Main Economic Indicators: Historical Statistics 1960-75
F. U.S. Department of Commerce, Survey of Current Business, January, 1976

Derivations

Some of the data was not directly available from the sources listed above. Derivations of these data are explained below.

Y (real Korean GNP in 1970 billion won) for the period 1963-72 was obtained from IMF, Asia Department; the data for 1973I-1976IV was obtained by adjusting the real GDP in source D by the real net factor income from abroad. To get the real net factor income, nominal net factor income from abroad found in source D were divided by the GDP deflator from source D and then multiplied by the ratio of yearly GDP deflator to the deflator of net factor income from abroad which is available from source B.

P (GNP deflator) is derived by dividing the nominal GNP by Y. Nominal GNP were also obtained from IMF and source D.

G (real government consumption and investment) Annual data were derived from source B through dividing gross government investment by the gross investment deflator and adding to this real government consumption. To derive the quarterly series this sum was then multiplied by the quarterly percentages representing real government expenditure derived from nominal government expenditure in source D, divided by P. This process is necessary because the nominal government expenditures in source D include such items as government subsidies, interest payments and transfer payments.

E (real private expenditure) = Y - G - (EXR/1000). (X - M + S). EXR is the trade conversion factor from source D. X is commodity exports in million dollars, f.o.b. price. M is commodity imports in million dollars, c.i.f. price. S (servide balance) is the difference between the goods and service balance (from source D) and the goods balance (X - M). X as used does not include those exports which are not cleared through customs, such as goods sold to military forces abroad. They are included in S.

K (net capital flow in million dollars) is derived by subtracting the goods and service balances from the changes in international reserve holdings (sources A, B).

KNET = K - AID. AID is official aid imports (source A).

EXRIN = EXR/310.42. Index of the won-dollar exchange rate (1970 = 1.00).

$RR = R - ([P_{-1} - P_{-5}]/P)$. The real interest rate is derived from the annual rate of three-month time deposit interest less the inflation rates of the previous four quarters.

JEXRIN = JEXR/360.0. Index of the yen-dollar exchange rate (1970 = 1.00).

PXC (Korea's competitor countries' export price index, 1970 = 1.00) is the index of average export prices from Taiwan, Isreal and the Philippines expressed in U.S. dollars (source D). Data for such other countries as

Mexico, Singapore and Hong Kong were not available for the same period.

DEPRES = Y/CAPY. Demand pressure in the Korean economy is measured as the ratio of actual Y to CAPY (the capacity level of Y). CAPY is derived by the following process. First, from Y series, comes the moving average Y. Then, the seasonal factor is found by dividing actual Y by the moving average Y and averaging the ratios for each quarter. The seasonally adjusted Y is obtained by dividing actual Y by seasonal factor. Next, the trend capacity level of seasonally adjusted Y is determined by peak-to-peak interpolation. The period is divided into two sub-periods for interpolation purposes after examining the adjusted Y series. The two sub-periods are 1963I-1971III and 1971IV-1975IV. Finally, the trend capacity Y obtained by the interpolation was corrected by the seasonal factors to get CAPY.

m (money multiplier) is derived by dividing MO^S (currency plus demand deposits) by the base money (source A).

$FB = \sum_{i=0}^{\infty} (\Delta IR \cdot EXR/1000)_{t-i}$. Foreign component of the base money is the sum of past changes in international reserve holdings of the Bank of Korea plus changes in the current period all converted into billion wons. The earliest date in the calculation is 1959I. Since the FB level was a very small portion of the total base money in the periods before 1963, there should be little discrepancy

between this FB and the real FB we expect from starting the calculation at the $(t-\infty)$ period.

$\underline{YDOT^{US,J}}$ = quarterly growth rate of the U.S.-Japanese real GNP. The U.S.-Japanese real GNP is the geometric mean of USY and JY. USY (the U.S. real GNP) is the nominal U.S. GNP (source E) divided by the GNP deflator (1970 = 1.00, source E). JY (Japanese real GNP in billion 1970 U.S. dollars) is derived by dividing the nominal Japanese GNP in billion yen (source E) by the GNP deflator (1970 = 1.00, source E) which is again divided by the 1970 average yen-dollar exchange rate. A geometric mean is used because the rate of change is a major concern and equal relative changes in USY or JY are regarded as equally important to Korea as shown in chapter 2. An arithmetic mean is quite incorrect as a measure of average ratio of changes.

$\underline{PDOT^{US,J}}$ is the quarterly growth rate of the geometric means of USWPI and JWPI (source D).

$\underline{DBDF = DBDOT - DBDOT^{US,J}}$ is the difference between quarterly growth rate of the domestic component of the base money in Korea and the growth rate of the U.S.-Japan base money. DB = Base money - Foreign component of base money (FB). $DB^{US,J}$ = geometric mean of USB (U.S. base money, source D) and JB (Japanese base money, source D). USB and JB are used instead of their domestic components because of the difficulty in dividing the domestic from the foreign components in USB.

CHAPTER 6

SIMULATION OF THE MODELS

For evaluating a model a look at the fit of individual equations is not only inadequate but often can be misleading. This is because in a simultaneous equation system interaction among individual equations and the dynamic structure of the system may show results quite different from what is expected in individual equations. True comparison of the performances of competing models, therefore, should be based on several simulation experiments. Simulation is particularly relevant in this case since nonlinear variables prohibit analytic comparison of the models. Their dynamic structure can be inferred only from examination of the numerical solutions. In this chapter, the results of one-period and dynamic simulations will be compared within the estimation period. Also, the result of forecasting simulation outside the estimation periods will be checked.

The real GNP and price level are the two variables in which we are most interested in our simulations. Computer technique used is the SIM program developed by Morris

Norman which solves the model by a simple iterative technique.

One-Period Simulation

In one-period simulation, a model is solved by using the actual values for the lagged endogenous variables; whereas, in dynamic simulation, previous solution values are used for the lagged endogenous variables. Thus, one-period simulation cannot display the model's inherent dynamic characteristics and the usefulness of it is limited where more accurate single-period forecast is needed.

General performances of the models in one-period simulation for the period of 1969II-1975IV can be compared by checking Figures 6-1 and 6-2 and Table 6-1. Figure 6-1 compares the actual and predicted values of the real GNP, based on the Keynesian and the monetary approach models. Figures 6-2 does the same for price level. Both models predict the direction and size of changes in real GNP quite well. The Keynesian model is wrong twice in predicting directions (1969III and 1973III) while the monetary model is wrong only once (1973III). In terms of the error statistics both models' performance is about the same. Root Mean Square Error (RMSE) is less with the monetary model, but in percentage Root Mean Square Error (% RMSE) the Keynesian model is better. Both models have a low negative mean bias.

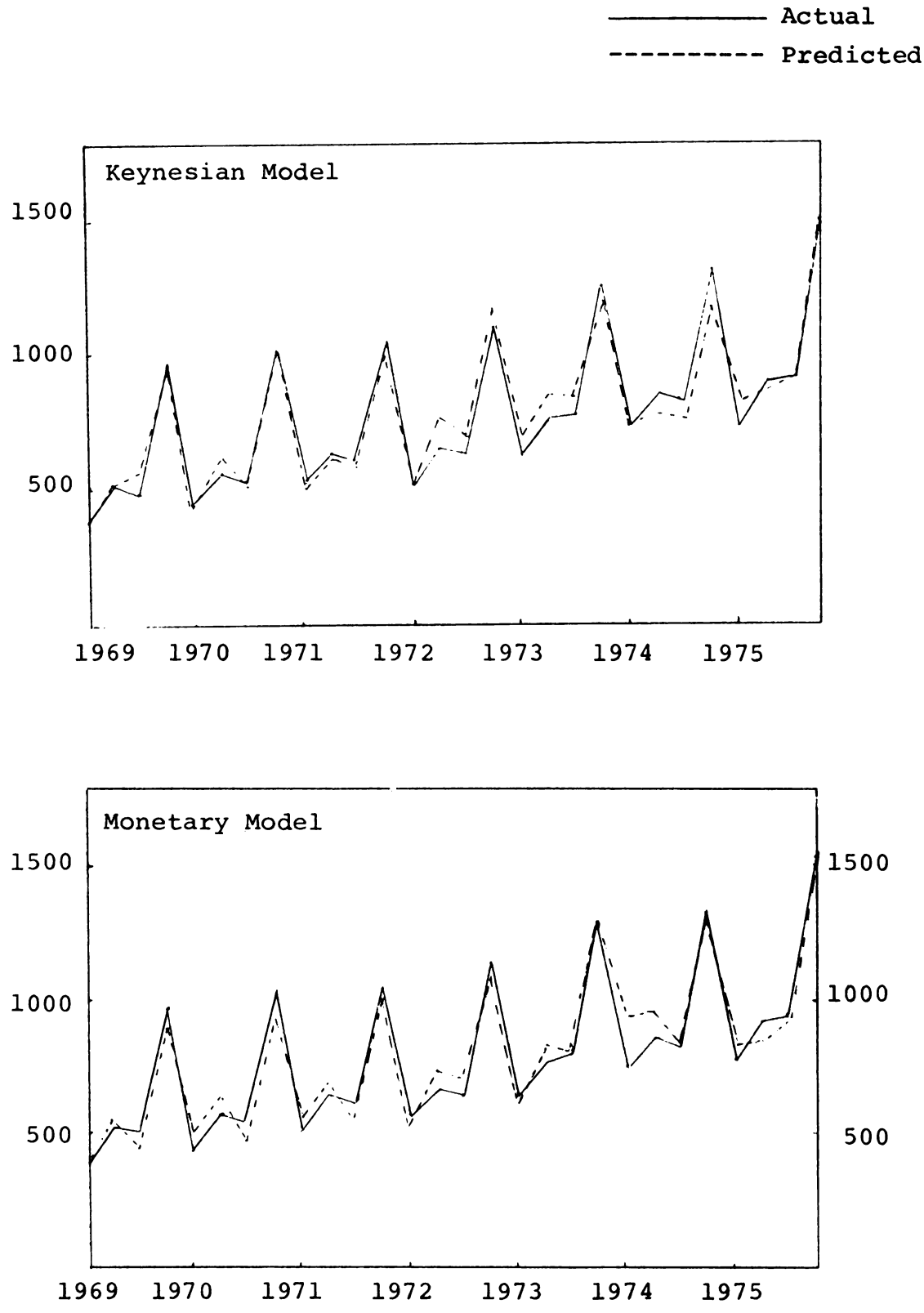


Figure 6-1. One-Period Simulation of Real GNP.

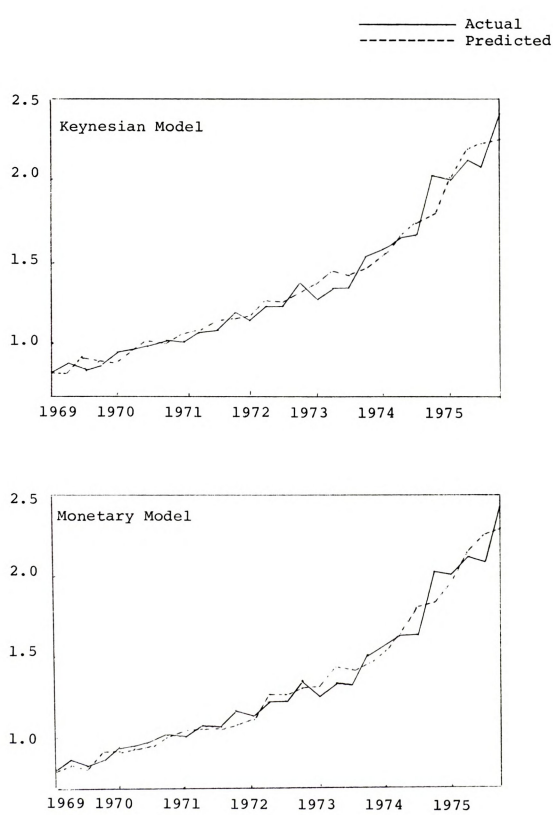


Figure 6-2. One-Period Simulation of Price Level.

