TWO ESSAYS ON INTERNATIONAL TRADE FLOWS AND FINANCIAL MARKET INTEGRATION: THE TAIWAN AND SOUTH KOREA CASES

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in partial fulfillment of
the requirements for
the degree of
DOCTOR OF PHILOSOPHY
July, 1993

TWO ESSAYS ON INTERNATIONAL TRADE FLOWS
AND FINANCIAL MARKET INTEGRATION:
THE TAIWAN AND SOUTH
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ACKNOWLEDGEMENTS

I would like to express my special thanks to Dr. Andreas Savvides, the Committee Chairman, for his guidance and encouragement through this study. I also want to express my thanks to other Committee Members, Dr. Michael R. Edgmand, Dr. Janice W. Jadlow, and Dr. Lee C. Adkins. Their assistance and support has important contribution to this study. The instruction and encouragement from Dr. Ronald L. Moomaw, the Department Head, Dr. Gerald M. Lage, Dr. Frank G. Steindl, Dr. Joseph M. Jadlow, Dr. Kent W. Olson, Dr. Michael J. Applegate, Dr. Edward O. Price, Dr. Mary N. Gade, and Dr. James R. Fain through my graduate study at Oklahoma State University are also appreciated.

Appreciation is also given to Dr. Andrew K. Rose and Dr. Janet L. Yellen, both of University of California at Berkeley, for providing me the programs and working papers of their studies.

Gratitude is expressed to my mother, Mrs. S. Y. Chen Hsing, and my wife, Sue-Meng Jeng, for their love, consideration, and support through these years.

Finally, I would like to dedicate this dissertation in remembrance of my father, Mr. Jen-Chou Hsing.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

This study concentrates on the external trade and financial markets of two Asian Newly Industrialized Countries (NICs): South Korea and Taiwan. It is composed of two parts. The first part examines whether a J-curve effect is evident in the trade between the countries of South Korea and Taiwan, on the one hand, and the countries of the United States, Japan and the rest of the world, on the other, over the last twenty years. The second part examines how well South Korea's and Taiwan's financial markets are integrated with the U.S. and Japanese financial markets. A brief introduction to each part is presented in this chapter.

The J-Curve Effect

It is commonly believed that the real (effective) exchange rate is one of the major determinants of a country's trade balance. Conventional wisdom on the effect of the real exchange rate on the trade balance is described by the J-curve effect: a real depreciation worsens a country's trade balance in the short run but improves it in

the long run. The rationale behind this argument is that import prices adjust quickly to real exchange rate changes (or relative price changes) while import and export volumes adjust only slowly. Thus, the initial effect of a real depreciation on a country's trade balance is "perverse" because total import value increases more than total export value increases. In the long run, however, as the import and export volumes adjust to the higher (lower) import (export) prices, the trade balance will improve. A number of empirical tests support the view that, following a real depreciation, the trade balance exhibits a "J-curve" effect.[1] Rose and Yellen (1989a and 1989b) and Rose (1991a and 1991b), on the other hand, question the theoretical reasons behind the J-curve effect.[2] Their empirical findings show that there is no significant relationship between the real exchange rate (and its lags) and the trade balance of the major OECD countries. In the first part of

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[1] Examples include Goldstein and Khan (1985), Helkie and Hooper (1987), and Krugman and Baldwin (1987). Chapter II, the literature review, discusses these papers.

[2] Rose and Yellen (1989) argue that no theoretical reason leads one to presume that the J-curve effect exist. They note that, "... while the conditions (i.e. the low short-run price elasticities of demand for imports both at home and abroad, a swift response of import prices to the exchange rate, and a long-run positive effect on trade balance of real depreciation) which lead to a J-curve may strike some as realistic, the complement (counterpart) to this set of hypothesis seems equally plausible." Rose and Yellen refer to Mann (1986), who finds that import prices adjust slowly to exchange rate changes, to demonstrate that the initial negative effect implied by the J-curve may not exist.

the dissertation, I shall adopt the methodology used by Rose and Yellen to examine whether the trade between the countries of South Korea and Taiwan, on the one hand, and the countries of the United States, Japan, and rest of the world, on the other, displays a J-curve phenomenon. I shall concentrate on Taiwan and South Korea because both economies are export oriented and have experienced a significant trade surplus (deficit) with the United States (Japan) in recent years, as shown in Tables 1-4.[3] In addition, the results will be checked for robustness.

Financial Market Integration

Since the 1970s, a number of financial liberalization policies have been inaugurated by Pacific Basin nations. These policies have increased the integration of Pacific Basin nations' financial markets into the world financial markets. Glick and Hutchison (1990) have shown that, because of the financial reforms in Pacific Basin countries, the linkages between real interest rates in the United States and other Pacific Basin nations have increased over time.[4]

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[3] A more detailed discussion of the U.S. (Japan) trade deficit (surplus) with Taiwan and South Korea will be presented in Chapter III.

[4] Glick (1987) has shown that the linkage of real interest rates between the United States and "financial liberalizing" Pacific Basin nations (Australia, Hong Kong, Japan, Malaysia, and Taiwan) during the 1974-1985 period is significantly greater than zero but less than one. Glick and Hutchison (1990) show that the linkages of real interest rates between the United States and these Pacific Basin

Frankel and MacArthur (1988) and Frankel (1989) use "covered" interest differentials to examine financial market integration (or financial capital mobility). Since they find that the Covered Interest Parity (CIP) condition holds quite well between the interest rates of liberalizing Pacific Basin nations (Hong Kong, Japan, Malaysia, and Singapore) and the Eurodollar rate, they conclude that the financial markets of these Pacific Basin nations are well integrated with the rest of the world financial markets.

Along with other Pacific Basin nations, Taiwan and South Korea have embarked on a liberalization process beginning in the early 1980s [see, for example Layman (1988) and Kuo (1990)]. Although in comparison to other Pacific Basin nations, Taiwan and South Korea begun the liberalization process late and proceeded slowly, the growing economic importance of these two economies necessitates a study of the linkage of their financial markets to the international capital markets. In the second part of the dissertation, I will use the "uncovered" nominal interest rates linkage instead of the real interest rates linkage and covered interest differential to examine how

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nations have increased over time in response to the financial liberalization process. Because the real interest rate linkages are greater than zero, they conclude that the economies in Pacific Basin nations are not independent of foreign economic conditions. Moreover, because the linkages are not complete (less than one), they also claim that domestic stabilization policies in these Pacific Basin nations are still effective.

TABLE 1

EXCHANGE RATES AND U.S. TRADE BALANCE WITH TAIWAN AND SOUTH KOREA
1970 - 1991[1,2]

Year	U.S.$-N.T.$ Exchange Rate	U.S.-Taiwan Trade Balance	U.S.$-Won Exchange Rate	U.S.-Korea Trade Balance
1970	40.10	-7.57	310.56	88.78
1971	40.10	-103.01	347.15	72.99
1972	40.00	-220.48	392.89	9.37
1973	38.26	-201.59	398.32	90.59
1974	38.00	-226.74	404.48	28.40
1975	38.00	-95.00	484.00	115.39
1976	38.00	-454.80	484.00	-141.60
1977	38.00	-629.40	484.00	-184.10
1978	37.05	-947.70	484.00	-219.90
1979	36.05	-875.10	484.00	29.60
1980	36.01	-852.40	607.43	143.10
1981	36.85	-1255.80	681.03	-37.10
1982	39.12	-1508.30	731.09	-35.90
1983	40.07	-2179.10	775.75	-407.50
1984	39.60	-3254.90	805.98	-1123.40
1985	39.85	-3898.80	870.02	-1352.30
1986	37.84	-4755.50	881.45	-2124.70
1987	31.84	-5736.30	822.57	-2962.80
1988	28.59	-4224.30	731.47	-2966.60
1989	26.41	-4334.20	671.46	-2087.90
1990	26.89	-3278.10	707.77	-1364.80
1991	26.81	-3281.60	733.36	-502.20

Source: OECD Monthly Trade Statistics, IMF International Financial Statistics, and Financial Statistics, Taiwan District, R.O.C., various issues.

1. Exchange rate is nominal and is defined as N.T.$/U.S.$ (Won/U.S.$).

2. The unit of trade balance is million U.S.$. Positive (negative) trade balance means the United States has trade surplus (deficit) with Taiwan (Korea).

TABLE 2

REAL EXCHANGE RATES AND U.S. REAL TRADE BALANCE WITH TAIWAN AND SOUTH KOREA
1970 - 1991[1,2]

Year	U.S.$-N.T.$ Exchange Rate	U.S.-Taiwan Trade Balance	U.S.$-Won Exchange Rate	U.S.-Korea Trade Balance
1970	48.29	-25.53	706.55	568.56
1971	48.64	-336.92	717.92	412.43
1972	48.30	-688.21	760.03	50.56
1973	48.53	-602.81	844.03	439.74
1974	38.68	-440.31	819.84	129.54
1975	40.13	-176.99	858.33	398.63
1976	40.97	-826.57	783.08	-381.36
1977	40.67	-1065.13	748.58	-447.64
1978	40.40	-1522.32	705.12	-473.00
1979	40.32	-1281.70	670.67	54.39
1980	38.67	-1052.08	746.56	203.27
1981	37.03	-1318.62	752.42	-29.47
1982	38.59	-1530.84	767.93	-39.82
1983	39.26	-2176.63	798.21	-426.57
1984	39.72	-3247.29	829.97	-1151.05
1985	39.84	-3898.60	869.97	-1350.98
1986	36.51	-4719.91	833.03	-2067.16
1987	31.35	-5668.95	744.50	-2793.73
1988	28.92	-4113.45	668.51	-2612.96
1989	26.86	-4047.83	609.45	-1741.53
1990	27.19	-3339.09	612.52	-1044.98
1991	26.23	-2835.68	580.03	-345.86

Source: Author's own calculations based on data from OECD Monthly Trade Statistics, IMF International Financial Statistics, and Financial Statistics, Taiwan District, R.O.C., various issues.

1. Exchange rate is real and is defined as $(e \cdot P^*) / P$, where e is the nominal exchange rate and is defined as N.T.$/U.S.$ (Won/U.S.$), P^* is foreign (U.S.) WPI, and P is domestic (Taiwan's and South Korea's) CPI.

2. Trade balance is real and is defined as the nominal trade balance divided by domestic (Taiwan's or South Korea's) CPI. The unit of trade balance is million U.S.$. Positive (negative) trade balance means the United States has trade surplus (deficit) with Taiwan (Korea).

TABLE 3

EXCHANGE RATES AND JAPAN TRADE BALANCE WITH TAIWAN AND SOUTH KOREA
1970 - 1991[1,2]

Year	Yen-N.T.$ Exchange Rate	Japan-Taiwan Trade Balance	Yen-Won Exchange Rate	Japan-Korea Trade Balance
1970	.1114	150.52	.863	196.86
1971	.1150	213.54	.998	194.57
1972	.1319	223.61	1.296	184.85
1973	.1409	250.85	1.467	192.33
1974	.1302	353.08	1.385	362.25
1975	.1281	337.14	1.631	313.65
1976	.1282	363.57	1.632	296.16
1977	.1419	422.67	1.808	646.19
1978	.1772	611.82	2.320	1130.77
1979	.1651	627.40	2.217	948.40
1980	.1593	950.30	2.694	780.50
1981	.1673	958.60	3.092	748.30
1982	.1572	600.60	2.939	532.30
1983	.1687	822.90	3.267	866.30
1984	.1669	925.20	3.395	1001.90
1985	.1683	550.60	3.679	1005.00
1986	.2253	1060.20	5.256	1742.50
1987	.2201	1417.00	5.693	1725.50
1988	.2232	1870.70	5.711	1205.50
1989	.1920	2150.60	4.877	1190.70
1990	.1865	2311.70	4.909	1915.70
1991	.1991	2924.00	5.449	2575.10

Source: OECD Monthly Trade Statistics, IMF International Financial Statistics, and Financial Statistics, Taiwan District, R.O.C., various issues.

1. Exchange rate is nominal and is defined as N.T.$/Yen (Won/Yen).

2. The unit of trade balance is million U.S.$. Positive (negative) trade balance means Japan has trade surplus (deficit) with Taiwan (Korea).