Table 6-1.--Error Statistics for One-Period Simulation.

		RMSE	%RMSE	Mean Bias	Directions Correctly Predicted (out of 27)
Real GNP	Keynesian Model	56.09	7.05	-7.13	25
	Monetary Model	51.37	7.54	-4.95	26
Price Level	Keynesian Model	0.080	5.06	-0.0028	21
	Monetary Model	0.075	4.69	0.0038	21

NOTE: RMSE is defined as $\sqrt{\frac{1}{N}\sum_{i=1}^{N}(P-A)_i^2}$

%RMSE is defined as $\sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(\frac{P-A}{A}\right)_i^2 \times 100}$

Mean Bias is defined as $\frac{1}{N}\sum_{i=1}^{N}(P-A)_i$

where N is number of observations

P is predicted value

A is actual value

For price level, the two models' performances are the same in predicting the direction of change. Both predicted 19 out of 20 price increases correctly but two out of seven (two of them very small) price decreases correctly. Both RMSE and % RMSE are smaller in the monetary model.

Dynamic Simulations

As mentioned above, for the dynamic characteristics of a model, we need a dynamic simulation using previously predicted values of lagged endogenous variables in the model. Also, we can expect that any comparison of competing models' performances will be clearer in the use of dynamic simulations. Results of dynamic simulations for the real income and price level are shown in Figures 6-3 and 6-4 and Table 6-2. The period covered is the same as before, 1969II-1975IV.

For real income the Keyensian model performs the same as the monetary model in predicting directions of change. Both models miss two out of twenty-seven. Error statistics, however, show that the Keynesian model slightly outperforms the monetary model since it has lower RMSE and % RMSE.

For price level the monetary model is better than the Keynesian model in correctly predicting turning points as well as in terms of RMSE and % RMSE. The monetary model correctly predicts four turning points out of fourteen;

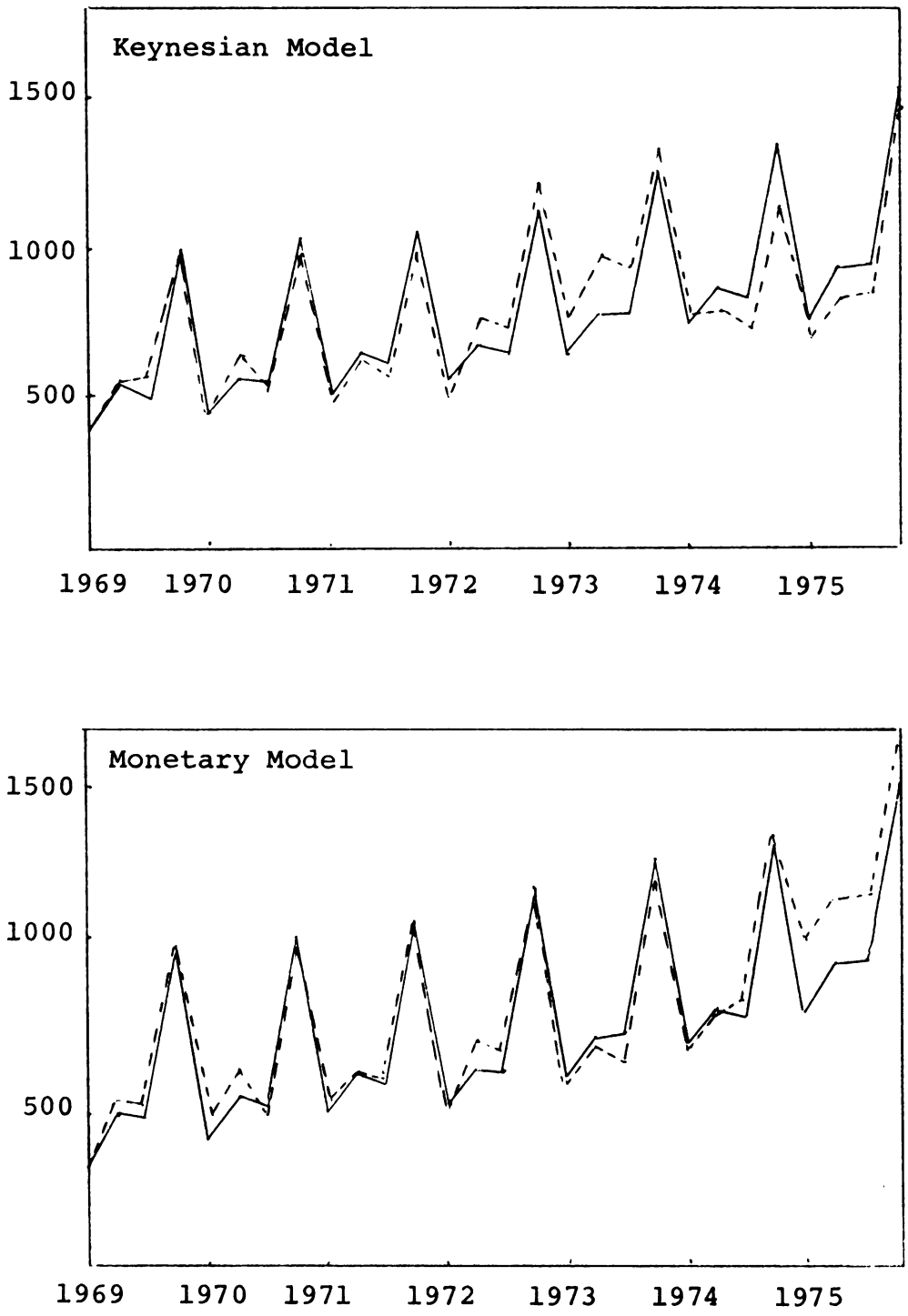
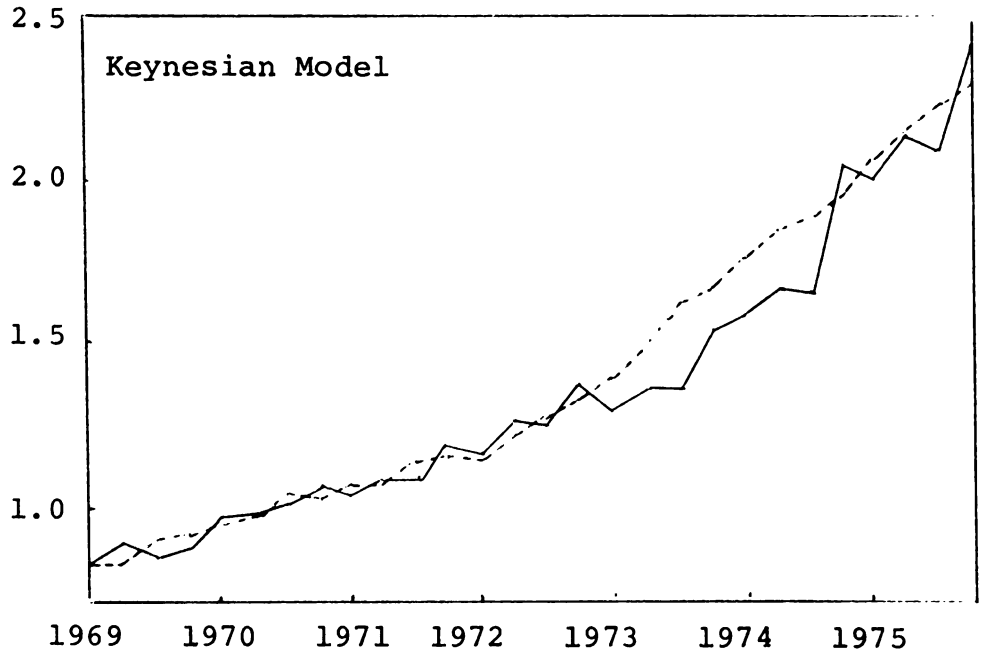


Figure 6-3. Dynamic Simulation of Real GNP.



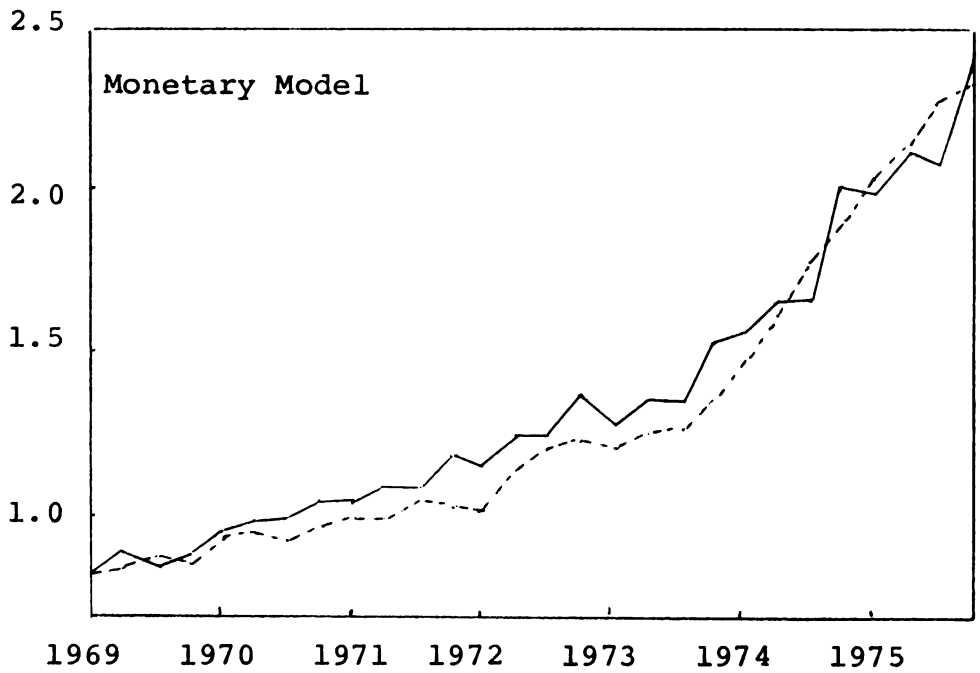


Figure 6-4. Dynamic Simulation of Price Level.

Table 6-2.--Error Statistics for Dynamic Simulations.

		RMSE	%RMSE	Mean Bias	Turning Points Ratio
Real GNP	Keynesian	85.24	10.32	- 1.031	2/22
	Monetary	92.22	11.43	-40.45	2/22
Price	Keynesian	0.108	7.24	- 0.0456	12/14
	Monetary	0.092	6.62	0.0468	10/14

See note for Table 6-1.

Turning Point Ratio is defined as Missed Turning Points over total Turning Points.

the Keynesian model predicts only two correctly. The Keynesian model is especially poor in predicting price decreases. It never predicted a decline in the price level, although there were seven of them. The monetary model predicted two of the seven. Overall, the Keynesian model is better for real income and the monetary model for price level.