TABLE 4

REAL EXCHANGE RATES AND JAPAN REAL TRADE BALANCE WITH TAIWAN AND SOUTH KOREA
1970 - 1991[1,2]

Year	Yen-N.T.$ Exchange Rate	Japan-Taiwan Trade Balance	Yen-Won Exchange Rate	Japan-Korea Trade Balance
1970	.1823	126.52	2.667	312.64
1971	.1819	175.00	2.689	272.00
1972	.2007	174.84	3.159	231.01
1973	.2301	178.89	4.012	233.90
1974	.1893	174.19	4.011	349.69
1975	.1821	156.73	3.899	246.75
1976	.1868	165.33	3.570	201.96
1977	.1970	179.50	3.624	395.12
1978	.2263	245.67	3.950	608.35
1979	.2062	229.90	3.432	432.21
1980	.1971	291.99	3.810	278.71
1981	.1805	254.04	3.670	218.61
1982	.1661	152.88	3.304	144.10
1983	.1708	205.54	3.472	226.97
1984	.1686	230.77	3.520	256.81
1985	.1680	137.63	3.670	251.22
1986	.2030	262.75	4.638	423.80
1987	.1902	349.82	4.702	408.28
1988	.1886	455.44	4.363	266.04
1989	.1593	501.76	3.613	248.43
1990	.1517	517.28	3.417	366.10
1991	.1566	632.44	3.465	450.98

Source: Author's own calculations based on data from OECD Monthly Trade Statistics, IMF International Financial Statistics, and Financial Statistics, Taiwan District, R.O.C., various issues.

1. Exchange rate is real and is defined as $(e \cdot P^*) / P$, where e is the nominal exchange rate and is defined as N.T.$/Yen (Won/Yen), P^* is foreign (Japan's) WPI, and P is domestic (Taiwan's and South Korea's) CPI.

2. Trade balance is real and is defined as the nominal trade balance divided by domestic (Taiwan's or South Korea's) CPI. The unit of trade balance is million U.S.$. Positive (negative) trade balance means Japan has trade surplus (deficit) with Taiwan (Korea).

well Taiwan's and South Korea's financial markets are integrated with the United States and Japanese financial markets.[5] Unlike that of the covered interest differential, measuring the uncovered interest rate linkage does not require forward exchange rates. Therefore, it can be applied to countries such as Taiwan and South Korea, where, either an official forward exchange market does not exist, or official forward exchange rates are not available.[6] Moreover, as the study is focused on financial market integration, the uncovered nominal interest rate linkage, which focuses solely on the degree of financial market integration, is more appropriate than the real interest linkage, which shows financial and goods markets integration jointly.

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[5] The term uncovered interest rate linkage denotes the linkage between domestic and (depreciation adjusted) foreign nominal interest rate.

[6] Beginning July 1, 1980, authorization has been granted for forward exchange transactions in South Korea. Its official forward exchange rates, however, are not available. Frankel and MacArthur (1988) and Frankel (1989) have pointed out the only less developed countries in Asia, where forward rate data are available, are Hong Kong, Malaysia, and Singapore.

CHAPTER II

Literature Review

This chapter is devoted to discussing previous studies of the J-Curve effect and financial market integration (liberalization). In particular, those studies which concentrate on the East Asian NICs as well as the United States and Japan are emphasized.

The J-Curve Effect

Goldstein and Khan (1985) provide a detailed survey of contemporary trade literature. Their conclusion supports the existence of the J-curve effect and the effectiveness of expenditure-switching (exchange rate) policies. However, they also note that exchange rate policies must work with the "lessons" of the absorption approach (i.e. support the expenditure-reducing policies) and the monetary approach (i.e. control the expansion of domestic money supply) in order to be successful. Finally, Goldstein and Khan claim that since factors such as the commodity composition of trade, the degrees of import and export openness, the degree of capacity utilization, and the degree of real wage resistance are different among countries, the effectiveness

of exchange rate changes are not equal across countries.

Helkie and Hooper (1987) present an empirical analysis of the factors which contributed to the unprecedented U.S. trade deficit in the first half of the 1980s. Using a partial-equilibrium current account model, they find that the decline in U.S. price competitiveness (associated with the appreciation of the dollar) is the dominant factor behind the U.S. trade deficit. They also draw on the results of an international macroeconomic model simulation to examine how the shifts of U.S. and other industrial countries' fiscal policies have contributed to the U.S. external deficit. Their analysis finds that the fiscal expansions (contractions) in the United States (foreign countries) in the first part of 1980's have contributed significantly to the rise of U.S. trade deficit during that period.[7] In their paper, Helkie and Hooper provide four reasons to explain the lack of improvement in the U.S. trade balance even in the first half of 1986, following the real depreciation of the U.S. dollar beginning in early 1985. First, cutting of profit margins by foreign exporters

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[7] Helkie and Hooper argue that over 50% of the rise of U.S. trade deficit in the first part of 1980s is due to the fiscal expansion (contraction) in the U.S. (foreign countries) during that period. However, based on model simulation, they note that the shifts in fiscal policy does not explain all of the real appreciation of the dollar. They point out other factors (e.g. changes in monetary policy) may have increased the relative attractiveness of dollar denominated assets and caused the appreciation of U.S. dollar during that period.

increases foreign goods' competitiveness. Second, because of the recognition-response and order-delivery lags, it takes import and export volumes two or more years to adjust to price changes. Third, due to the J-Curve effect, the import prices rise before import volumes fall, the initial effect of real depreciation of U.S. dollar is the deterioration of the U.S. trade balance. Finally, the sharp appreciation of the dollar in 1984 and the first two months of 1985, which, because of the lags involved, offset the gains of the dollar's decline that began in March 1985 (at least through mid-1986).

Krugman and Baldwin (1987) assert that the real depreciation of the U.S. dollar is effective in improving the U.S. trade balance. They take issue with the Mundell-McKinnon view, which states that the trade balance is determined by the difference between national income and national expenditure (or saving and investment) and is unrelated to the exchange rate.[8] Krugman and Baldwin also cite three reasons as to why the real depreciation of the U.S. dollar beginning in early 1985 did not improve the U.S. trade balance till the end of 1986. First, due to the

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[8] They cite two papers as representing the Mundell-McKinnon argument: Robert A. Mundell, "A New Deal on Exchange Rates," paper presented at Japan-United States Symposium on Exchange Rates and Macroeconomics (Tokyo, Japan, January 29-30, 1987) and Ronald I. McKinnon and Kenichi Ohno, "Getting the Exchange Rate Right: Insular versus Open Economies," paper presented at the meeting of the American Economic Association, December 1986.

substantial lags in the adjustments of prices and quantities to the exchange rate changes, the trade balance will be improved some time later (in 1987). Second, because foreign demand had not grown as rapidly as U.S. demand since 1980, the dollar needed to fall below its 1980 level to restore the 1980 trade position. Third, because of the diminishing U.S. productivity and technological advantage over competing countries (especially those countries in East Asia), a secular depreciation of the U.S. dollar may be necessary to maintain the price competitiveness of U.S. exports and eliminate the U.S. trade deficit.

Bahmani-Oskooee (1985) estimated a trade balance equation for four less developed countries (Greece, South Korea, India, and Thailand), using quarterly data for the 1973-1980 period. By imposing an Almon lag structure on the real exchange rate variable (which is defined as nominal exchange rate divided by domestic wholesale price level), he found that a J-Curve effect exists in Greece, South Korea, and India. However, the cumulative (long-run) effect of the real depreciation was detrimental to the trade balance in those three countries.

Hickok and Klitgaard (1988) examined different factors affecting U.S. export and import growth rates with Taiwan and South Korea. They found that the real appreciation of New Taiwan dollar (N.T.$) and Korea Won were the major factor behind the strength (moderation) in U.S. exports to

(imports from) Taiwan and South Korea between mid-1987 and mid-1988 period. Other important factors were the import liberalization measures and domestic economic growth in Taiwan and South Korea (which increase U.S. exports) and the problems in specific consumer goods industries in the United States (which reduce U.S. imports).

Moreno (1989) employs aggregate data to examine how relative prices affect Taiwan's and South Korea's import and export volume for the period 1974-1987. Although he finds that current (first differenced) relative prices (of import and export) have no significant effect on import and export volume, the lagged (but not differenced) relative prices have a significant (and expected) negative effect.[9] Moreno also shows that (the favorable) changes in relative prices in Taiwan and South Korea have contributed to the trade surpluses in both economies.[10]

Noland (1989) uses a generalized gamma distributed lag

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[9] In the study, Moreno assumes that both Taiwan and South Korea are small countries, so that the import and export supply are perfectly elastic. Similar assumptions are used in Arize and Spalding (1991). Based on this assumption, Moreno finds that the long-run relative export (import) price elasticities for Taiwan's exports (imports) is -0.79 (-1.44) and for South Korea's exports (imports) is -0.72 (-0.74).

[10] Moreno claims that different factors have caused relative prices changes in favor of Taiwan and South Korea. For Taiwan, he notes the low domestic inflation rate, and for South Korea the depreciation of the Won. However, he argues that the lower income elasticities of imports in Taiwan compared to its trading partners, rather than the relative prices effects, is the dominant cause of rising trade surpluses for Taiwan in the 1980s.

model to estimate the price and income elasticities of Japanese trade for the period 1970Q1-1985Q4. His results show that all the price and income coefficients have the expected signs and almost all of these coefficients are significant at the 95% level or better. The results also show the activity (income) variables tend to have higher long-run elasticities and shorter lags (i.e. less than a year) and the relative price variables tend to have lower long-run elasticities and longer lags.[11] Moreover, based on the estimated elasticities, Noland claims that the Japanese trade balance exhibits the familiar J-curve effect. As he notes in the paper, a 10% devaluation of Yen will immediately worsen the Japanese trade balance by 9% (of the value of imports) and will improve the trade balance by 4.6% (of the value of imports) in the long-run. Finally, Noland uses the model to investigate the possible effects of the yen's appreciation through 1987. He claims that, by 1990, the yen's appreciation will ultimately reduce the Japanese surplus (in yen terms) by 35% from its mid-1987 level, or by around 2% of GNP.

Arize and Spalding (1991) find that not only the long-run but also the short-run import demand price elasticities are significantly negative in South Korea for 1973-1985.

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[11] For example, he finds the average lag of the response of import demand to changes in relative prices is nine quarters.

Thus, they conclude that the real depreciation of the Won (which increases Korea's relative import prices) is effective in reducing South Korea's import demand. Moreover, using the long-run import and export price elasticities to examine the Marshall-Lerner condition, they show that the restricted form of the Marshall-Lerner condition is satisfied in South Korea's case.

O'Neill and Ross (1991) use both structural and reduced form equations to evaluate the major determinants of South Korea's exports to the United States, Japan, and the four largest EC countries - West Germany, France, the United Kingdom, and Italy - for the period 1972-1988. Using a structural (reduced-form) model, they find that for Korea's exports, all the "direct" relative export price (exchange rate) variables have the expected negative sign while the "cross" relative export price (exchange rate) effect is positive.[12] O'Neill and Ross note that the positive "cross" relative export price (exchange rate) coefficient may be explained by complementarity in export demand and the large role of imported inputs in South Korean production.

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[12] According to O'Neill and Ross, the direct relative export price (exchange rate) is defined as the prices of Korean exports relative to prices of the OECD economy's competing domestic goods (the ratio of Korean wholesale prices to the OECD economy's wholesale prices, adjusted by the latter's currency rate against the won). The cross relative export price (exchange rate) is defined as the prices of Korean exports relative to the prices of other suppliers to the OECD economy (the ratio of Korean wholesale prices to a geometrically weighted average of the other suppliers' export prices).