Simulation with Exogenous Shocks

Thus far, the actual exogenous variables have been used to see the predictive ability of the two models. In this section, some exogenous shocks are used to see how each model changes its predictions about price, income and trade balance levels with changes in exogenous variables. Tables 6-3 and 6-4 reports the two models' responses in terms of the differences between the control and shocked solutions of dynamic simulations over the period 1969II-1975IV. The two shocks are: (a) real incomes of the U.S. and Japan (in 1969II) increase by 10 percent and keep the same growth rates afterward just as actual real income did, and (b) the wholesale price index of the U.S. and Japan (in 1969II) increases by 10 percent and keep same increase rate afterward as actual price index. Also, the import price index of Korea increases by 6 percent in 1969II (as a result of price increases in the U.S. and Japan) and keeps the same rates of increase thereafter as the actual index.

The results of these simulations should show the effects of the external changes in income and price on the Korean economy. To the increases in U.S.-Japanese real income the Keynesian model responds with higher income and prices and an improved balance of trade as shown in Table 6-3. Higher income in the U.S. and Japan lead to increased export and thus, higher aggregate demand. Increased aggregate demand raises price level. Real income increases reach a peak in one or one and a half years and then increase becomes smaller. The effect on price level peaks in three years and then slowly decreases. The effect on trade balance is almost constant over the period.

The monetary model, on the other hand, depicts lower income, lower prices, and deteriorated trade balance. This is what is expected from the theory of the monetary approach. It says that, if income increases with other things unchanged, demand for money increases and leads to less spending and less imports. Thus, when income in the U.S. and Japan increase, their imports from Korea decrease, lowering the level of the Korean income. This decrease in the balance of trade (capital inflow also declines because of lower income) lowers the foreign component of base money and thus the total money supply in Korea. Price level and also income is lowered through decrease in the excess supply of money. The reason changes in trade balance become positive after one year and then become smaller in either sign, while income and price continue to be less than

Table 6-3.--Effects of a 10 Percent Increase in U.S.-Japanese Real Income.

Quarter	Real GNP		Price		Trade Balance	
	Keynesian	Monetary	Keynesian	Monetary	Keynesian	Monetary
1st	32.4	- 30.7	.013	-.023	12.5	-20.7
2nd	48.3	- 24.0	.035	-.028	17.2	- 8.2
3rd	65.7	- 22.6	.046	-.030	21.7	- 3.1
4th	76.0	- 47.0	.081	-.046	24.2	-16.4
5th	76.0	- 6.8	.106	-.025	24.1	18.1
6th	75.6	- 18.2	.132	-.024	23.7	5.2
7th	65.0	- 24.4	.137	-.021	21.0	- 0.6
8th	64.1	- 10.8	.160	-.014	22.1	9.2
12th	46.9	- 48.0	.193	-.046	21.8	- 7.0
16th	14.2	- 47.8	.179	-.024	17.2	7.5
20th	17.8	- 89.7	.155	-.034	20.9	- 2.1
24th	36.4	-134.5	.152	-.032	21.1	- 3.1

NOTE: All numbers indicate the differences between the solutions of the shocked and controlled dynamic simulations. Real income and trade balance are in 1970-billion won and Price is in index with 1970 = 1.0. Trade balance in both models includes service balance.

controlled solution, is that even if income and price are lower their growth rates can be higher. The trade balance in our monetary approach model depends on the growth rates of these variables. Also, capital imports are continuously less than controlled solution (not shown in the table), and this will more than offset the trade balance effect and will lead to decreased money supply and lower price.

The second experiment with lower U.S.-Japan price levels shows consistent results for the Keynesian model. As shown in Table 6-4, the Keynesian model predicts that both income and price will be higher, when U.S. and Japanese prices increases, because of increases in exports, demand pressure and import prices. Trade balance improves because of increased exports and decreased imports. But, over time, the price increase will also raise export price and lower the relative price of imports. So, the trade balance would not continue to improve. In the model, increasing price lowers the real money balance and will decrease aggregate private spending, and thus the income level. Income levels in the fourth and fifth year are less than income levels in the controlled solution.

For the monetary approach model, the results are not consistent with what is expected from the theory. When there is an initial price increase in the U.S. and Japan, this will tend to cause the Korean trade balance to deteriorate, according to our monetary approach model. But, due to the wrong signs of the price terms in the goods and

Table 6-4.--Effects of a 10 Percent Increase in Prices in the U.S. and Japan and a 6 Percent Increase in Import Prices of Korea.

Quarter	Real GND		Price		Trade Balance	
	Keynesian	Monetary	Keynesian	Monetary	Keynesian	Monetary
1st	18.8	20.1	0.010	0.034	2.5	11.6
2nd	32.0	55.4	0.027	0.077	7.6	27.1
3rd	43.0	51.3	0.038	0.085	10.7	10.2
4th	54.5	43.3	0.065	0.074	13.9	- 4.4
5th	58.8	69.5	0.087	0.089	14.1	8.6
6th	97.1	91.5	0.110	0.109	14.2	13.9
7th	60.2	68.0	0.116	0.092	11.2	-11.6
8th	48.9	93.0	0.136	0.107	12.8	1.4
12th	27.1	178.7	0.166	0.178	10.0	15.2
16th	-12.6	290.7	0.148	0.197	2.7	10.1
20th	-18.5	442.6	0.119	0.224	1.9	3.1
24th	6.5	657.7	0.127	0.239	6.4	14.6

NOTE: See the note on Table 6-3.

service balance equation, there is improved trade balance and increased money supply. Increased money supply, coupled with increased import prices, raises the price index. This higher price may be seen as consistent with the monetary approach's transmission of inflation if we accept the goods arbitrage as a direct link between commodity markets in Korea and the U.S.-Japan. But, this is not the case. In our model it is the combined effects of increases in the money supply and import price that cause inflation. The money supply increases by the capital account too, because of the higher income levels. Changes in income and price and money supply all interact to accelerate growth of each other after the third year.

Summing up the experiments with external shocks, the Keynesian model predicts the changes in Korean income and price as expected, but the monetary models' response to higher U.S.-Japanese price is not consistent with the theory and predicts that Korean price and income would explore according to the model. By itself this should not be taken as a proof against the monetary approach since the experiment just assumed isolated, sudden price increase in the U.S. and Japan and held all other exogenous variables constant, particularly money supply in these countries.

Forecasting Simulation

The simulation experiments above have in common that all the periods used are within the sample period. To

test the models' performance as short-run forecasting tools, the study compares the results of forecasting simulations for the period of 1976I-1976IV, which is outside our sample period. Given the actual exogenous variables up to 1976IV and the actual endogenous variables up to 1975IV, the models provide forecasted values of the endogenous variables.

Figure 6-5 shows the actual and forecasted values of the real GNP and price level produced by the two models. Both models forecasted higher real GNP and price levels than the actual values. The discrepancies in the Keynesian forecast are larger than those in the monetary forecast. For real GNP the monetary model is correct for all direction changes, but the Keynesian model fails to forecast a slight decrease in the third quarter. Both models fail to forecast the slight decrease in price level in the third quarter. There is not a typical pattern of increasing discrepancies between actual and forecasted values as the forecasting period extends further into the future. The discrepancies do not show any trend except that they are positive in all cases. Any general conclusion from this, however, is not possible because of the small number of observations.

The error statistics in Table 6-5 show that the monetary model outperforms the Keynesian model in both the real GNP and price level forecasts. This is a quite different result from those of the within-sample-period simulations. In terms of error statistics, the two models were little different and the Keynesian model was somewhat

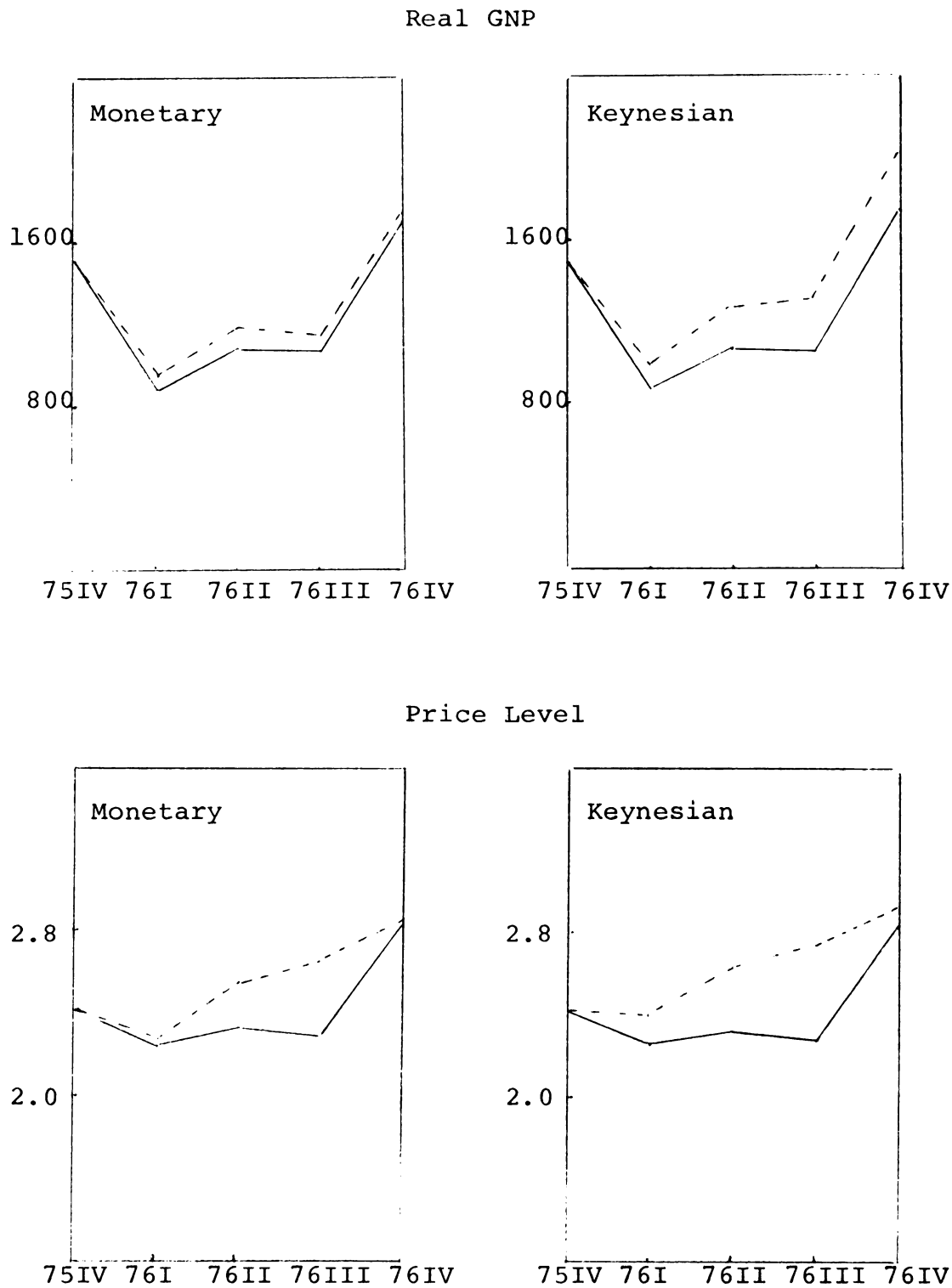


Figure 6-5. Forecasts of 1976 Real GNP and Price Level.

Table 6-5.--Error Statistics of 1976 Forecasts.