Hill (1990) argues that both the trade balance and the real exchange rate are "endogenous" and the relationship between the trade balance and the real exchange rate is "bi-directional". He states that too much emphasis has been placed on the causality that runs from the exchange rate to the trade balance and not enough on the causality that runs the other way. In contrast to previous studies, Hill points out that the disturbances with the greatest potential for generating a large and persistent U.S. trade deficit are "intertemporal shocks", and the direction of causality of those "intertemporal shocks" is the one that runs from the trade balance to the real exchange rate. He cites three intertemporal shocks that have contributed to the U.S. trade deficit in the 1980s. First, the growth in the U.S. federal budget deficit has worsened the trade deficit. Second, the decontrol of capital flows in major foreign countries (especially, the Japanese liberalization of controls on capital outflows) have kept U.S. interest rates from rising to a higher level. Third, the cyclical movements (surges) of investment in the U.S. have reduced the U.S. capacity to produce consumption goods and encouraged international borrowing. Therefore, to reduce the U.S. trade deficit, Hill argues, one should "target" those "shocks" (e.g. the reductions in the federal budget deficit or a cutoff in foreign lending) instead of focusing on the real depreciation of the U.S. dollar. As he notes in the paper:

> A decline in the trade deficit is likely to be accompanied by a depreciation of the real dollar. But that depreciation itself will explain only part of the ultimate improvement in the deficit. Studies that ask "How far must the dollar fall to balance the trade account?" are likely to over-estimate seriously the extent of needed dollar depreciation.

In summary, most of the papers we reviewed in this section support the view that exchange rate (relative price) changes are effective in improving the trade balances either in developed or developing countries [Goldstein and Khan (1985), Helkie and Hooper (1987), Krugman and Baldwin (1987), Bahmain-Oskooee (1985), Hickok and Klitgaard (1988), Moreno (1989), Noland (1989), Arize and Spalding (1991), and O'Neill and Ross (1991)]. Moreover, some studies claim the existence of J-curve effect following the real depreciation of the domestic currency [Goldstein and Khan (1985), Helkie and Hooper (1987), Krugman and Baldwin (1987), Bahmani-Oskoose (1985), Noland (1989)]. This conventional view of the effectiveness of exchange rate changes (and thus exchange rate policy), however, has been challenged by Hill (1990) and the Mundell-McKinnon view of the trade deficit. Goldstein and Khan (1985) also point out that exchange rate policies must work with the "absorption approach" and "monetary approach" in order to be successful. Finally, Rose and Yellen (1989a and 1989b) and Rose (1991a and 1991b), using different statistical techniques, have shown that exchange rate changes are ineffective and no J-curve effect is evident for the OECD countries.

Financial Market Integration

Feldstein and Horioka (1980) argue that if capital is perfectly mobile internationally, there should be little or no relation between domestic investment in a country and the amount of saving generated in that country. Using cross-section data for sixteen OECD countries for the period 1960-1974, they find that the correlation between gross domestic saving and investment is highly significant and close to one. Thus, Feldstein and Horioka conclude that the world's capital is not mobile. They note that this conclusion, however, is consistent with the international mobility of short-term liquid capital as well as the existence of substantial international flows of long-term portfolio and direct investment. As for the former, they note that only a small part of the total world capital stock is held in liquid form and the high mobility of liquid capital can only eliminate short-term interest rate differentials, not saving and investment correlation. As for the later, they claim that since much direct foreign investment is made to enhance trade positions or to take advantage of special knowledge, it is not sensitive to differences in saving rates or relative capital intensities. Finally, they note that the extent of direct and portfolio investment which is made in pursuit of higher yields is apparently limited by institutional barriers and portfolio preferences.

Frankel (1985) argues that the high correlation between

the domestic saving and investment rates found by Feldstein-Horioka for cross-section data does not indicate that international (financial) capital is immobile. He points out three different definitions of perfect capital mobility. First, closed (covered) interest parity, which requires insignificant barriers such as transactions costs and capital controls. Second, uncovered interest parity, which requires both closed interest parity and small exchange risk premiums. Third, real interest parity, which requires both uncovered interest parity and ex-ante relative purchasing power parity. Since the first two definitions of perfect capital mobility hold between the United States and other major industrial countries, Frankel claims that the world's "financial" markets are highly integrated.

In addition, he notes that the failure of real interest parity is consistent with the high correlation between domestic saving and investment rates, since both saving and investment are functions of the real interest rate. However, as the failure of real interest parity is due to the failure of ex-ante relative purchasing power parity, which in turn is because of the imperfect integration of international goods (not financial) markets, he claims that neither the real interest differential nor the high saving and investment correlation indicates that the world's "financial" assets are immobile.

Cumby and Mishkin (1986) find that real (ex-ante)

interest rates climbed dramatically between the 1970s and the 1980s in both the United States and the European countries. They also find that there is a significant (but not perfect) positive correlation between real interest rate movements in the United States and seven European industrialized countries. In addition, they note that real interest rates within European countries are not more closely linked with one another than with the U.S. real interest rate. Finally, since the European real interest rates do not move one-for-one with the U.S. real interest rate, Cumby and Mishkin conclude that it is possible that European monetary policy can influence domestic economic activity.

Frankel and MacArthur (1988) claim that the covered interest differential is the most appropriate measure of international financial capital mobility. By using the covered interest differential criterion, they find that the financial markets in the United States and a number of other countries (Canada, Germany, the Netherlands, Switzerland, the United Kingdom, Belgium, Sweden, Japan, Hong Kong, and Singapore) are highly integrated in the 1980's. They also find that almost all real interest differentials among those countries are due to the two currency premia (i.e. expected real depreciation and exchange risk premium) rather than the country premium. Moreover, among the two currency premia, they find that the expected real depreciation is the major

determinant of real interest differentials.

Frankel (1989) notes that the continuing worldwide trend of financial markets integration in the 1980s has eliminated the country premium (i.e. the covered interest differentials are smaller). He claims, however, that the real and nominal exchange rate variability (which are the sources of the currency premium) remain and are even higher in the 1980s than in the 1970s. Because the currency premium remains, Frankel claims that the large differentials in (domestic and foreign) real interest rates persist. Finally, by including the latest data available for his study (1987), Frankel finds that the traditional Feldstein-Horioka result of a near-unit correlation between domestic saving and investment rates broke down in the United States. He notes that this result was attributable to the U.S. borrowing excessively from foreign countries in the 1980's and the process of liberalization in Japan and other major countries stimulated the massive flow of capital to the United States.

Lindner (1992) examines changes in South Korea's foreign exchange policy, monetary policy, and capital market developments in the second half of the 1980s, a time when South Korea experienced a significant current account surplus. She notes that the South Korean government had taken several liberalization measures (which include liberalizing the exchange rate and capital control system,

domestic interest rates, and the system of allocating domestic credit) to relieve the potential inflation consequences of the large balance of payments surplus during that time. However, some liberalization policies were postponed or reversed when South Korea's external surplus fell dramatically in 1989. Lindner concludes that South Korea's liberalizing policies were not a comprehensive plan to improve the efficiency of the economy.[13]

Amsden and Euh (1993) point out that although there has been some financial liberalization in South Korea in the 1980s, South Korea's financial system continues to operate within the framework of its industrial policy. They further note that, instead of relying exclusively on market forces, South Korea has achieved its goals of modernizing the financial sector by creating new institutions or remodeling old ones. One example is that the South Korean government, instead of liberalizing interest rates, has chosen an alternative method, developing the Korean stock market, to achieve the economic goals of relying less on foreign capital to finance investments, mobilizing domestic saving, and encouraging efficient investment. Through the

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[13] Nevertheless, she notes this conclusion is offset somewhat as a number of liberalization policies are continuing in some areas in the early 1990s in South Korea. These policies include the introduction of a new (more liberalized) foreign exchange system in 1990 and the permission of limited foreign investment through the stock market in January 1992.

development of the stock market, not only is South Korea's industrial policy of low cost finance to business maintained, but the savers are also provided attractive opportunities for their saving. Amsden and Euh presented another example which showed South Korean government does not rely on market forces to achieve economic goals. That is, in order to support small- and medium-size firms, instead of granting banks and other financial institutions the authority to decide to whom to lend, the Korean government has set minimum quotas on the amount of credit that financial institutions must allocate to such firms.

Kuo (1990) examines the process and results of Taiwan's financial liberalization during the 1980s. She notes that because of the careful planning as well as the general economic background of price stability, budgetary surplus, and trade liberalization, Taiwan's financial liberalization appears to be on the right track in terms of order, speed, and coverage. Kuo's study covers three areas of Taiwan's financial market liberalization: (a) interest rate liberalization; (b) foreign exchange liberalization; and (c) the liberalization of the securities and insurance markets. In general, her study showed that most of Taiwan's financial liberalization in these three areas were successfully implemented in the second half of the 1980s.

Cunningham (1991) points out that Taiwan's financial liberalization policies [e.g. the 1987 lifting of all

restrictions on current account transactions and up to a net nontrade-related outflow (inflow) of U.S.$5 million ($50,000) per year] have diminished the central bank's ability to influence the domestic real interest rate. This development, he notes, is to be expected in a small open economy, as real interest rate movements in the rest of the world force similar movements domestically. Cunningham also notes that the liberalization has two desirable long-term effects on Taiwan's economy. First, the liberalization slows the mercantilist-like accumulation of foreign assets, and eventually will reduce Taiwan's trade surplus and ease trade tensions with the country's trading partners. Second, the accessibility of the large accumulation of national savings to (higher return) international markets relieves the domestic political pressure for both international and domestic liberalization.

CHAPTER III

A RE-EXAMINATION OF THE J-CURVE EFFECT: THE SOUTH KOREA AND TAIWAN CASES

Since the mid-1980s, the U.S. economy has experienced substantial trade deficits. The prolonged recession in the early 1990s has raised concern about reducing the U.S. trade deficit with the rest of the world. Among the world's major trading countries, the trade surpluses (deficits) of Taiwan and South Korea with the U.S. (Japan) were significant and large during the 1980's and early 1990's. During this period, Taiwan and South Korea imported mostly capital goods and intermediate products from Japan and exported manufactured goods to the United States [see, for example, Liang and Liang (1990)].

Table 5 shows the composition of trade between Taiwan (South Korea) and the United States (Japan) for the period 1981-1990. In this period, over 95% of Taiwan's and South Korea's exports to the United States are either manufactured goods or machinery and transport equipment, and over 80% of imports from the United States are food, crude materials, chemicals, and machinery and transport equipment. During the same time, over 85% of Taiwan's and South Korea's

TABLE 5

THE COMPOSITION OF TRADE BETWEEN TAIWAN (SOUTH KOREA) AND THE UNITED STATES (JAPAN) AVERAGE 1981-1990[1,2]

Sec	Taiwan Export to U.S.	Taiwan Import from U.S.	Taiwan Export to Japan	Korea Import from Japan	Korea Export to U.S.	Korea Import from U.S.	Korea Export to Japan	Import from Japan
0	2.1%	11.8%	30.3%	1.9%	1.4%	12.1%	17.3%	0.8%
1	0.0%	1.6%	0.1%	0.1%	0.2%	0.4%	0.2%	0.0%
2	0.3%	17.3%	6.7%	2.3%	0.2%	23.9%	3.3%	2.7%
3	0.1%	4.7%	1.6%	0.8%	0.2%	4.8%	7.4%	1.5%
4	0.0%	0.2%	0.0%	0.1%	0.0%	0.6%	0.0%	0.1%
5	1.3%	14.9%	3.8%	11.9%	0.9%	11.3%	4.1%	13.8%
6	15.0%	5.6%	13.6%	22.6%	16.7%	6.3%	24.7%	23.3%
7	33.6%	37.2%	15.2%	52.5%	33.8%	34.9%	12.0%	48.9%
8	46.8%	5.4%	27.0%	6.7%	45.6%	4.9%	29.6%	7.3%
9	0.8%	1.3%	1.8%	1.2%	0.6%	0.8%	1.5%	1.6%

1. Source: author's own calculation based on data from the OECD Statistics Directorate Foreign Trade by Commodities.

2. According to the Standard International Trade Classification (SITC), the one-digit sectors are as follows: 0: Food and live animals; 1: Beverages and tobacco; 2: Crude materials, inedible, except fuels; 3: Mineral fuels, lubricants and related materials; 4: Animal and vegetables oils, fats and waxes; 5: Chemicals and related products, n.e.s.; 6: Manufactured goods classified chiefly by material; 7: Machinery and transport equipment; 8: Miscellaneous manufactured articles; 9: Commodities and transactions not classified elsewhere in SITC.

imports from Japan are manufactured goods and machinery and transport equipment, while over 80% of exports to Japan are food, manufactured goods, and machinery and transport equipment. Therefore we can conclude that the U.S. (Taiwan and South Korea) trade deficit with Taiwan and South Korea (Japan) in the 1980s was mainly in the sectors of manufactured goods and machinery and transport equipment.