		RMSE	% RMSE	Mean Bias
Real GNP	Keynesian	226.1	18.4	-217.2
	Monetary	67.9	5.9	- 65.3
Price Level	Keynesian	0.223	9.2	- 0.187
	Monetary	0.155	6.4	- 0.105

better than the monetary model in real GNP simulations. But there are some substantial differences in the forecasting abilities of the models. The Keynesian model's poor performance is more distinct in the real GNP forecast than in the price level forecast.

Compared to the error statistics of within-sample-period dynamic simulations in Table 6-2, the RMSEs and mean biases in the forecasting simulation are larger. This is partly due to the larger actual values of the variables in 1976 than in the previous years. What is interesting in the comparison is that while the % RMSEs in the Keynesian model increased from 10.32 and 7.24 to 18.4 and 9.2 for real GNP and price level respectively, those in the monetary model decreased from 11.43 and 6.62 to 5.9 and 6.4. Therefore, it is evident that the monetary model's performance in short-run forecasting is comparable to that of within-sample-period predictions.

The most significant conclusion to be drawn from the simulations of the two models is the solid establishment of the monetary approach, as a competing mechanism of transmission, against the traditional Keynesian approach. Past empirical studies of the monetary approach, of course, tested many different implications of the theory. But, most of them were partial equilibrium studies because they neglected the feedback from variables that are simultaneously determined with the included variables but are excluded from the tests. The results from this study are based on simultaneous equation systems and both models were tested with the same set of data. This is the basis of the contention that the monetary model is as competent as the Keynesian model in explaining the transmission of foreign economic fluctuations to a small open economy.

Specifically, the two models' performances in within-sample-period predictions are similar. The Keynesian model is slightly better in real GNP and the monetary model in price level. When arbitrary changes in the foreign countries' economic conditions are introduced, Keynesian model solutions are more consistent than monetary model solutions. When the models are used for forecasting outside of the sample period, the monetary model performs much better than the Keynesian model.

Overall, the results of our simulations indicate that the monetary approach model is valid in explaining the

movements of the Korean economy and deserves more attention from economists and policy makers.

CHAPTER 7

GEOGRAPHIC CONCENTRATION AND THE LINKAGE OF ECONOMIC FLUCTUATIONS

The idea behind the simulation experiments is to look at how a model predicts the behavior of endogenous variables with given information about predetermined variables. Specifically, knowing the actual behavior of endogenous variables, we are interested in comparing predicted behaviors of the variables with the actual behaviors.

Economic fluctuations in the U.S. or Japan are transmitted to Korea through the channels described in our models. In this chapter our main concern is how closely the Korean economy is linked to the U.S. and/or Japanese economy because of the high concentration of Korean foreign transactions with these two countries. The economic fluctuations in the U.S. and Japan will be compared with actual fluctuations in Korea regardless of the predictions of the models.

Export Concentration and Instability: A Review

For a small open economy a stable growth of exports is important both for internal stability and for rapid economic growth. A change in the value of exports will produce a change in the national income in the same direction but in greater proportion, than the change in export value because of the multiplier and accelerator effects. Fluctuations in exports will directly affect the income, employment and capital formation of export industries and, depending on the closeness of linkage, other industries' income and employment will be affected in the same direction. The more severe the fluctuations and the more uncertain the future, the larger will be the damaging effects on the economy. For instance, a high level of uncertainty in future exports would increase the risk of investing in the export industry and this, in turn, would reduce the investment level.

If a country's exports are concentrated in a small number of products (especially primary products) or countries, exports of that country are likely to be unstable because demand for a particular product or demand by a particular country is more unstable than demand for a large variety of products or demand by a large number of countries.

Therefore, the argument goes, a country with a high commodity and/or geographic concentration in its exports

would show considerable instability in its exports and economic growth. In general, the detrimental effects of export instability will be larger in a developing country than in a developed country. In the former, resources will not be moving as well between industries and the monetary or fiscal policies of the government to offset the disturbances will not be as effective as in the latter.

Past empirical studies of export instability were centered on the causes of instability. Coppock (1962) investigated the total exports of 83 countries for the period 1946-58. Calculating a log-variance index of instability[1] of each country's export proceeds and regressing the indices on such variables as foreign trade percentage in GNP, GNP per capita, rate of growth of export proceeds, commodity export concentration index and geographic export

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[1]Coppock's instability index was obtained in this manner:

$$\text{Instability index} = \text{antilog}\left[\frac{1}{N-1}\sum_{t=1}^{N-1}\left(\log\frac{X_{t-1}}{X_t} - m\right)^2\right]^{\frac{1}{2}}$$

where $$m = \frac{1}{N-1}\sum_{t-1}^{N-1}\log\frac{X_{t+1}}{X_t}$$ is the trend difference. This is just an approximation of the average year-to-year percentage variation adjusted for trend. But, notice that the trend is exclusively determined by the first and the last observed values because

$$m = \frac{1}{N-1}\sum_{t=1}^{N-1}\log\frac{X_{t+1}}{X_t} = \frac{1}{N-1}(\log X_N - X_1).$$

concentration index. His findings show, among other things, that instability of export proceeds is very closely related to instability of quantity of exports, instability of value of imports, instability of terms of trade, and growth rate of export. It has very little positive correlation with commodity concentration and a negative correlation with geographic concentration.

This weak correlation between the export instability and the export concentrations is supported by other empirical studies such as Massell (1964), MacBean (1966), Massell (1970) and Kingston (1976). Their results of the weak correlation are similar even though they used different countries, different periods and different instability indices.[2] The degree of concentration is measured by the Gini-Hirschman coefficient of concentration in all the above studies which is equal to $(\Sigma c_i^2)^{\frac{1}{2}}$, where c_i is the proportion of total exports in commodity group i or the proportion of total exports shipped to country i. Therefore, commodity concentration coefficients depend on the degree of disaggregation used for each study.

Massell (1964) studied the data of 36 countries for the period 1948-59, using the standard error of estimate divided by the mean of the observations, and the trend-corrected average annual rate of change from the linear

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[2]An exception is Massell (1970). That study found that the coefficient of commodity concentration is significantly positive at 1 percent.

regression of export earnings on time, as the two measures of instability. MacBean (1966) used the same data Coppock used (82 countries, 1946-58) and his index of instability is the average percentage deviation from a five-year moving average. Massell (1970) used 55 countries, 1950-66, and the standard deviation of the residuals from the trend. Finally Kingston's (1976) data includes 31 countries during the period 1954-67. He used three different measures of instability: the two measures used by Massell (1964) and Massell (1970) and a third one defined as the average percentage deivation from a trend with a constant rate of growth. Kingston's study is different from others in that he was concerned with the geographic concentration only and he used the mean values of geographic concentration coefficients over the entire period while other studies used only one year to compute the coefficients.

The statistically insignificant relationship of primary product and geographic concentrations to the fluctuations of export proceeds implies that efforts to diversify the export products or markets would not result in a marked reduction in fluctuations.

Whether export concentration increases the instability of export earnings or not is a different problem from whether the instability causes damage to the domestic economic stability and to sustained economic growth. It is commonly argued that domestic consumption, investment and government expenditure are affected by export instability

and that its consequences are instability of these variables and retardation of stable growth.

One recent study by Knudson and Parnes (1976), however, argues that the opposite is more plausible, that is, instability has a positive effect on growth. Their argument is based on a permanent income theory of export instability. The permanent income theory states that changes in permanent income only result in changes in consumption, and a change in income that is only transitory does not influence consumption decisions. Hence, a chance in export income that is transitory should not change consumption of people in the export sector and should not affect the demand for domestic goods. If the demand for the domestic goods remains unchanged, the income of the domestic sector should also remain unchanged. Furthermore, higher levels of instability, which mean higher proportions of transitory to permanent income, result in lower propensities to consume and, hence, a higher savings ratio. Greater savings results in increased investment and in greater economic growth.

In Knudson and Parnes' study export instability is measured by the sum of the square of transitory export earnings normalized by permanent export earnings, i.e.,

$$I_E = \sum_{t=1}^{N} \frac{(E_t - E_t^*)^2}{(E_t^*)^2}$$

where E_t and E_t^* represent actual and permanent export earnings respectively. The E_t^* series is generated by the equation

$$E_t^* = (1 + r_E) E_{t-1}^* + \alpha (E_t - E_{t-1}^*)$$

where the initial level of E_t^*, that is E_o^*, and r_E, the rate of growth, are derived from a fitted exponential trend line of export earnings, using the initial expected export earning, as E_o^*. α is the adjustment coefficient and should be assigned a value a priori, which should be less than one and equal to or greater than zero.

Using the same method, Knudson and Parnes derived the domestic income instability and also the weighted average instability of domestic and export incomes. From the data of 28 countries for the period of 1958-68, they regressed the marginal propensities to consume, the percentage of gross domestic investments in gross domestic products, and the growth rates of gross national products on the weighted average of the export and domestic income instabilities. The results show that instability reduces the marginal propensity to consume, raises the percentage investment and has a positive effect on growth of both the real GNP and per capita real GNP.

Fluctuations of Korean Exports, Income and Price

The foregoing review of past studies on export instability reveals that, contrary to a priori reasoning,

export instability is not significantly related to commodity or geographic concentrations and that instability does not damage the prospect of stable economic growth.

However, regarding the relationship between export instability and the domestic economy, only one empirical study was considered and the methodology of the study warrants some doubts as to the results. For instance, it is strange that Knudson and Parnes did not allow any interaction between export and domestic incomes. Any mechanism of transmission shows that domestic income cannot be independent of export income over time. If we cannot separate the instability of domestic income from the instability of export income, then the weighted average instability of Knudson and Parnes is meaningless. At best, it can be only an approximation of the instability of total income.

This section will investigate the degree of instability of the Korean exports, the relationship, if any, between the instability and export concentration on the U.S. and Japan and, lastly, how export instability is related to the instability of GNP.

According to Knudson and Parnes (1976, p. 111) Korea is ranked 4, 4, 5, and 6 out of 28 developing countries in the level of export instability as measured by four different indices.[3] The relevant period was 1958 to

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[3]Those four indices are the transitory income index by Knudson and Parnes, Coppock's log-variance index,

1968. Thus, it is evident that whatever index is used, Korean exports are very unstable in comparison to other countries' exports.

Considering the high geographic concentration of Korean exports, the exports were divided into three groups, exports to the U.S., to Japan, and to the rest of the world. These three groups were then compared for instability over time. The period covered is 1963-75 and quarterly data were used.

The quarterly data were adjusted for seasonal variations using the same method that was used for deriving CAPY series as explained in the appendix of chapter 6. The exponential trend lines were fitted as

$$\log (X_{it}) = a_i + b_i t + \mu_i$$

where X_{it} = seasonally adjusted exports to country i at time t. t = 1, 2 . . . 52, denotes 52 quarters. For the trend, an exponential form was preferred over a linear form because the growth rates, rather than absolute increments of exports, are more relevant to government's and exporters' planning.[4]

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the deviation from a five-year moving average and the deviation from an exponential trend.

[4]The results of ordinary least squares regressions are the following with t statistics in the parentheses:

$$\ln XUS = \underset{(32.09)}{1.795} + \underset{(48.10)}{0.0883}\, t \qquad R^2 = 0.9788$$

Finally, two instability indices of exports are derived from the residuals of the regressions. One is the standard deviation of the residuals and the other is the mean ratio of residuals to actual values. Table 7-1 shows the two instability indices for four groups of exports. The fourth export group is the exports to the U.S. combined with the exports to Japan.