While several policy instruments may be used to reduce the deficit, the real depreciation of the U.S. dollar against the currencies of its trading partners is believed to be highly effective, especially in the long run.[14] Since the mid-1980s, the U.S. dollar has depreciated significantly (both in nominal and real terms) against Taiwan's and South Korea's currencies.[15] During the 1985-1991 period, the U.S. dollar depreciated, in nominal (real) terms, by 33% (34%) against the N.T. dollar and by 16% (33%) against the Won, despite the depreciation of Won against U.S. dollar since 1989. Over this period, the U.S. trade deficit with Taiwan has not changed much in nominal terms

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[14] Recent U.S. government policy reflects the policy makers' belief in the effectiveness of exchange rates in affecting the trade balance. One example is the United States Treasury Report's accusation of major trade surplus countries' manipulation (undervaluation) of their currencies. This Report has put pressure on those (surplus) countries to appreciate their currencies [see Baum (1992) and Park and Park (1991)].

[15] This discussion of Taiwan's and South Korea's trade balance and exchange rate with the United States and Japan are based on the data from Table 1-4.

(from $3,898 million in 1985 to $3,281 million in 1991) but significantly in real terms (from $3,899 million in 1985 to $2,836 million in 1991). In the same period, however, the U.S. trade deficit with South Korea has been reduced significantly in both nominal and real terms (from $1,352 million to $502 million in nominal terms and from $1,351 million to $346 million in real terms). Figures 1-4 show the nominal and real exchange rate and trade balance (in domestic currency) between Taiwan (South Korea) and the United States for the period 1973Q2-1991Q4. In both the Taiwan-U.S. (Figures 1 and 2) and South Korea-U.S. (Figures 3 and 4) cases, visual inspection shows a relationship between (real and nominal) exchange rate depreciation of the U.S. dollar and (real and nominal) U.S. trade balance improvement in the late 1980s. This relationship, however, is not evident between Taiwan and the United States before the mid-1980s and between South Korea and the United States before 1982.

During the last two decades, the Japanese Yen has appreciated significantly against N.T.$ and Won in nominal terms. In real terms, however, the exchange rate between Yen and N.T.$ and Won are relatively stable. In the 1970-1991 period, Yen has appreciated 78% (531%) in nominal terms and has depreciated 14% (appreciated 30%) in real terms against N.T.$ (Won). During the same time, Japan's trade surplus with Taiwan and South Korea have grown significantly

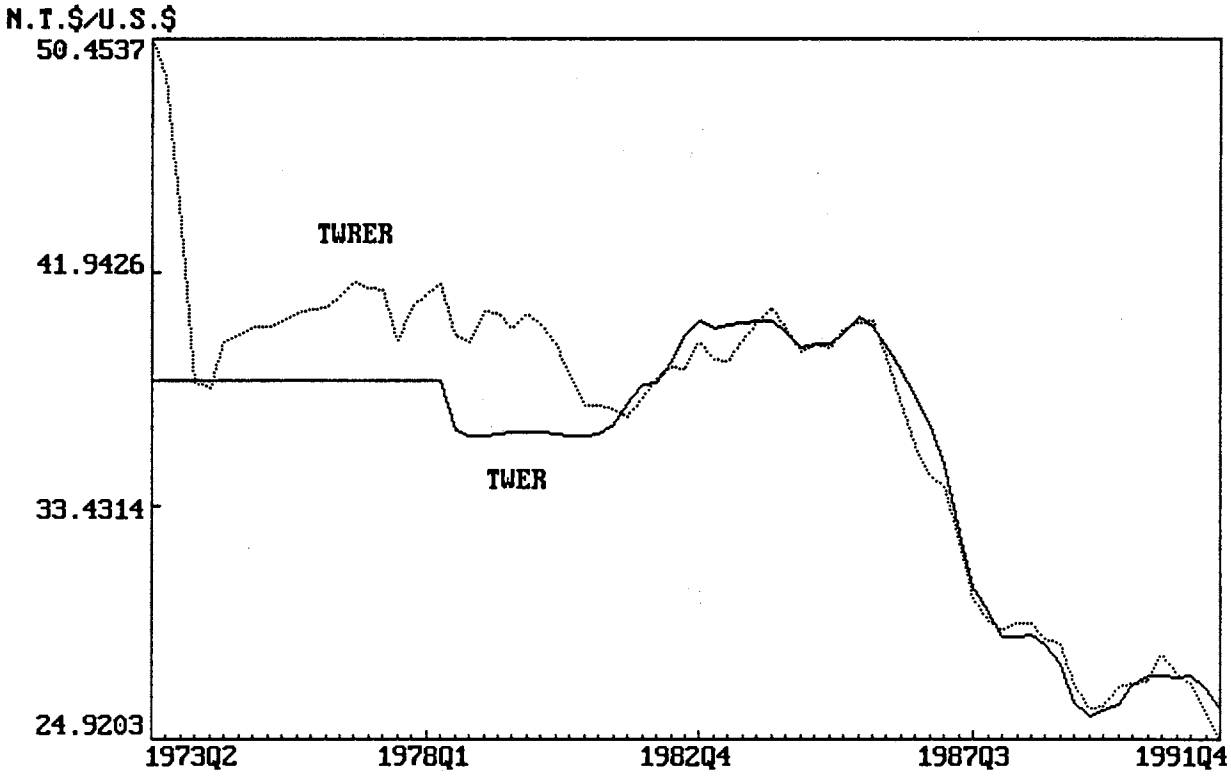

Figure 1. Taiwan-U.S. Nominal (TWER) and Real Exchange Rate (TWRER)
Source: Author's own calculations based on data from Financial Statistics, Taiwan District, ROC.

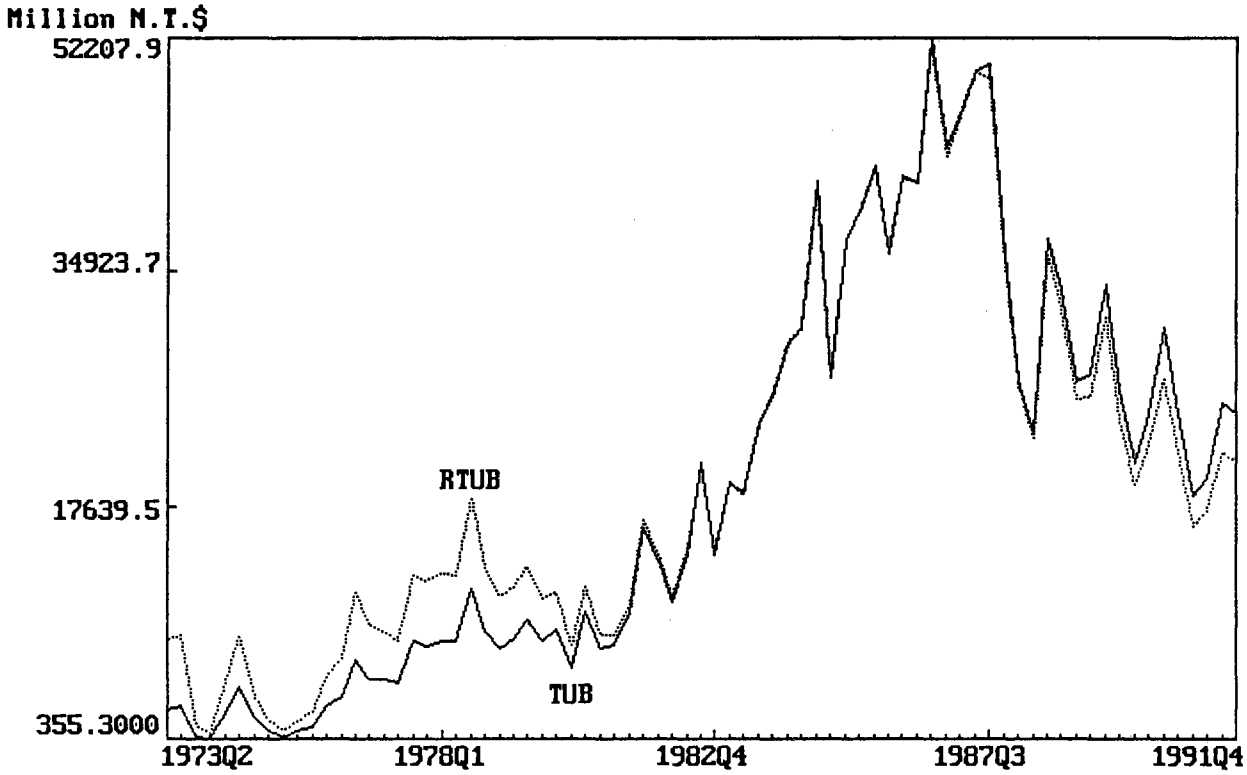

Figure 2. Taiwan-U.S. Nominal (TUB) and Real Trade Balance (RTUB)
Source: Author's own calculations based on data from OECD, Monthly Trade Statistics, and Financial Statistics, Taiwan, ROC.

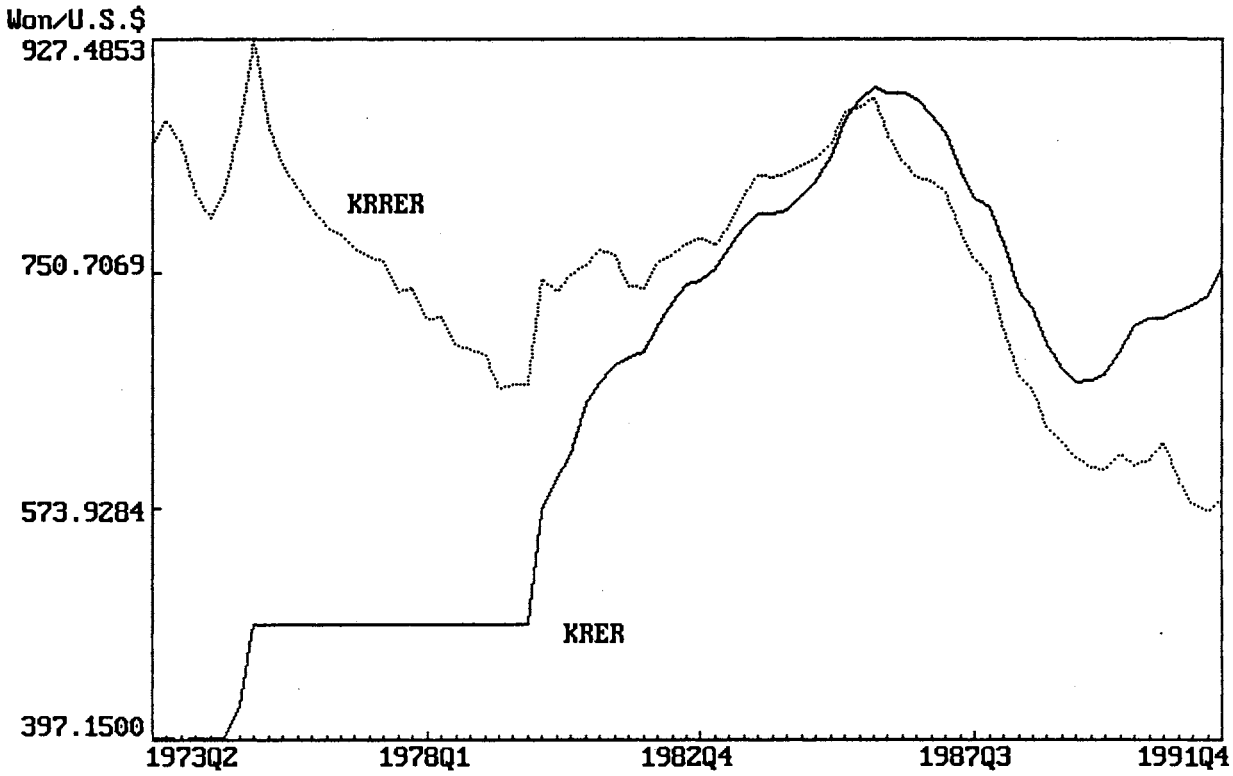

Figure 3. South Korea-U.S. Nominal (KRER) and Real Exchange Rate (KRRER)
Source: Author's own calculations based on data from IMF, International Financial Statistics.

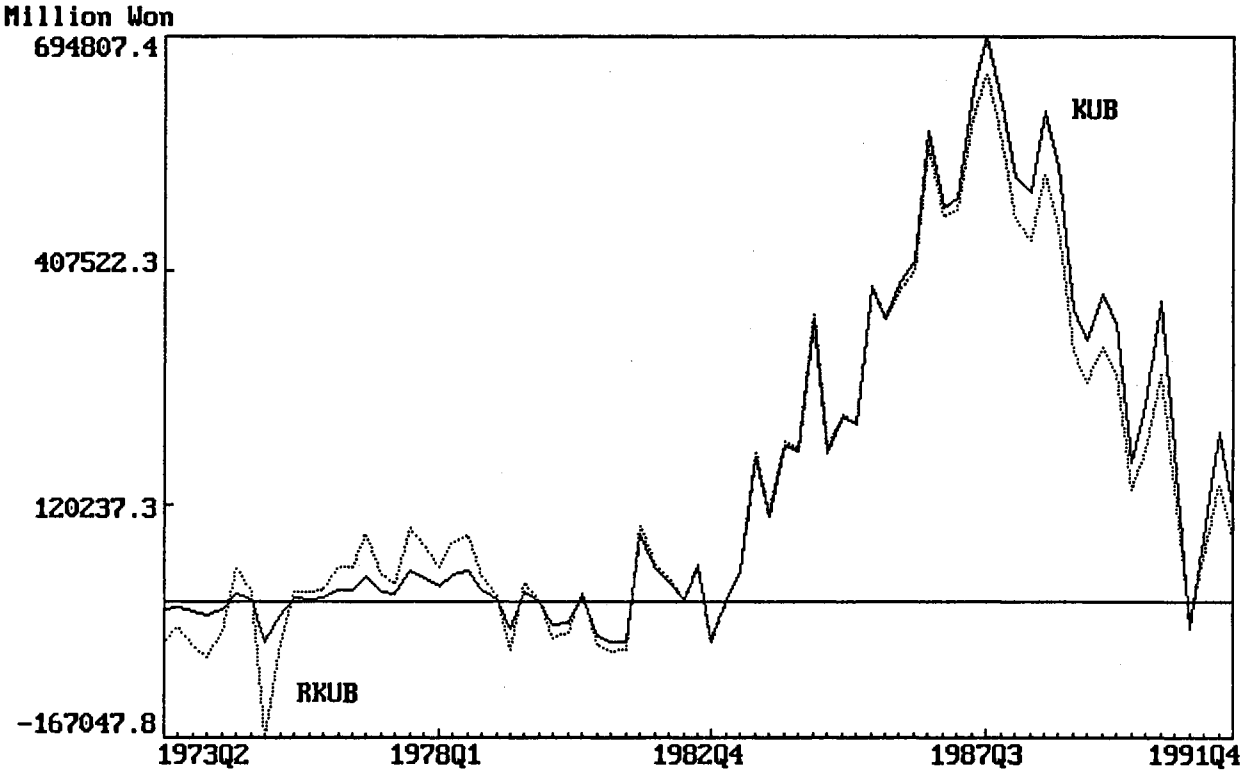

Figure 4. South Korea-U.S. Nominal (KUB) and Real Trade Balance (RKUB)
Source: Author's own calculations based on data from OECD, Monthly Trade Statistics, and IMF, International Financial Statistics.

in nominal terms (from $150 million to $2,924 million with Taiwan and from $196 million to $2,575 million with South Korea). In real terms, however, Japan's trade surplus has grown more significantly with Taiwan than with South Korea (from $126 million to $632 million with Taiwan and from $312 million to $450 million with South Korea). Figures 5-8 show the nominal and real exchange rate and trade balance (in domestic currency) between Taiwan (South Korea) and Japan during the 1973Q2-1991Q4 period. Visual inspection shows a relationship between nominal (real) depreciation of Yen and the increase of Japan's nominal (real) trade surplus with Taiwan in the late 1980's (see Figures 5 and 6). This relationship, however, is not evident between Taiwan and Japan before the mid-1980's and between South Korea and Japan throughout the entire period.

Rose and Yellen (1989a and 1989b) and Rose (1991a and 1991b) have shown there is no significant short- or long-run relationship between the real exchange rate and the trade balance both in bilateral terms (U.S. versus the major OECD trading partners) and in aggregate terms (major OECD countries versus rest of the world).[16] Therefore, it is of

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[16] Rose and Yellen point out two factors which have been neglected by conventional trade studies - the unit-root of the time series data and the simultaneity problems between the trade balance, the exchange rate and domestic and foreign output. By applying first-differencing process and two stage least squares, they have shown that no J-curve effect exists in both the bilateral and the aggregate trade of the OECD countries.

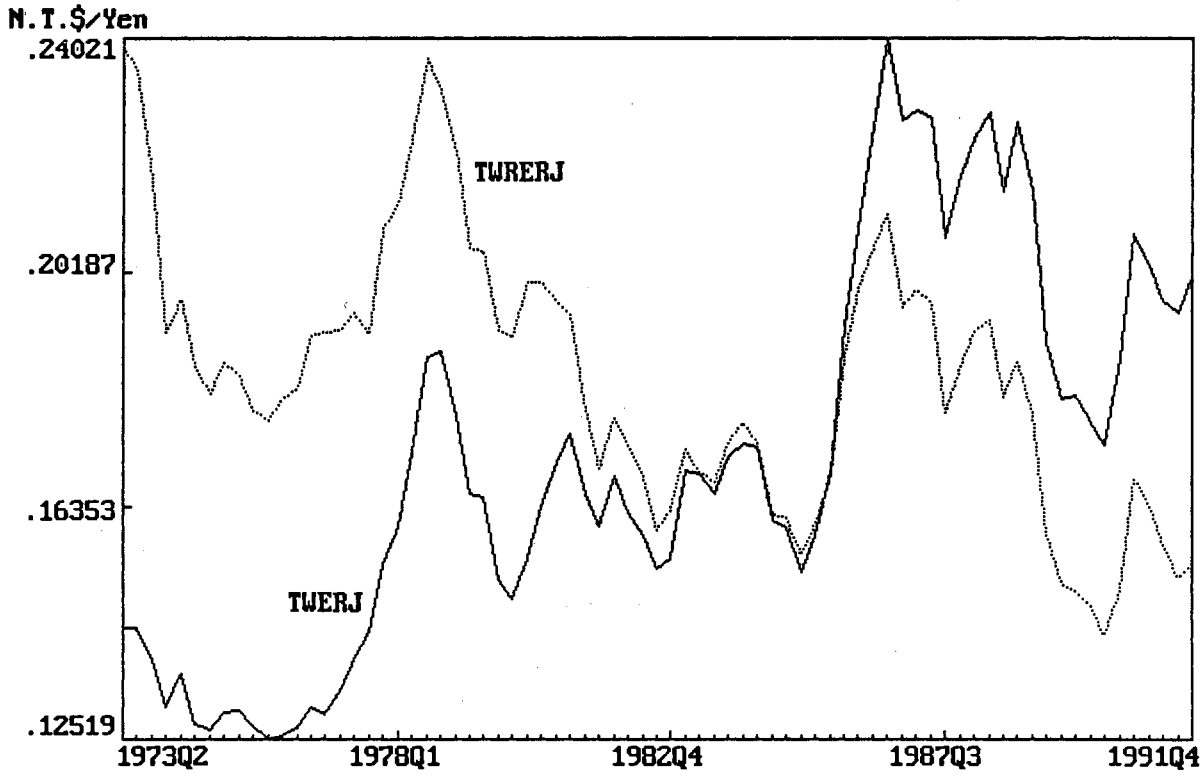

Figure 5. Taiwan-Japan Nominal (TWERJ) and Real Exchange Rate (TWRERJ)
Source: Author's own calculations based on data from IMF, International Financial Statistics, and Financial Statistics, Taiwan, ROC.

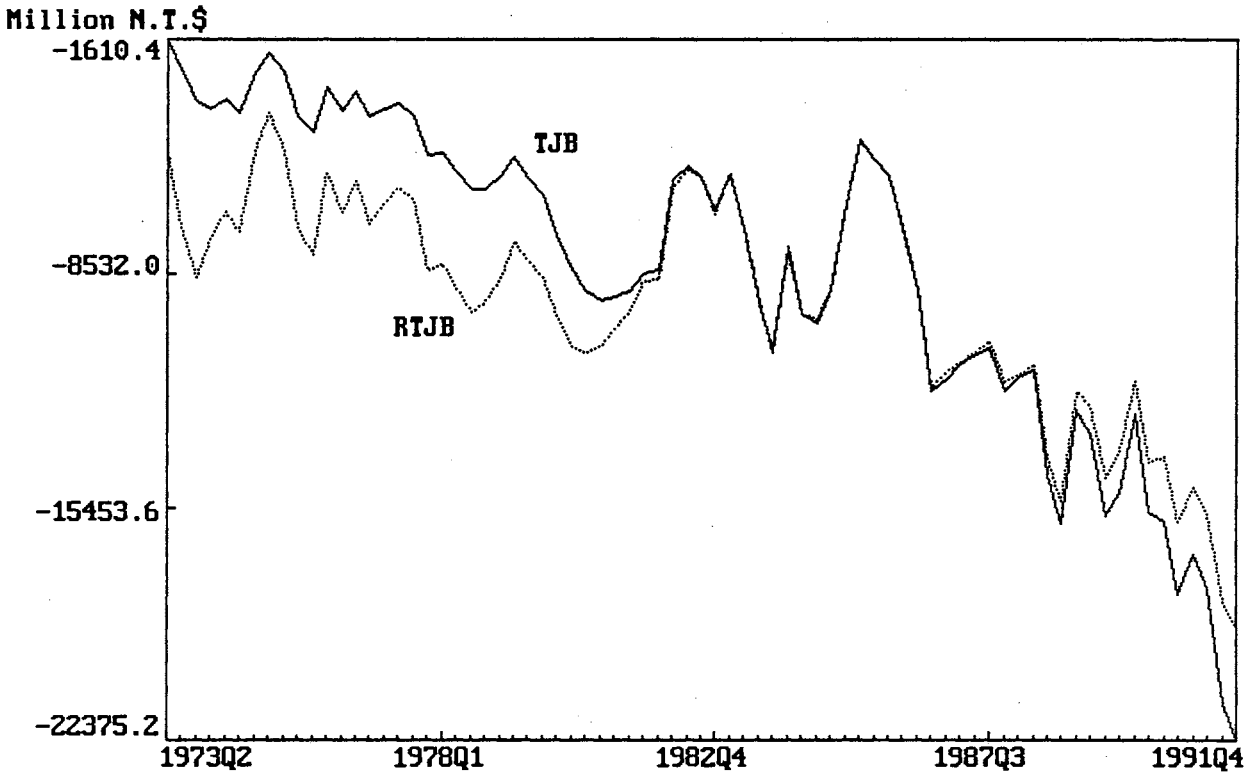

Figure 6. Taiwan-Japan Nominal (TJB) and Real Trade Balance (RTJB)
Source: Author's own calculations based on data from OECD, Monthly Trade Statistics, and Financial Statistics, Taiwan, ROC.