From the table it is evident that, regardless of the measures used for the instability, exports to the U.S. are much more stable than exports to Japan. Exports to Japan and exports to the rest of the world have approximately the same degree of instability. Exports to the U.S. and exports to Japan combined show the least instability.

Therefore, the fact that about two-thirds of Korean exports are directed to two countries should not be the reason for the high instability of exports. The economies of large industrial countries like the U.S. and Japan do not fluctuate wildly and when they do they move in the same direction. Also, for those countries with high geographic

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$$\ln XJ = \underset{(17.81)}{1.454} + \underset{(32.54)}{0.0872}\ t \qquad R^2 = 0.9549$$

$$\ln XW = \underset{(22.52)}{1.774} + \underset{(31.68)}{0.0819}\ t \qquad R^2 = 0.9525$$

The coefficients of t denote the quarterly growth rates since $\frac{d \ln X}{d t} = \frac{1}{X}\frac{dX}{dt}$.

Table 7-1.--Instability Indices of Exports According to Destinations.

	I_{SD}	I_{DR}
XUS	0.1967	0.0452
XJ	0.2871	0.0564
XW	0.2770	0.0618
XUSJ	0.1547	0.0242

Note: $I_{SD} = \sqrt{\frac{\Sigma e^2}{N-1}}$ is the standard deviation of residuals.

$I_{DR} = \sum_{i=1}^{N} (\frac{e}{x})_i / N$ is the average of ratios of residuals to actual values.

where, X = XUS, XJ, XW, XUSJ

e = residuals from $\ln X = a + b\ t$

N = 52

concentration, the largest importers of their products are almost always large industrial countries. This may explain why the empirical studies find the geographic concentration to be an insignificant variable in explaining the instability.

If high geographic concentration is combined with other factors, such as high commodity concentration, then a shift in demand in a large partner country would cause a large fluctuation in exports. But, if the exports are more diversified as they are in Korea, geographic concentration is not likely to imply high export instability. Then, diversification of export markets, in itself, may not contribute to any reduction in export instability.

Of course, the relationship between geographic concentration and export instability should not be confused with the relationship between the exports and the economic conditions in the countries to which most of the exports are directed. As noted in export functions (in chapter 4), Korean exports are closely related to income levels in the U.S. and Japan. As exports are closely linked to other sectors of the economy, then it is a reasonable conclusion that Korean income levels must have close ties with those of the U.S. and Japan.

The larger the proportion of exports in Korean GNP and the larger the proportion of Korean exports in the U.S. and Japanese total imports, the greater will be the correlations between Korean GNP, Korean exports, and the GNP of the U.S. and Japan. This proposition is tested by measuring

the correlation coefficients of these variables in the sub-periods 1964I-1969IV and 1970I-1975IV, using the growth rates of each variable during the preceding four quarters. Korean real exports grew at the rate of 36 percent during the first sub-period and 33 percent during the second sub-period. Because of this unusually rapid growth in exports with approximately the same proportion going to the U.S. and to Japan, Korea's share of these countries' imports and GNP's must have increased. Also, the share of exports in the Korean GNP increased from 13.1 percent in the first to 22.8 percent in the second sub-period when measured in constant 1970 won.

Table 7-2 lists the correlation coefficients between rates of GNP growth and export growth for two sub-periods. All the coefficients in sub-period I are not significantly different from zero at the 5 percent level while those in sub-period II are all significant except that between YDOT and JYDOT. This means that correlations between Korean exports and GNPs in the U.S. and Japan, between the Korean exports and Korean GNP, and between the Korean GNP and GNPs of the U.S. and Japan all become significant only when the proportion of Korean exports in the two countries' imports and in the Korean GNP have increased sufficiently.

If the Korean exports grow at a similar rate and the country composition remains approximately the same in the future, it is expected that Korean GNP will move

Table 7-2.--Correlation Coefficients Between Growth Rates of Real GNPs and Real Exports.

	Sub-Period I (1964 I - 1969 IV)			
	YDOT	RXDOT	USYDOT	JYDOT
YDOT	1			
RXDOT	0.043	1		
USYDOT	-0.307	0.278	1	
JYDOT	-0.084	-0.370	-0.388	1

	Sub-Period II (1970 I - 1975 IV)			
	YDOT	RXDOT	USYDOT	JYDOT
YDOT	1			
RXDOT	0.531*	1		
USYDOT	0.409*	0.866*	1	
JYDOT	0.235	0.557*	0.613*	1

NOTE: * indicates the coefficients are significant at the 5 percent level. YDOT, USYDOT, and JYDOT denote the growth rates of quarterly real GNP over the real GNP four quarters before in Korea, the U.S. and Japan. RXDOT denotes the same growth rates for real exports (value of exports deflated by export price index).

more closely with exports and also with the GNPs in the U.S. and Japan.

The tendency of increasing similarity of Korean economic fluctuations to those of the U.S.-Japan is also evident in the movements of prices. Inflation in the U.S. or Japan caused by income expansion and easing of monetary policies would increase Korean exports to these countries, thus increasing demand pressure and money supply in Korea. It also increases the price of Korean imports from these countries. All these will exert upward pressure on Korean price levels. The pressure will be greater the larger the shares of Korean exports and imports in the Korean GNP and in the imports and exports of the U.S. and Japan.

Table 7-3 shows the simple correlation coefficients between inflation rates in the three countries. In the first sub-period the Korean inflation rates show negative correlations with U.S. and Japanese inflation rates, the correlation with Japanese inflation rates being not significantly different from zero. But, in the second sub-period, both correlations are positive and significant.

These two coefficients in the second sub-period, however, are not significantly different from each other at the 5 percent level, meaning that the Korean inflation rates cannot be said to be more closely tied to the U.S. inflation

Table 7-3.--Simple Correlation Coefficients Between Inflation Rates.

	Sub-Period I		
	PDOT	USPDOT	JPDOT
PDOT	1		
USPDOT	-0.513*	1	
JPDOT	-0.104	-0.048	1

	Sub-Period II		
	PDOT	USPDOT	JPDOT
PDOT	1		
USPDOT	0.789*	1	
JPDOT	0.476*	0.751*	1

NOTE: * indicates that the coefficients are significant at the 5 percent level.

PDOT, USPDOT, and JPDOT denote the inflation rates of Korea, the U.S., and Japan measured as the percentage increases in GNP deflators during the previous four quarters.

rates than they are to the Japanese inflation rates during the same period.[5]

In summary, correlations investigated in this section--the growth rates of real exports, the real GNPs of Korea, the U.S., and Japan; inflation rates of Korea, the U.S. and Japan--are all insignificant or negative in the first sub-period but they all become positive and significant (except one) in the second sub-period. This means that as the proportions of the exports and imports in the Korean real GNP, and in the U.S. and Japanese imports and exports become larger, the Korean real GNP and price levels move more in line with the real GNPs and price levels in the U.S. and Japan. Among the two countries, however, the seemingly closer tie with the U.S. than with Japan is not supported by the test.

The foregoing observations do not enable us to conclude that reduction in the dispersions of the growth rates of real GNP and price level in Korea with the rates of its two large trading partners necessarily means an increase in international transmission of economic fluctuations from the two countries to Korea. It is also possible, as Salant (1976) argues, that such non-market forces as common policy responses to common causes,

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[5]Test of the significance of the difference between two observed correlations is from the logarithmic transformation of correlation coefficients due to R. A. Fisher. See Mills (1955, pp. 297-311).

convergence in rates of productivity growth, institutional and structural changes, and supranational monetary developments could generate a synchronized expansion and inflation in many countries. So, the extent to which an increase in transmission explains the reduced dispersions of economic changes is very difficult to identify.

CHAPTER 8

EFFECTS OF THE FLOATING EXCHANGE RATE SYSTEM ON THE TRADE OF KOREA

Since the breakdown of the Bretton Woods system in February 1973 the industrial countries, including the U.S. and Japan, have adopted a floating exchange rate system. Most developing countries, on the other hand, kept their currencies pegged to a single intervention currency--the U.S. dollar or the British pound or the French franc. Some other developing countries, however, chose to float independently or to peg to a basket of currencies.

Variations of Exchange Rate and Uncertainty

The general attitude to the developing countries in favor of pegging to a single currency is manifested by the fact that, as of June 30, 1975, 79 developing countries of 99 surveyed were pegging their currencies to a single currency and only 20 were either floating independently or pegging to a basket of currencies or the SDR (Crockett and Nsouli, 1977).

Theoretical arguments for the single currency peg include: (1) pegging to the currency of a major trading

partner reduces the uncertainties associated with changes in relative currency values, thus increasing trade and capital flows between the two countries, and (2) to the extent that the exchange rate of the major trading partner is more stable vis-a-vis the rest of the world than the exchange rate of the small country would have been without pegging, it will stimulate trade with the rest of the world by reducing uncertainties.[1]

Therefore, the central issue at hand is the uncertainty involved in fluctuating exchange rates. Trade and financial transactions of a developing country pegging its currency to the currency of its major trading partner would be biased toward the major trading partner and the transmission of economic fluctuations from the major partner to the small country would become stronger and faster. This is so not only because the trade between the two countries increases but also because the exchange rates of the small country currency vis-a-vis the other key currencies would now fluctuate in the same way as the exchange rates of the major partner currency vis-a-vis the other key currencies.

The Korean won has remained pegged to the U.S. dollar. Therefore the value of won vis-a-vis the Japanese yen has varied frequently since 1973, while the won-dollar

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[1]See Diaz-Alejandro (1975) and Crockett and Nsouli (1977) for various advantages and disadvantages of alternative exchange rate systems open to developing countries in the world of floating exchange rates among industrial countries.

exchange rate has changed only once. Considering that Korea trades as much with Japan as it does with the U.S., it is worthwhile to investigate the impact on Korean trade with Japan of pegging won to the dollar since the general floating of key currencies. Particularly, there is a concern about the uncertainty of varying won-yen exchange rates and whether this caused any reduction of Korean exports to Japan and, thus, any bias against trade with Japan.

Before 1973, under the fixed exchange rate system, the won-yen rate was not perpetually fixed. That rate changes whenever exchange rates between the won and the dollar or the yen and the dollar changed. Those changes were infrequent and large compared to frequent, small changes after 1973. Therefore, there is a measurement problem of uncertainty about the exchange rate changes. The time span used for measuring will influence the size of variability. For instance, daily exchange rates could fluctuate severely and yet remain stable on a monthly or yearly basis. But day-to-day movements of the exchange rate are not so relevant to the decision-making of exporters and importers as monthly or quarterly movements.

We chose quarterly exchange rates of won to yen to compare the variability during 1963I-1973I and 1973II-1976IV. The means, standard deviations and coefficients of variations of the rate are shown in Table 8-1. The table indicates that the actual exchange rate varied less under

Table 8-1.--Coefficients of Variations in the Won-Yen Exchange Rate.

	63I-73I	69III-73I	73II-76IV
Mean	0.804	1.038	1.539
Standard Deviation	0.250	0.206	0.108
Coefficient of Variation	0.311	0.198	0.070

NOTE: Coefficient of Variation = $\frac{\text{standard deviation}}{\text{mean}}$

the floating rate system than under the fixed rate system. This result is similar to Cline's (1976, p. 17) comparison of exchange rates of major currencies before and after the general floating. Cline, however, compared the variability of exchange rates between currencies that have been floating against each other while this study compared the variability of the exchange rate between one currency which has been tied to the dollar all the way and one currency which has been floating against the dollar since February 1973. Another difference is that Cline used the spot rates at the end of each quarter (1959I-1975I) and this study used the average rate for each quarter (1963I-1976IV). Even if another period for the fixed rate system is chosen, 15 quarters immediately preceeding the general float (69III-73I), the result remains the same (see Table 8-1).

This leads to the conclusion that the won-yen exchange rate, contrary to general expectation, has been more stable under the floating system than under the fixed

system. This does not mean, however, that the level of uncertainty about the exchange rate is less under the floating system as Cline implies. Ex-post less uncertainty is not so meaningful if the people involved in trade feel more uncertain about the future.

Uncertainty and the Level of Trade

Although it is not possible to measure uncertainty actually felt by people under different exchange rate systems, the effects of uncertainty can be tested indirectly. If differences in uncertainty actually exist under different exchange rate systems, and given that uncertainty works toward reducing the level of trade (by risk aversion), then there will be a downward bias in observed trade levels.

Assuming that Korean exports to Japan are determined by relative prices and Japanese income level and that there has been no major development to shift Japanese demand for Korean exports since March 1973 (other than the floating of yen vis-a-vis the dollar), the coefficients of the export equation estimated for 1963I-1973I period were fitted to the actual values of post-1973I relative prices and Japanese incomes. If there actually was a downward bias in exports to Japan the residuals (i.e., the fitted value less the actual value) should tend to be positive and significantly larger than the residuals of 1963I-1973I period.

Exports to the U.S. after the floating, on the other hand, would be affected by upward pressure from a shift of exporters' preferences away from the Japanese market to the U.S. market induced by a relatively more stable dollar-won exchange rate. This will increase exports above the level predicted by relative price and income changes, leaving the residuals negative and significantly smaller than the residuals of the 1963I-1973I period.

But observations of post-1973I exports do not agree with these expectations. Exports to Japan did not shift downward and exports to the U.S. did not shift upward. This is illustrated in Table 8-2. Mean residuals and mean percent residuals for exports to Japan are both negative, contradicting the expectations of positive values. Also, the same residuals for exports to the U.S. show the wrong signs (positive instead of negative).

As an alternative method of testing the uncertainty argument, we can use dummy variables in export equations for the period of yen floating. Then, test to see if the dummy variable coefficient is significant and negative for exports to Japan and positive for exports to the U.S., when the equations are estimated for the whole period of 1963I-1976 IV.

The results of this experiment are the same as the results seen above. The coefficient of the dummy variable for exports to Japan is positive, in contrast to expectations, and the coefficient for exports to the U.S. is

Table 8-2.--Analyses of Differences Between Predicted and Actual Exports to Japan and to the U.S. for the Period 1973II-1976IV.

	Mean Residuals	Mean Percent Residuals
Exports to Japan	-0.347	-6.78%
Exports to the U.S.	0.006	0.73%

NOTE: Estimated equations from the samples of 1963I-1973I using ordinary least squares are

$$\underset{}{\ln XJ} = \underset{(7.14)}{-8.456} - \underset{(3.27)}{1.378}\ \ln RPXJ + \underset{(7.69)}{2.211}\ \ln JY + \underset{(2.12)}{0.190}\ \ln XJ_{-1}$$

$$R^2 = .955 \qquad DW = 2.21$$

$$\underset{}{\ln XUS} = \underset{(6.90)}{-52.364} - \underset{(2.46)}{1.518}\ \ln RPXUS + \underset{(6.98)}{8.133}\ \ln USY + \underset{(1.50)}{0.158}\ \ln XUS_{-1}$$

$$R^2 = .967 \qquad DW = 1.58$$

positive, as expected, but is not significantly different from zero.[2] This means that, if the floating yen vis-a-vis the dollar had any effect on Korean exports, it worked toward increasing exports to Japan and leaving exports to the U.S. uninfluenced. When the same methods are used to measure the impact of the floating yen on Korean imports from Japan and from the U.S., the mean percent residuals are -5.07 percent and -8.74 percent respectively. The coefficient of the dummy variable is 0.324 and 0.486 and both are significantly different from zero. This means that imports from both countries are shifted upward after the yen floating vis-a-vis the dollar. Increased imports from Japan contradict the uncertainty hypothesis although larger increases in imports from the U.S. than increases in imports from Japan can be used to support the hypothesis.

It is very hard to tell whether this is because uncertainty under the floating system was less than uncertainty under fixed system, as the actual fluctuations of

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[2]Equations, with dummy variables and for the period of 1963I-1976IV are

$$\ln XJ = \underset{(7.02)}{-7.613} \underset{(3.16)}{-1.235 \ln RPXJ} + \underset{(7.61)}{1.999 \ln JY} + \underset{(3.23)}{0.261 \ln XJ_{-1}} + \underset{(2.87)}{0.322D}$$

$$R^2 = .978 \qquad DW = 1.96$$

$$\ln XUS = \underset{(7.20)}{-49.79} \underset{(3.35)}{-1.592 \ln RPXUS} + \underset{(7.30)}{7.739 \ln USY} + \underset{(1.99)}{0.191 \ln XUS_{-1}} + \underset{(0.10)}{0.008D}$$

$$R^2 = .975 \qquad DW = 1.53$$

where D is one for 1973II-1976IV and zero otherwise.

of won-yen rate show or whether it is just because uncertainty under any exchange rate system does not much affect the trade between countries. Or, it can result from the pricing behavior of exporters who try to maintain stable prices in the importing country's currency as the exchange rate moves from quarter to quarter. As large industrial firms normally avoid changing domestic prices constantly in response to short-term variations in market conditions, large exporters may not react to what they see as transitory change in the exchange rate, partly because of importer's preferences. See Dunn (1973).

Therefore, at least in the case of Korea, pegging to the dollar under a floating rate system does not affect the trade with Japan or the U.S. Transmission of economic fluctuations in the two countries to Korea through trade would not change in its nature and extent because of the different exchange rate system. Capital movements, however, would be more dependent on whether the yen-dollar rate is fixed or fluctuating. Short-term capital inflow into Korea would be especially likely to shift from the stronger currency to the weaker of the two. But long-term capital movements are not so dependent on quarterly, or even yearly, changes in the yen-dollar rate. Unfortunately, this cannot be tested, because data are not available.

The main reason that many developing countries choose to peg their currencies to one of the major currencies may not be to reduce uncertainty and increase

trade with their major partners as is generally believed. It may be just to keep the management of the foreign exchange as simple as possible in the complex world of day-to-day changes in the values of major currencies. By controlling only one exchange rate, policy-makers in the developing countries can more easily achieve their targets in external transactions.

CHAPTER 9

SUMMARY AND CONCLUSIONS

Economic activity in an open economy is linked to the economies of the foreign countries. The impact of changes in outside economic conditions on a small open economy would depend on many things: degree of openness, size of the economy, stage of development, trading partners, commodity compositions of trade, and effectiveness of stabilizing policies.

Two alternative transmission mechanisms (the Keynesian and the monetary approaches) are adapted in this study for the purpose of building simultaneous equation models to be used to investigate the process of transmission of economic fluctuations from trading partners (the U.S. and Japan) to a small open economy (Korea). The Keynesian approach model is based on the traditional export and import functions with relative prices and income levels as key variables. An increase in exports would raise income level by a multiple of the original increase in exports, while imports are regarded as leakage from an income stream. The monetary approach model is based on the stable demand for

money and money supply which is influenced by the overall balance of payments. A temporary excess demand or excess supply of money is supposed to change spending by the holders of money, hence influencing balance of payments positions.

Any model that follows the strict assumptions of the monetary approach, such as the full employment and the one-world-price, cannot be useful for the analysis of short-run fluctuations in real income and price levels. Also, a rigid price assumption in the Keynesian model must be replaced by a price level influenced by other variables.

By building two alternative models using the same country's data over the same period, we not only can investigate the different mechanisms through which the country is influenced by foreign economic changes, but also can test the actual performance of the two competing approaches.

Each of the structural equations in both models is fairly satisfactory in terms of signs and significance of coefficients and overall fitness. But, the comparison of the performance of different models should be based on the "solution" of the endogenous variables that a model generates once we have individual equation estimations that agree with the models' assumptions.

Growth of real income and inflation in Korea are the two variables that the models intended to explain by using changes in real income, price, interest rate and

money supply in the U.S. and Japan. Tests of the models, based on the predicted and actual movements of these variables over time, show that the two models are very close in their overall performances, the Keynesian model being a little better in explaining real income changes and the monetary approach model outperforming the Keynesian model in explaining inflation. When the two models are used for short-run forecasting outside the observation period, the monetary approach model is more accurate for both real income and price level, as well as the current account balance.

Therefore, one significant result of the study is the firm establishment of the monetary approach as a useful model of explaining the transmission of economic fluctuations for a small open economy. Until now, most of the claims of the monetary approach, as a device explaining a balance of payments position or inflation, were based on empirical tests of partial equilibrium models. In this study, empirical tests are conducted through an economy-wide model, in comparison with a competing model. Although this study did not attempt to provide any comparison of the effectiveness of various policies (monetary, fiscal, or exchange rate), the models presented in the study can be used to test the effects of domestic policies on real GNP and price levels.

Since the proportion of trade with the U.S. and Japan in Korean foreign trade has been so large over the

whole period, the study attempted to show how fluctuations in the Korean economy synchronize with those in the U.S. and Japanese economies. In terms of the rates of changes in real income and price, the Korean economy is found to be more closely related to the U.S. and Japanese economies as the proportion of Korean exports to Korean income, and to the total imports of the U.S. and Japan are getting larger. However, a high concentration of exports to the U.S. and Japan is not established as a cause of the high level of instability in Korean exports.

The general floating of the industrial countries' currencies after the breakdown of the Bretton Woods system left many developing countries with the problem of choosing the best exchange rate system. Korea opted to stay with pegging the won to the dollar, thus letting the won-yen exchange rate fluctuate at the same rate as the dollar-yen rate fluctuated. The question raised here is whether this affects Korean trade with the U.S. and Japan and, if so, whether any change occurs in the relative importance of the U.S. and Japan in explaining the Korean economic fluctuations.

Investigation of Korean exports to these two countries does not show any bias of the exports against Japan or toward the U.S. in the post-Bretton Woods period. In the case of imports some bias toward imports from the U.S. is observed but no bias against imports from Japan is found. This result discredits the most common argument that

pegging to the currency of the major trading partner reduces uncertainty about future exchange rate and so increases trade between the two countries. The implication is that the change in the exchange rate system did not produce any significant change in the transmission process from the U.S. and Japan.

One important policy implication of the study is that the economic conditions in the U.S. and Japan should be more closely watched to facilitate future stabilization policies in Korea. As the size of the foreign sector and the Korean share in the imports of the U.S. and Japan increase, the transmission of inflation or economic growth becomes faster and stronger. Diversification of export markets for the purpose of decreasing the instability in exports, however, is not justified.

Another implication is that monetary consequences of the balance of payments deficits or surpluses should be considered more carefully. Since the transmission mechanism by the monetary approach is as well applied to the Korean economy as the traditional mechanism by the Keynesian approach, more attention to the monetary market situations in Korea as well as in the U.S. and Japan is required for examining the future movements of the Korean economy.

Also, in exchange rate policy, as far as the choice between the pegging to one currency or a basket of currencies or floating is concerned, the stability or certainty argument should not be weighted as much as the interference

with the internal policy objectives, the need for reserves, debt management, or the functioning of foreign exchange market.