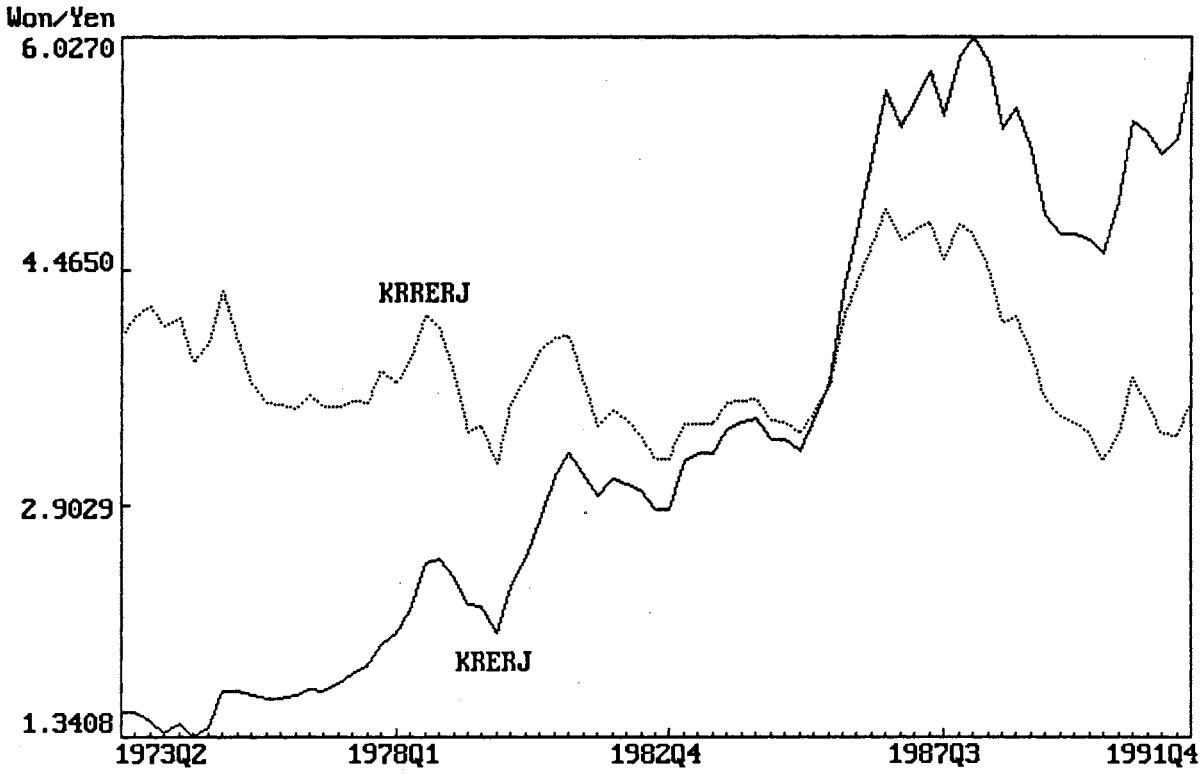

Figure 7. South Korea-Japan Nominal (KRERJ) and Real Exchange Rate (KRRERJ)
Source: Author's own calculations based on data from IMF, International Financial Statistics.

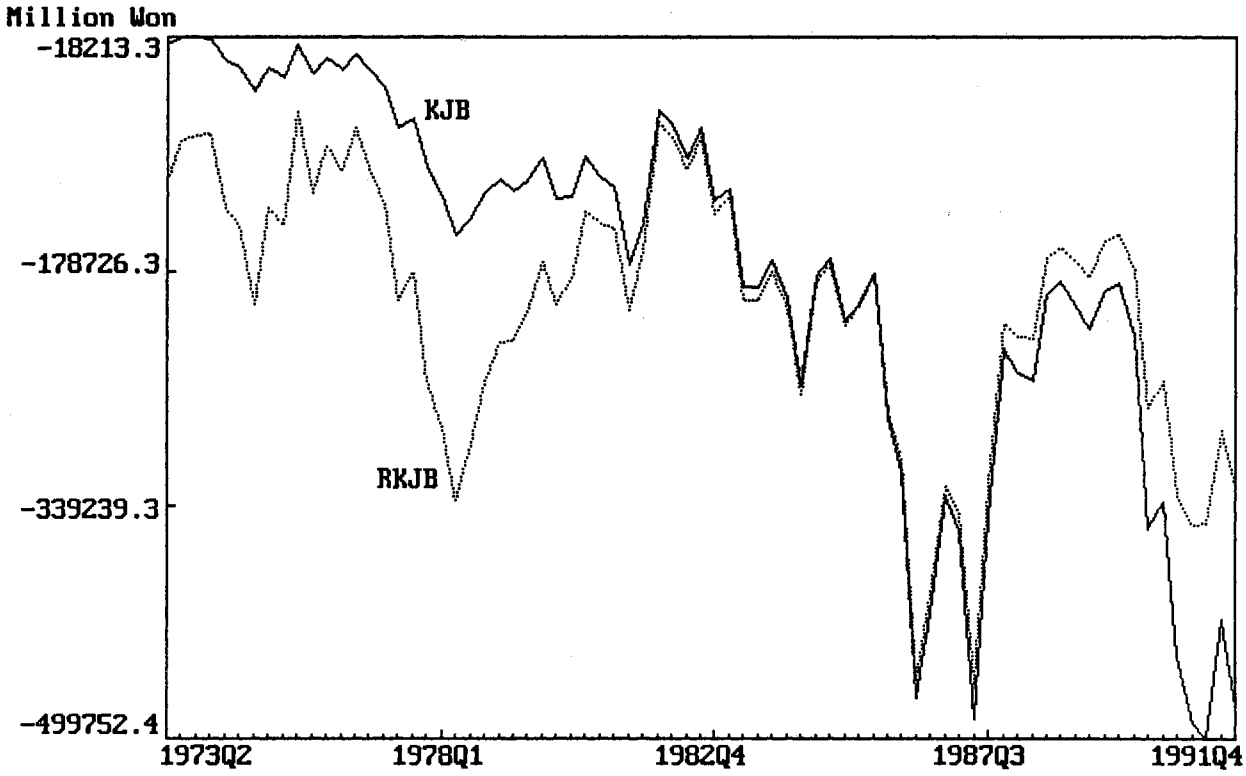

Figure 8. South Korea-Japan Nominal (KJB) and Real Trade Balance (RKJB)
Source: Author's own calculations based on data from OECD, Monthly Trade Statistics, and IMF, International Financial Statistics.

interest to test whether any significant J-curve relationship exists in bilateral trade between Taiwan (South Korea) and the United States. In order to extend and generalize our results, the bilateral (aggregate) trade between the two NICs and Japan (rest of the world) will also be tested.

Methodology

Following Rose and Yellen (1989a and 1989b) and Rose (1991a and 1991b), the direct estimation of non-structural equations will be used to estimate the effects of real exchange rates on the trade balance.[17]

$$B = B\ (q,\ Y,\ Y^{*}) \qquad [1]$$

Equation [1] is the non-structural equation of interest to our study. In this equation, B is the domestic real trade balance, defined as the value of net exports in

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[17] According to Rose and Yellen, the use of a single non-structural equation to estimate the relationship between the real exchange rate and the trade balance is much easier than the prevalent structural approach, which requires estimation of the structural parameters. They claim another advantage of using non-structural equation is to resolve the simultaneity problem; choosing valid instruments in the non-structural equation is less difficult than obtaining correct specifications of the structural price and volume equations. Finally, Rose and Yellen note that investigators employing the detailed structural approach have frequently imposed priors in their estimation and implicitly assumed the validity of the structural equations. This strategy is consciously avoided, they said, by imposing extensive tests for the sensitivity of the (non-structural) model. The working paper version of Rose and Yellen (1989a) provides a detailed discussion of these arguments.

domestic currency deflated by the domestic price level (P), q is the real exchange rate,[18] and Y (Y^*) is the level of real income measured in domestic (foreign) output.

Determining the signs of the long- and short-run derivative Db/dq is the primary objective of the study. If db/dq is positive, it means that the Bickerdike-Robinson-Metzler (BRM) condition or the generalized Marshall-Lerner condition is satisfied.[19] The estimated empirical equations are the log-linear approximations to equation [1] augmented by a "suitable" number of lags of the independent variables, a constant, and a disturbance term. Finally, Rose and Yellen have pointed out that a simultaneity exists between the trade balance and the current values of income and exchange rate. Therefore, two stage least squares (2SLS) will be used to estimate equation [1].

Data and Preliminary Analysis

The bilateral import and export values are taken from the OECD Monthly Trade Statistics. The domestic and foreign Consumer Price Index (CPI), the Wholesale Price Index (WPI), Industrial Production Index (IP) (used as a proxy for real

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[18] The real exchange rate, q is equal to $(E \cdot P^*) / P$, where E is the nominal exchange rate (defined as the domestic currency price of foreign exchange) and P^* is the foreign price level, and P is the domestic price level.

[19] In the case of initially balanced trade and infinite supply elasticities in both home and foreign countries, BRM reduces to the Marshall-Lerner condition.

output), nominal exchange rate (E), and three instrumental variables - money supply (M1), government consumption, and the current account balance - are taken from the IMF International Financial Statistics or from the Financial Statistics, Taiwan District, ROC. All the variables are measured in real terms using the CPI as the price deflator[20]. The equation is estimated in logarithmic form.[21]

All the data are quarterly and span the first quarter of 1971 (1972) through the fourth quarter of 1991 for Taiwan (South Korea). The beginning point of the analysis is dictated by the availability of a consistent data series for the instrumental variables.[22]

Two preliminary tests, unit-roots and co-integration

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[20] In calculating Taiwan's and South Korea's real exchange rate and real effective exchange rate, the foreign Wholesale Price Index (WPI) is used instead of Consumer Price Index (CPI), because WPI reflects more appropriately the price of "traded" goods. For some countries (France, Australia, and Malaysia), the CPI is used instead because the WPI is either unavailable or the data are inconsistent.

[21] In Rose and Yellen (1989a and 1989b) and Rose (1991a and 1991b), domestic and foreign interest rates are also used as instrumental variables. However, due to the capital controls during most of the 1970s and 1980s in Taiwan and South Korea, this study does not use interest rates as instruments. Instead, the domestic and foreign current account balances are used as instruments. Lindner (1992), argues that the balance of payments is one of the factors that affects South Korea's "managed floating" exchange rate.

[22] The data series needed to calculate (lagged) real (effective) exchange rate start from the fourth quarter of 1968 for Taiwan and the fourth quarter of 1969 for South Korea.

tests, are applied to each variable in equation [1]. Unit-root tests show whether a time-series variable is stationary. If unit-roots are found in time-series variables, these variables are not stationary, which means some transformation (e.g. first-differencing of the non-stationary variables) is necessary.[23] Co-integration analysis indicates whether there exists a stable linear steady-state relationship between a set of variables (e.g. the trade balance, the real exchange rate, and domestic and foreign output) when all these variables have been found to have unit-roots. A set of variables are co-integrated if each individual variable is not stationary (i.e. has unit-root), but some linear combination of all the variables is stationary (i.e. does not have unit-root). If variables in equation [1] are found to have unit-roots but are co-integrated, the hypothesis that there is a stationary linear relationship linking the trade balance to the (logarithms of the) real exchange rate and domestic and foreign output should be accepted.

Unit-Roots Tests

A time series variable X is said to have unit-root if

[23] Without the transformation, the regression results of these non-stationary variables will be "spurious" and the standard errors of the coefficients will be under-estimated.

its autoregressive representation has the form:[24]

$$(1-L)X_t = \Phi_1(1-L)X_{t-1} + \ldots + \Phi_p(1-L)X_{t-p} + \epsilon_t \qquad [2]$$

where ϵ is a stationary random error term, $\Sigma\Phi_i$ $(i=1,\ldots,p) < 1$, and $L^kX_t \equiv X_{t-k}$.

To test whether variable X has a unit-root, the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests use the following regression:

$$(1-L)X_t = \beta X_{t-1} + \Sigma\Phi_i(1-L)X_{t-i} + \epsilon_t \qquad (i=1,\ldots,p) \qquad [3]$$

A significant negative estimate of β means the null hypothesis (i.e. variable X has unit-root) can be rejected. However, the test statistics in the "t-like" DF and ADF tests are not distributed as the traditional "Student's t" under the null hypothesis. The test statistics and the critical values for the DF and ADF tests are obtained using the statistical software package Microfit 3.0.