Some limitations of the study, however, should be noted. First, the two models presented in the study are very simple in terms of the numbers of equations and the variables used in them. Second, especially in the monetary approach model, model adaptations for the study may raise some questions regarding comparison with the Keynesian approach model in the sense that it does not represent the pure monetary approach. Finally, it should be acknowledged that any conclusions derived from the study relate only to the Korean economy. Further empirical studies including other countries and longer periods are necessary for more general conclusions.

APPENDIX

THE NUMERICAL DATA

APPENDIX

THE NUMERICAL DATA

(For the explanations and sources of the variables, see the last sections of chapters 4 and 5.)

		Y	R	MO	XUS	XJ	XW	X	MUS	MJ	M
1963	I	225.4	9.0	40.1	4.4	3.8	7.7	15.9	61.0	37.9	118.5
	II	276.7	"	40.2	8.0	6.1	8.5	22.6	75.4	52.8	157.2
	III	227.0	"	44.8	6.7	8.3	10.9	25.9	77.3	34.4	149.5
	IV	599.3	"	41.9	5.2	6.6	10.7	22.5	65.3	36.5	135.1
1964	I	217.6	"	43.2	5.8	5.7	8.2	19.7	53.4	19.8	99.3
	II	288.8	"	45.1	10.3	10.2	12.3	32.8	46.8	32.4	100.9
	III	249.7	"	48.1	10.0	10.1	10.8	30.9	40.7	23.9	95.6
	IV	685.8	"	48.9	9.5	12.1	14.0	35.6	51.6	34.2	108.2
1965	I	236.4	"	50.9	9.3	7.4	10.4	27.1	36.5	28.7	84.8
	II	326.4	"	56.1	15.3	12.0	16.1	43.4	41.0	46.4	110.0
	III	274.9	18.0	61.6	19.4	11.4	19.0	49.8	48.2	48.1	122.9
	IV	692.0	"	65.6	17.8	13.1	23.9	54.8	56.6	43.4	145.8
1966	I	260.4	"	68.3	17.7	15.5	17.8	51.0	47.1	47.6	128.9
	II	389.7	"	71.8	25.9	14.1	25.6	65.6	71.7	64.6	170.9
	III	310.1	"	78.2	26.9	16.6	19.9	63.4	39.4	82.2	159.7
	IV	759.0	"	85.1	25.3	20.2	24.9	70.4	95.4	99.4	256.9
1967	I	302.2	"	91.8	24.8	16.1	19.9	60.8	67.5	91.5	199.1
	II	403.5	"	101.2	33.8	21.7	23.2	78.7	57.5	93.4	211.9
	III	368.6	"	109.0	32.8	22.1	22.4	77.3	76.8	107.9	242.9
	IV	778.8	"	123.0	46.0	24.8	32.6	103.4	103.3	150.2	342.3
1968	I	338.2	"	154.4	42.3	19.9	21.1	83.3	108.8	111.2	296.2
	II	468.3	15.6	160.8	59.3	29.2	30.5	119.0	113.7	161.4	355.0
	III	428.7	"	166.3	61.1	22.4	33.5	117.0	99.0	166.8	349.5
	IV	851.9	14.4	177.9	72.6	28.2	35.3	136.1	130.8	184.8	467.5
1969	I	391.1	"	184.4	58.9	20.1	29.8	108.8	93.7	151.0	344.4
	II	520.8	12.0	191.4	91.7	32.5	41.2	165.4	113.3	186.4	441.0
	III	497.8	"	222.3	81.0	34.2	41.8	157.0	143.7	232.2	533.8
	IV	990.8	"	252.0	80.6	46.5	64.1	191.2	179.5	184.2	514.3
1970	I	431.3	"	239.7	75.5	45.8	42.5	163.8	121.4	160.0	422.6
	II	579.2	"	253.8	110.4	48.2	50.6	209.2	132.5	187.2	450.7
	III	547.1	"	279.2	103.8	62.2	54.2	220.2	136.9	183.2	466.2
	IV	1031.7	"	307.6	105.5	78.2	58.3	242.0	194.1	278.9	644.4
1971	I	503.8	"	296.8	97.3	48.7	52.5	198.5	150.1	203.5	509.4
	II	650.2	10.2	300.1	157.6	51.8	61.8	271.2	224.4	246.4	659.6
	III	605.4	"	342.6	134.5	71.4	68.2	274.1	161.2	250.2	639.0
	IV	1067.0	"	360.8	142.4	90.1	91.4	323.9	142.5	253.7	586.1
1972	I	538.4	8.4	356.5	128.0	74.8	76.8	279.6	131.9	200.7	509.5
	II	678.1	"	382.4	194.9	81.9	106.9	383.7	192.5	246.5	659.1
	III	655.4	6.0	468.2	214.6	113.2	123.3	451.1	179.1	268.7	647.0
	IV	1151.3	"	519.4	221.5	138.0	150.1	509.6	144.4	315.3	706.3
1973	I	639.2	"	568.4	226.0	176.9	122.5	525.4	234.6	304.2	770.2
	II	779.2	"	597.7	276.3	276.6	162.5	715.4	341.2	427.8	1120.3
	III	795.4	"	653.9	255.1	368.8	243.1	867.0	297.0	465.9	1098.0
	IV	1294.0	"	730.3	280.3	458.5	353.5	1092.3	329.9	534.4	1230.1
1974	I	741.6	12.0	751.7	271.2	406.1	328.1	1005.5	375.7	531.3	1434.1
	II	872.9	"	730.7	425.6	385.8	436.7	1248.1	467.0	694.2	1841.2
	III	841.5	"	885.1	467.3	323.8	379.7	1170.8	452.6	683.6	1802.0
	IV	1355.0	"	945.7	328.1	264.5	443.4	1036.0	405.4	711.5	1774.6
1975	I	765.0	15.0	915.8	242.6	240.9	402.8	886.3	504.8	663.6	1880.4
	II	916.1	"	928.4	345.0	285.0	530.2	1160.2	515.9	661.2	1959.3
	III	924.4	12.6	1072.7	447.9	340.2	534.2	1322.3	363.3	496.7	1487.7
	IV	1524.6	"	1181.7	483.8	377.1	718.4	1579.3	497.1	612.1	1947.1
1976	I	885.3	"	1214.4	485.8	356.8	580.9	1423.5	405.6	620.7	1803.9
	II	1082.4	"	1258.3	679.4	437.3	874.0	1990.7	488.5	829.4	2201.2
	III	1079.4	15.0	1327.5	705.9	496.7	891.7	2094.3	482.9	877.4	2473.9
	IV	1718.4	"	1544.0	621.5	510.7	1075.7	2206.8	585.9	771.4	2294.7

		EXR	EXRIN	PX	PM	P	K	AID	S	PXC	G
1963	I	130	.419	.808	.976	.327	68.9	52.2	3.9	.896	68.9
	II	"	"	.804	.978	.374	71.2	65.2	35.9	.956	49.1
	III	"	"	.803	.985	.360	98.5	60.1	21.0	.981	55.7
	IV	"	"	.815	.980	.383	126.8	55.1	10.0	.965	44.4
1964	I	"	"	.805	.972	.413	61.3	40.0	19.0	1.007	62.3
	II	193	.622	.814	.990	.551	56.9	32.6	10.5	.966	40.3
	III	256	.825	.838	1.000	.448	46.5	32.6	11.9	.957	49.1
	IV	"	"	.822	1.002	.495	61.0	37.5	19.8	.917	69.5
1965	I	"	"	.868	1.019	.500	42.3	29.8	3.7	.893	60.0
	II	265	.854	.841	1.007	.544	43.2	33.2	16.6	.904	45.0
	III	272	.876	.849	.987	.526	49.9	39.4	32.1	.881	60.7
	IV	"	"	.873	.998	.526	68.5	33.0	42.0	.888	66.7
1966	I	"	"	.918	.993	.597	76.8	28.9	12.9	.915	77.3
	II	271	.873	.933	.991	.618	90.1	35.7	27.3	.907	54.6
	III	"	"	.927	.979	.617	102.0	20.4	24.3	.896	55.6
	IV	"	"	.962	1.022	.586	153.0	58.7	78.5	.919	82.5
1967	I	270	.870	.968	.989	.655	114.3	34.9	53.3	.911	69.6
	II	"	"	.963	1.000	.717	87.7	19.2	77.2	.911	66.5
	III	"	"	.978	1.002	.680	163.4	29.8	.6	.938	77.4
	IV	272	.876	.994	.979	.683	162.9	35.2	127.9	.951	85.5
1968	I	275	.886	1.008	.966	.751	176.9	26.3	56.9	.938	107.3
	II	"	"	.999	.966	.784	157.1	23.7	81.0	.939	65.2
	III	276	.889	1.011	.979	.766	167.1	32.7	47.5	.933	99.8
	IV	281	.905	1.013	.986	.761	198.9	43.0	161.4	.922	95.1
1969	I	282	.908	.974	.944	.825	151.4	30.8	69.6	.952	112.7
	II	284	.915	.959	.954	.886	241.7	26.1	69.0	.946	100.4
	III	287	.925	.966	.962	.854	341.3	30.1	145.8	.949	119.2
	IV	299	.963	.940	.965	.880	221.4	33.5	122.1	.993	125.4
1970	I	304	.980	.964	.968	.957	189.3	22.1	70.8	1.006	105.6
	II	310	.999	1.004	.987	.980	219.8	23.8	69.5	.996	118.1
	III	312	1.005	1.015	.980	.999	213.2	28.3	49.0	.996	116.8
	IV	315	1.015	1.013	1.047	1.029	236.5	86.9	157.4	.986	110.4
1971	I	319	1.028	.990	.995	1.025	182.4	15.0	88.9	.994	120.4
	II	327	1.053	.994	1.005	1.082	309.3	29.8	90.4	.997	118.2
	III	371	1.195	.985	.992	1.091	282.6	27.5	72.9	.987	123.9
	IV	"	"	.989	1.002	1.191	205.0	33.1	56.2	.999	130.1
1972	I	379	1.221	.989	1.014	1.155	201.8	4.9	39.9	1.019	124.1
	II	394	1.269	1.002	1.008	1.240	179.9	4.9	123.4	1.014	144.3
	III	399	1.285	1.027	1.024	1.238	185.0	7.9	85.9	1.017	134.4
	IV	"	"	1.006	1.033	1.377	142.0	3.9	108.7	1.035	135.1
1973	I	"	"	1.073	1.118	1.284	164.8	-	103.8	1.132	143.4
	II	"	"	1.207	1.283	1.341	383.8	-	159.9	1.281	119.1
	III	"	"	1.284	1.381	1.346	226.4	-	137.0	1.392	133.7
	IV	398	1.281	1.403	1.580	1.518	87.2	-	110.8	1.484	129.8
1974	I	399	1.285	1.569	1.866	1.579	364.7	-	.5	1.706	160.0
	II	"	"	1.647	2.138	1.652	555.2	-	51.6	1.945	96.7
	III	"	"	1.614	2.195	1.657	569.2	-	32.5	1.969	133.2
	IV	427	1.377	1.568	2.226	2.021	717.3	-	61.8	2.095	144.1
1975	I	484	1.559	1.566	2.319	1.999	742.7	-	82.7	1.914	205.6
	II	"	"	1.480	2.224	2.110	992.9	-	16.5	1.736	137.2
	III	"	"	1.439	2.098	2.086	288.0	-	51.1	1.544	153.6
	IV	"	"	1.498	2.037	2.420	584.4	-	62.5	1.519	185.7
1976	I	"	"	1.565	2.065	2.363	566.1	-	-33.4	1.589	179.0
	II	"	"	1.637	2.096	2.427	523.9	-	28.2	1.589	176.0
	III	"	"	1.682	2.139	2.396	390.6	-	319.1	1.661	159.6
	IV	"	"	1.722	2.182	2.815	451.0	-	223.3	1.709	276.8