Table 6 reports the ADF tests for unit-roots of variables B, Y, Y*, and q in equation [1].[25] Because of the quarterly nature of the data, four augmented lags are chosen in the ADF tests.[26] The sample period, which covers

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[24] This discussion of unit-roots is adopted from Rose (1991a and 1991b).

[25] As we need to estimate six "pairs" of trade flows (i.e. Taiwan-U.S., Taiwan-Japan, South Korea-U.S., South Korea-Japan, Taiwan-Rest of the World, and South Korea-Rest of the World) in equation [1], there are seventeen variables [B(6), Y(2), Y^*(3), and q(6)] to be tested for unit-root.

[26] In the ADF tests, a constant term is included in equation [3]. Moreover, in the ADF tests with trend case, a time trend is also included in equation [3].

TABLE 6

AUGMENTED DICKEY-FULLER (ADF)
UNIT-ROOT TESTS[1]

Variable[2]	Without Trend	With Trend
RTUB	-1.45	-1.53
RTJB	-.70	-2.47
RKUB	-1.80	-1.86
RKJB	-3.09+	-4.07+
RTWTB	-1.29	-2.52
RKRTB	-2.10	-2.32
LTWIP	-.77	-2.36
LUSIP	-.77	-3.76+
LKRIP	-1.54	-2.48
LJPIP	.51	-3.90+
LWIP	-.28	-3.80+
LTWRER	-.57	-1.52
LTWRERJ	-2.26	-2.91
LKRRER	-.76	-1.30
LKRRERJ	-2.91+	-2.89
LTWREER	-.82	-1.85
LKRREER	-.92	-1.56

1. The ADF(4) 95% Critical Value is -2.90 for the without trend case and is -3.47 for the with trend case. A + indicates that the null hypothesis (i.e. variable has unit-root) can be rejected at the 95% level.

2. RTWB, RTJB, RKUB, RKJB, RTWTB, and RKRTB are the real trade balance variables between Taiwan and U.S. and Japan, Korea and U.S. and Japan, Taiwan and the rest of the world (ROW), and Korea and the ROW, respectively. LTWIP, LUSIP, LKRIP, LJPIP, and LWIP are the industrial production variables for Taiwan, U.S., Korea, Japan, and the world, respectively. LTWRER, LTWRERJ, LKRRER, and LKRRERJ are the bilateral real exchange rate between Taiwan and U.S. and Japan, and Korea and U.S. and Japan, respectively. LTWREER and LKRREER are, respectively, Taiwan and Korea's real effective exchange rate. Together, these variables represent B, Y, Y*, and q in equation [1] for six pairs of countries.

the flexible exchange rate period, is from the second quarter of 1973 to the fourth quarter of 1991. Seventy five observations are included for each variable.

With a few exceptions, the test statistics in Table 6 show that most variables in equation [1] have unit-roots (or are not stationary) in all six pairs of countries.[27] This finding is consistent with the bilateral and aggregate results of Rose and Yellen (1989a and 1989b) and Rose (1991a and 1991b) for the OECD countries. Therefore, in order to have a "non-spurious" result when testing equation [1], it is necessary to take the first differences of all the variables in Table 6.

Co-Integration Tests

Given that the variables in equation [1] are found to have a unit-root, we can then examine whether these variables are co-integrated. Two methods are used to check for co-integration. The first method uses the DF and ADF tests for unit-root of the residuals from a regression of each of the variables in equation [1] (e.g. the real trade balance) on the other three variables (e.g. the log of real exchange rate, real domestic and foreign output). If the residuals are found to have a unit-root, variables in

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[27] The variable plots show that only the five output variables have trend. Even though the unit-root hypothesis can be rejected for some output variables, twelve out of seventeen variables in Table 4 are found to have unit-root.

equation [1] are not co-integrated.[28] Table 7 reports the unit-root test results for six pairs of countries. Since all of the DF and most ADF test statistics are not significant (i.e., the null hypothesis that the residuals have a unit-root cannot be rejected), we can conclude that the variables in equation [1] are not co-integrated in all six cases. Therefore, first differencing of the variables is appropriate.

The second method to test for co-integration is to use the Johansen maximum-likelihood-ratio test to examine the number of co-integrating vectors (r) among the total co-integrating variables (m). If r = 0 cannot be rejected, it indicates that there is no co-integration relationship among the variables in equation [1]. If r = m cannot be rejected, it indicates that the hypothesis that the variables in equation [1] have a stationary process cannot be rejected. Table 8 reports the Johansen maximum-likelihood-ratio test results. The number of co-integrating vectors equal to zero cannot be rejected at both the 95% and 90% levels in the Taiwan-U.S. and Taiwan-ROW (Rest of the World) cases. The largest number of co-integrating vectors appear in the Taiwan-Japan case and is less than or equal to three. The

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[28] Since every variables in equation [1] can be used as a regressand, ADF unit-root tests are applied to four groups of residuals (from four regressions) for each of six pairs of trade flows.

TABLE 7

CO-INTEGRATION TESTS[1]
(UNIT-ROOT TESTS FOR RESIDUALS)

Regressand	DF/ADF	TW-US	TW-JP	KR-US	KR-JP	TW-ROW	KR-ROW
B	DF	-3.14	-2.85	-3.09	-3.62	-3.33	-4.20
	ADF(1)	-2.06	-2.82	-2.55	-3.29	-3.16	-3.29
	ADF(2)	-2.09	-2.12	-1.76	-2.65	-1.88	-2.63
	ADF(3)	-1.30	-2.09	-1.08	-2.08	-1.93	-2.13
	ADF(4)	-2.18	-2.81	-2.21	-3.27	-1.95	-2.77
q	DF	-2.38	-3.11	-2.39	-2.58	-2.64	-2.18
	ADF(1)	-2.39	-3.63	-2.18	-2.78	-3.44	-2.21
	ADF(2)	-2.31	-2.89	-1.67	-2.28	-2.21	-1.87
	ADF(3)	-1.66	-2.85	-1.34	-2.00	-2.19	-1.75
	ADF(4)	-2.79	-3.19	-1.87	-2.35	-2.79	-1.89
Y	DF	-2.99	-3.30	-3.03	-3.62	-2.94	-3.46
	ADF(1)	-2.64	-3.37	-3.72	-3.56	-3.27	-4.04
	ADF(2)	-3.19	-3.26	-3.49	-3.81	-3.06	-4.47+
	ADF(3)	-2.35	-3.46	-3.39	-4.06	-2.98	-4.54+
	ADF(4)	-3.34	-4.09	-4.42+	-4.41+	-2.91	-4.81+
Y*	DF	-3.03	-3.85	-2.74	-3.11	-3.35	-3.03
	ADF(1)	-4.02	-3.82	-3.81	-3.27	-4.04	-3.99
	ADF(2)	-3.10	-3.44	-3.58	-3.74	-3.46	-4.07
	ADF(3)	-2.90	-3.46	-3.74	-4.35+	-2.85	-4.24
	ADF(4)	-4.51+	-4.46+	-4.78+	-3.83	-4.88+	-4.06

1. The 95% critical value is -4.2491 for the DF, -4.2512 for the ADF(1), -4.2534 for the ADF(2), -4.2556 for the ADF(3), and -4.2579 for the ADF(4). A + indicates that the hypothesis of unit-root residuals can be rejected at the 95% level.

TABLE 8

CO-INTEGRATION TESTS[1]
(JOHANSEN MAXIMUM LIKELIHOOD RATIO TESTS)

Country	Null	Alternative	Statistic	95% C.V.	90% C.V.
TW-US	$r = 0$	$r = 1$	21.75	27.07	24.73
TW-JP	$r \leq 3$	$r = 4$	.97	3.76	2.69
KR-US	$r \leq 2$	$r = 3$	9.59	14.07	12.07
KR-JP	$r \leq 2$	$r = 3$	11.68	14.07	12.07
TW-ROW	$r = 0$	$r = 1$	23.64	27.07	24.73
KR-ROW	$r \leq 2$	$r = 3$	5.18	14.07	12.07

1. r represent the number of co-integrating vectors.

co-integrating vectors in all the Korean cases are less than or equal to two.[29] This finding is consistent with what Rose (1991a and 1991b) has found for the OECD countries. Since the number of co-integrating vectors in every case is less than the number of co-integrating variables (which is equal to four), we conclude that the Johansen maximum-likelihood-ratio test results indicate that variables in equation [1] do not have a stationary process. Therefore, we are confirmed that it is appropriate to take the first differences of all the variables in Table 6.

Empirical Results

This section presents results from estimating equation [1]. The estimated equation of the cumulative impact of the exchange rate and output takes the following form of equation [1]:

$$\Delta B_t = \alpha + \Sigma \beta_i \Delta q_{t-i} + \Sigma \Gamma_j \Delta Y_{t-j} + \Sigma \Gamma_j^* \Delta Y^*_{t-j} + \epsilon_t \qquad [4]$$

where Δ stands for the first-differencing operation, i

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[29] At only the 95% level, the number of co-integrating vectors equal to zero can not be rejected in the Taiwan-U.S., Taiwan-Japan, and Taiwan-ROW cases. The highest number of co-integrating vectors, which is less than or equal to two, appears in the Korea-U.S. case. Table 8 reports results which assume the variables in equation [1] have a trend in Johansen maximum likelihood procedure. Variables plots indicate that two variables (i.e., trade balance and exchange rate) in equation [1] show no trend. We have re-run the tests assuming all the variables (in equation [1]) do not have a trend. The no-trend results show the highest number of co-integrating vectors at the 95% level is less than or equal to three and appears only in the Korea-Japan case.

represents the current and eight lags of real (first-differenced) exchange rate, j represents the current and two lags of real (first-differenced) domestic and foreign output, and ϵ_t is a random error term.

Because of the simultaneity problem between the exchange rate and trade balance and the unit-root of the variables in equation [1], two stage least squares and first-differencing of the variables are employed in the tests. Our study will report the test results with current and eight (two) lags of the exchange rate (domestic and foreign output) as independent variables. The results with different lags for the exchange rate and domestic and foreign output are similar to the ones we report here.[30] The instrumental variables estimation of equation [1] for the six pairs of countries are presented in Tables 37-42 of

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[30] We have used the Akaike Information Criterion (AIC) to choose the maximum number of lags which yields the minimum value for the AIC (the AIC is calculated as $\sigma^2 \exp(2K/N)$, where $\sigma^2 = e'e/N$, N is the number of observations, K is the number of parameters, and e is the vector of OLS estimated residuals). We find that the number of exchange rate lags (with two lags of domestic and foreign output) which minimizes the AIC is less than or equal to eight in all cases. The exchange rate lags for each case is as follows: Taiwan-U.S. (6), Taiwan-Japan (4), Korea-U.S. (7), Korea-Japan (1), Taiwan-ROW (8), and Korea-ROW (2). This finding supports using eight exchange rate lags in estimating equation [1]. In the robustness tests section of Chapter III, we have re-estimated equation [1] with different exchange rate (and output) lags.

Appendix A.[31] In all six cases, none of the exchange rate coefficients is significant and no J-Curve (i.e. the initial negative real exchange rate coefficients turning to positive in later time periods) appears.[32]

Table 9 exhibits the cumulative impact of the exchange rate and domestic and foreign output on the trade balance of Taiwan and South Korea. All of the cumulative coefficients (except in the KR-JP case) have the expected signs, but none is significant. That is, even though the long-run effects of a real depreciation and an increase of foreign (domestic) output are beneficial (detrimental) to Taiwan's and South Korea's trade balance, the effects are not significant.

Table 10 reports the Wald test results of the hypothesis that the current and lagged exchange rate are

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[31] The instruments used includes an intercept term, two lags of real (effective) exchange rate, four lags of domestic and foreign (world) industrial production, current and three lags of foreign government consumption (in the Taiwan-ROW and Korea-ROW cases, no government consumption instruments are used), current and three lags of domestic and foreign money supply (M1) (in the Taiwan-U.S., Korea-U.S., Taiwan-ROW, and Korea-ROW cases, only the domestic country's M1 is used), and current and three lags of domestic and foreign current account balance (in the Taiwan-ROW and Korea-ROW cases, U.S. and Japan current account balances are used as "world" current account balances). All the instruments, except the current account balances, are the first differences of the logged real value with domestic and foreign CPI used as a deflator. Current account balances are the first differences of the real value.