		CB	DB	FB	m	RRD	RRT	CAPY	USY	USWPI	USR
1963	I	-98.7	20.9	5.6	1.513	20.0	10.0	225.4	743.8	.855	2.92
	II	-98.7	25.2	2.0	1.478	"	"	308.6	752.8	.854	2.98
	III	-102.6	27.5	1.4	1.550	"	"	274.5	766.9	.857	3.41
	IV	-102.6	23.3	4.6	1.502	"	"	632.9	773.6	.858	3.52
1964	I	-57.6	18.8	5.1	1.808	"	"	262.2	786.9	.859	3.53
	II	-57.6	21.7	4.9	1.695	12.0	"	357.0	797.5	.855	3.48
	III	-52.8	25.7	3.3	1.659	"	"	315.9	804.6	.858	3.56
	IV	-52.8	27.3	5.4	1.495	"	"	724.8	807.5	.860	3.86
1965	I	-54	26.7	2.4	1.749	"	"	299.0	825.6	.865	3.92
	II	-50	32.2	0.6	1.710	"	"	405.4	836.9	.872	3.78
	III	-41	35.3	3.0	1.608	16.0	"	357.3	851.8	.878	3.98
	IV	-49	40.1	8.3	1.355	20.0	"	816.9	870.9	.884	4.46
1966	I	-65	31.5	11.6	1.585	35.0	15.0	335.7	886.1	.898	4.56
	II	-78	35.5	14.8	1.427	"	"	453.8	892.1	.902	4.44
	III	-72	37.1	23.0	1.301	"	"	398.8	901.4	.912	5.50
	IV	-108	45.0	35.2	1.061	"	"	908.9	907.9	.905	4.75
1967	I	-85	38.2	43.1	1.129	"	"	372.6	908.3	.905	4.15
	II	-56	45.1	51.6	1.047	"	"	502.2	914.8	.903	3.46
	III	-165	49.5	51.2	1.082	"	18.0	440.2	926.3	.907	4.63
	IV	-111	45.6	65.3	1.109	"	"	1001.0	933.5	.908	4.99
1968	I	-156	44.9	71.1	1.331	32.0	"	409.3	942.9	.921	5.19
	II	-155	64.7	71.7	1.179	"	"	550.6	959.7	.927	5.24
	III	-185	78.4	66.9	1.145	"	"	481.6	970.2	.931	5.18
	IV	-170	81.2	75.0	1.139	"	"	1093.0	973.6	.936	6.20
1969	I	-166	91.6	70.9	1.135	"	"	446.2	981.7	.949	6.07
	II	-206	95.5	81.0	1.084	"	"	599.0	986.2	.962	6.46
	III	-221	84.1	115.6	1.113	"	"	523.0	990.5	.969	7.11
	IV	-201	94.3	121.7	1.167	"	"	1185.1	984.8	.979	8.10
1970	I	-188	123.2	122.1	.977	"	"	482.9	981.9	.993	6.26
	II	-172	113.2	136.9	1.015	"	"	647.4	981.4	.997	6.35
	III	-197	128.3	141.9	1.034	"	"	564.5	989.6	1.003	6.03
	IV	-245	160.7	139.0	1.026	"	"	1277.1	978.7	1.006	4.83
1971	I	-222	152.7	126.4	1.063	26.0	16.0	519.8	1001.0	1.019	3.52
	II	-298	160.2	130.1	1.034	"	"	695.8	1008.8	1.031	5.08
	III	-292	182.1	126.6	1.110	"	"	605.9	1015.5	1.039	4.68
	IV	-206	162.0	126.2	1.252	18.0	12.0	1119.3	1023.6	1.040	3.73
1972	I	-190	143.5	130.7	1.300	"	"	630.5	1042.6	1.060	3.85
	II	-152	134.4	141.7	1.385	"	"	749.2	1062.2	1.071	4.14
	III	-110	160.8	171.6	1.409	"	"	735.3	1076.9	1.086	4.60
	IV	-88	234.3	193.2	1.215	19.0	14.0	1220.6	1099.5	1.098	5.16
1973	I	-141	214.0	202.7	1.364	"	"	686.2	1122.4	1.151	6.53
	II	-245	249.5	257.9	1.178	22.0	18.0	814.0	1122.8	1.207	7.99
	III	-94	239.8	310.6	1.188	"	"	797.5	1130.8	1.256	7.15
	IV	-27	289.5	334.6	1.170	"	"	1322.0	1133.9	1.267	7.41
1974	I	-428.1	316.1	309.3	1.202	"	"	742.1	1122.8	1.351	8.36
	II	-541.5	285.3	314.7	1.218	"	"	844.3	1111.9	1.399	7.81
	III	-598.7	388.1	303.0	1.281	19.0	15.0	895.2	1105.9	1.498	6.39
	IV	-676.8	454.7	320.3	1.220	"	"	1423.2	1085.3	1.551	7.11
1975	I	-911.4	460.5	238.7	1.310	21.0	17.0	797.6	1059.6	1.551	5.56
	II	-782.6	499.8	340.5	1.105	23.0	16.0	943.8	1067.7	1.567	6.01
	III	-114.3	530.2	424.6	1.123	24.0	17.0	922.2	1098.1	1.601	6.55
	IV	-305.3	517.3	554.7	1.097	"	"	1524.6	1111.6	1.618	5.23
1976	I	-413.8	467.6	633.4	1.103	"	"	853.7	1138.6	1.626	4.93
	II	-182.3	265.4	798.7	1.183	"	"	1008.6	1151.3	1.649	5.37
	III	-60.5	287.8	958.5	1.065	"	"	984.6	1163.1	1.669	5.09
	IV	135.4	195.4	1243.3	1.074	"	"	1626.0	1170.4	1.685	4.41

		USB	USP	USPX	JY	JWPI	JR	JB	JP	JPX	JEXR
1963	I	51.3	.780	.829	90.2	.882	6.08	1682	.695	.842	359.7
	II	52.4	.781	.826	93.3	.887	5.71	1748	.706	.912	"
	III	52.7	.783	.824	96.4	.891	"	1729	.717	.914	"
	IV	54.7	.789	.825	100.7	.897	"	2254	.723	.919	"
1964	I	53.9	.791	.828	104.6	.895	"	2066	.728	.925	"
	II	54.7	.793	.826	106.6	.888	"	2108	.739	.929	"
	III	55.3	.798	.831	108.9	.889	"	2113	.751	.927	"
	IV	57.7	.800	.842	110.8	.892	"	2547	.754	.922	"
1965	I	56.1	.806	.864	110.6	.900	"	2302	.770	.924	"
	II	57.9	.811	.861	112.5	.897	"	2293	.778	.921	"
	III	58.6	.816	.859	115.0	.896	"	2252	.780	.919	"
	IV	60.5	.819	.855	115.4	.900	"	2785	.794	.916	"
1966	I	59.5	.828	.872	118.9	.913	"	2652	.801	.915	"
	II	61.1	.838	.881	123.0	.917	"	2607	.819	.919	"
	III	62.3	.842	.893	126.5	.922	"	2625	.828	.922	"
	IV	64.4	.850	.911	129.6	.927	"	3154	.832	.928	"
1967	I	62.7	.856	.907	134.6	.936	"	2977	.847	.926	"
	II	64.2	.859	.900	137.7	.930	"	2992	.847	.922	"
	III	65.7	.867	.900	143.1	.935	"	3048	.861	.924	"
	IV	68.3	.877	.907	147.0	.945	"	3736	.874	.927	"
1968	I	67.4	.888	.899	152.5	.948	"	3560	.881	.929	"
	II	69.1	.898	.920	155.8	.941	5.90	3602	.890	.928	"
	III	69.6	.907	.915	160.9	.942	5.71	3560	.899	.928	"
	IV	72.7	.919	.922	168.3	.948	"	4441	.913	.931	"
1969	I	71.0	.930	.938	169.0	.951	"	4110	.914	.937	"
	II	71.7	.942	.934	176.1	.958	"	4195	.927	.947	"
	III	73.0	.956	.948	177.2	.968	5.93	4240	.944	.958	"
	IV	76.0	.968	.979	183.9	.982	"	5313	.959	.975	"
1970	I	75.2	.982	.990	188.8	.998	"	5029	.978	.997	"
	II	76.3	.995	1.000	195.1	1.004	"	5053	.994	1.001	"
	III	78.7	1.003	1.004	199.9	1.000	"	4968	1.005	1.001	"
	IV	81.2	1.018	1.007	200.7	.997	5.80	6193	1.023	1.002	"
1971	I	82.2	1.033	1.039	205.6	.992	5.68	5798	1.027	1.008	"
	II	82.9	1.047	1.034	208.5	.995	5.42	5856	1.037	1.015	"
	III	84.2	1.056	1.024	213.0	.995	5.17	5938	1.052	1.011	354.6
	IV	88.8	1.066	1.037	215.4	.987	"	7094	1.061	.994	327.9
1972	I	88.3	1.081	1.051	222.8	.985	4.66	6583	1.064	.976	307.7
	II	89.7	1.089	1.059	224.0	.990	4.15	6864	1.080	.977	"
	III	89.5	1.097	1.061	231.8	.998	"	7059	1.103	.976	"
	IV	92.2	1.109	1.096	239.4	1.027	"	9153	1.123	.981	"
1973	I	92.2	1.127	1.136	248.4	1.077	"	8804	1.139	.996	284.1
	II	92.6	1.147	1.191	252.8	1.113	5.43	9420	1.192	1.027	265.0
	III	99.4	1.167	1.272	253.1	1.171	5.55	9714	1.237	1.072	"
	IV	99.6	1.193	1.360	253.2	1.273	5.80	12292	1.298	1.169	274.6
1974	I	99.8	1.221	1.471	245.6	1.459	6.83	11215	1.388	1.328	292.3
	II	103.9	1.251	1.524	248.3	1.508	"	12029	1.451	1.392	279.1
	III	108.2	1.288	1.625	251.1	1.552	"	11850	1.500	1.492	294.6
	IV	105.6	1.328	1.726	251.7	1.570	"	14277	1.539	1.486	300.0
1975	I	108.5	1.353	1.785	251.0	1.561	"	12951	1.543	1.406	293.3
	II	107.2	1.368	1.773	253.7	1.558	6.31	13354	1.577	1.379	292.4
	III	111.1	1.392	1.762	255.9	1.567	6.06	13287	1.591	1.371	297.9
	IV	112.6	1.415	1.771	257.7	1.585	5.68	14855	1.611	1.381	303.6
1976	I	113.6	1.437	1.799	267.8	1.616	"	13494	1.626	1.393	302.4
	II	116.3	1.455	1.817	271.4	1.642	"	13851	1.680	1.408	299.2
	III	119.4	1.470	1.838	272.3	1.673	"	13654	1.711	1.405	291.1
	IV	118.9	1.491	1.876	273.9	1.686	"	16132	1.726	1.406	293.6

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