[32] Since the instruments are possibly non-linear (see Rose and Yellen (1989a)), R^2 is meaningless in the instrumental variable estimation. For this reason, we do not report R^2 in the test results.

TABLE 9

TESTS OF SIGNIFICANCE OF CUMULATIVE
EXCHANGE RATE (OUTPUT) COEFFICIENT
1973Q1-1991Q4

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	$\Sigma\beta i$	190423.3	190902.6	.998[.322]
	$\Sigma\Gamma j$	-161649.2	123760.3	-1.306[.196]
	$\Sigma\Gamma^* j$	245268.2	192787.1	.272[.207]
TW-JP	$\Sigma\beta i$	7774.7	12951.6	.600[.550]
	$\Sigma\Gamma j$	-21522.6	10874.9	-1.979[.052]
	$\Sigma\Gamma^* j$	5156.0	13951.2	.370[.713]
KR-US	$\Sigma\beta i$	1180001.0	1575438.0	.749[.456]
	$\Sigma\Gamma j$	-1707629.0	1133463.0	-1.507[.136]
	$\Sigma\Gamma^* j$	2840744.0	1756884.0	1.617[.110]
KR-JP	$\Sigma\beta i$	-201565.1	766362.4	-.263[.793]
	$\Sigma\Gamma j$	178160.0	807751.4	.221[.862]
	$\Sigma\Gamma^* j$	181469.2	686591.5	.264[.792]
TW-ROW	$\Sigma\beta i$	1180.0	824.5	1.431[.157]
	$\Sigma\Gamma j$	-307.3	397.3	-.773[.442]
	$\Sigma\Gamma^* j$	40.1	586.4	.068[.946]
KR-ROW	$\Sigma\beta i$	17582.8	15648.7	1.124[.265]
	$\Sigma\Gamma j$	-11004.9	9495.6	-1.159[.250]
	$\Sigma\Gamma^* j$	11917.5	11833.0	1.007[.317]

TABLE 10

WALD TESTS OF EXCHANGE RATE COEFFICIENTS
1973Q1-1991Q4[1]

Country	Wald Statistics Value	Probability level
TW-US	2.4934	.981
TW-JP	9.1520	.423
KR-US	5.4512	.793
KR-JP	12.6953	.177
TW-ROW	15.5151	.078
KR-ROW	9.7086	.375

1. The 95% critical value of CHI-SQ(9) is 16.9190.

jointly significant as determinants of the trade balance. As the Wald statistics are not significant in all cases, we conclude that the null hypothesis [i.e. β_i (i=0, ... ,8) = 0] in equation [4] can not be rejected. In other words, the current and lagged (first-differenced) real exchange rates are jointly insignificant in determining the trade balances in all cases.

In summary, our results are similar to those of Rose and Yellen (1989a and 1989b) and Rose (1991a and 1991b) for the major OECD countries. They indicate that there is no J-Curve in either the bilateral or aggregate trade of two Asian NICs, Taiwan and South Korea. Moreover, our results show that none of the exchange rate coefficients is significant in determining the trade balance.

Robustness Checks

The results of previous section are contrary to most previous studies. As our study has used a different statistical technique (i.e., first-differenced data and two stage least squares) in the tests, it is of interest to examine whether these different techniques are responsible for the results. Several robustness tests, adopted from Rose and Yellen (1989a and 1989b), are included. The test results are reported in the following sections.

Use of Different Instruments, Time Periods, Lag Numbers, and Estimation Methods

Since there are doubts about the suitability of the instrumental variables used in estimation of equation [1] [see Rose and Yellen (1989a and 1989b)], we have re-estimated the equation using different sets of instruments. The instruments used include various combinations of domestic and foreign money supplies, government consumption, current account balance, lagged exchange rate and lagged output. However, none of the results shows any significant changes from those reported in the previous section. Table 11 exhibits the cumulative impact of the exchange rates and output on the trade balance using a different set of instrumental variables.[33] As we can see, almost all the coefficients in Table 11 have the correct signs but none of the cumulative exchange rate coefficients is significant. Moreover, the instrumental variable estimation of current and lagged values of the variables (not reported in this

[33] The instruments used in the bilateral trade cases (i.e. TW-US, TW-JP, KR-US, and KR-JP) include an intercept term, four lags of the exchange rate and domestic and foreign industrial production, and current and three lags of domestic and foreign money supplies and current account balances. The instruments used in the aggregate trade cases (i.e. TW-ROW and KR-ROW) include an intercept term, four lags of effective exchange rates and domestic and world's industrial production, current and three lags of domestic, the U.S., and Japan's money supply, current and three lags of domestic, the U.S., and Japan's government consumption, and current and three lags of domestic current account balances.

TABLE 11

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS WITH A NEW SET OF INSTRUMENTS 1973Q1-1991Q4[1]

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σßi	56559.4	106052.5	.910[.366]
	ΣΓj	-75989.4	53519.8	-1.420[.160]
	ΣΓ*j	149738.6	92151.4	1.625[.109]
TW-JP	Σßi	5039.4	17227.4	.293[.771]
	ΣΓj	-19358.0	11700.0	-1.655[.102]
	ΣΓ*j	6239.3	15163.5	.411[.682]
KR-US	Σßi	1425417.0	1445273.0	.986[.327]
	ΣΓj	-1718018.0	1010598.0	-1.700[.093]
	ΣΓ*j	3084469.0	1538870.0	2.004[.049]+
KR-JP	Σßi	-141014.2	794680.8	-.177[.860]
	ΣΓj	71004.7	729447.8	.097[.923]
	ΣΓ*j	315067.5	735601.0	.428[.670]
TW-ROW	Σßi	673.2	408.2	1.649[.104]
	ΣΓj	-169.5	198.1	-.856[.395]
	ΣΓ*j	74.2	278.9	.266[.791]
KR-ROW	Σßi	10878.4	11039.3	.985[.328]
	ΣΓj	-10267.7	6388.3	-1.607[.112]
	ΣΓ*j	5701.1	8911.3	.640[.524]

1. A + indicates that the coefficient is significant at the 95% level.

study) also give no indication of significant exchange rate coefficients or existence of a J-curve.

The second robustness test involves re-estimating equation [1] for different time periods. We have re-estimated equation [1] with the data going back to the first quarter of 1971 for Taiwan and the first quarter of 1972 for South Korea, as these are the earliest time that the lagged instrumental variables data are available in both economies. Furthermore, the nominal exchange rate in Taiwan (South Korea) was fixed prior to February 1979 (1980), after which a managed floating regime was instituted in both economies. We have estimated equation [1] using the first quarter of 1981 as the starting point for both countries. The test results, based on these different time periods, again, do not show any significant changes from those we reported previously. Tables 12 and 13 report the cumulative impact of the exchange rate and output on the trade balance for the 1971Q4-1991Q4 (1972Q4-1991Q4 for South Korea) and 1981Q1-1991Q4 periods respectively. Similar to our previous findings, we observe that almost all the coefficients in both tables have the correct signs, but only two of them are significant (both for the 1981Q1-1991Q4 period). The only case where real depreciation improves the trade balance significantly in the long run is trade between Taiwan and the rest of the world (TW-ROW).However, from the results for individual current and lagged coefficients (not reported

TABLE 12

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS 1971Q4-1991Q4[1]

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σβi	183369.9	191353.9	.958[.341]
	Σγj	-161682.5	118322.4	-1.367[.176]
	Σγ*j	253477.6	193223.0	1.312[.193]
TW-JP	Σβi	17369.0	17979.7	.966[.337]
	Σγj	-24861.5	12577.1	-1.977[.052]
	Σγ*j	10089.2	14885.4	.678[.500]
KR-US	Σβi	443290.9	1930493.0	.230[.819]
	Σγj	-2461089.0	1275647.0	-1.929[.058]
	Σγ*j	3557554.0	2307799.0	1.542[.127]
KR-JP	Σβi	-28218.4	732918.6	-.039[.969]
	Σγj	128771.9	826579.7	.156[.877]
	Σγ*j	357054.5	639525.7	.558[.578]
TW-ROW	Σβi	1198.6	961.7	1.246[.216]
	Σγj	-407.5	463.6	-.879[.382]
	Σγ*j	154.6	696.1	.222[.825]
KR-ROW	Σβi	15064.5	15493.3	.972[.334]
	Σγj	-11158.2	9441.7	-1.182[.241]
	Σγ*j	9265.9	11125.5	.833[.408]

1. For the KR-US, KR-JP, and KR-ROW cases, the time period is 1972Q4-1991Q4.

TABLE 13

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS 1981Q4-1991Q4[1]

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σβi	103734.9	82686.4	1.255[.217]
	Σγj	-57611.5	62532.9	-.921[.362]
	Σγ*j	143288.8	109358.6	1.310[.197]
TW-JP	Σβi	10239.4	19260.0	.532[.598]
	Σγj	-33482.1	12737.0	-2.629[.012]+
	Σγ*j	9703.2	26898.9	.361[.720]
KR-US	Σβi	2633843.0	1437862.0	1.832[.047]
	Σγj	-740942.0	2151767.0	-.344[.732]
	Σγ*j	869729.5	2325489.0	.374[.710]
KR-JP	Σβi	1872113.0	991796.2	1.888[.066]
	Σγj	-2544899.0	1814200.0	-1.403[.168]
	Σγ*j	1338495.0	1631956.0	.820[.417]
TW-ROW	Σβi	1315.2	609.0	2.160[.037]+
	Σγj	33.6	268.6	.125[.901]
	Σγ*j	37.3	595.7	.063[.950]
KR-ROW	Σβi	11853.0	17775.0	.667[.509]
	Σγj	-19511.5	20789.3	-.939[.353]
	Σγ*j	29195.3	28400.0	1.028[.310]

1. A + indicates that the coefficient is significant at the 95% level.

in this study), there reveal absence of a J-curve in all cases.

It is possible that the number of lags in the real exchange rate and domestic and foreign output can affect the test results. Therefore, equation [1] is re-estimated with four and twelve lags of real (first-differenced) exchange rates and four lags of real (first-differenced) domestic and foreign output. Tables 14-16 report the cumulative impact of the exchange rate and output for the different lags. A few more coefficients have the wrong sign, but are insignificant, in all cases. In none of the cases does the exchange rate have a significant long-run effect on the trade balance. Individual coefficient estimates (not reported in this study) show several lagged exchange rate coefficients are "randomly" significant in some cases. However, none of the signs of the exchange rate coefficients changes from negative to positive as the lags increase. That is, we can not find the existence of J-curve in any of the cases.

Finally, following the conventional approach, equation [1] is re-estimated using ordinary least squares (OLS). Table 17 reports the cumulative impact of the exchange rate and output on the trade balance. Most coefficients have the correct signs, but only three of them are significant. The long-run impact of exchange rate is significant only in the KR-US (Korea-U.S.) case. Individual-coefficients estimates

TABLE 14

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS WITH FOUR LAGS OF EXCHANGE RATE 1973Q4-1991Q4[1]

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σßi	135140.0	102433.9	1.319[.191]
	Σγj	-103083.7	55993.1	-1.841[.070]
	Σγ*j	232991.2	84686.0	2.751[.008]+
TW-JP	Σßi	3557.6	8854.6	.402[.689]
	Σγj	-24620.1	8830.6	-2.788[.007]+
	Σγ*j	8661.0	11110.6	.780[.438]
KR-US	Σßi	942807.2	1344136.0	.701[.485]
	Σγj	-74975.6	1145866.0	-.065[.948]
	Σγ*j	1943612.0	1507092.0	1.290[.201]
KR-JP	Σßi	-296160.1	496063.4	-.597[.552]
	Σγj	-80795.2	636084.4	-.127[.899]
	Σγ*j	268162.7	629067.7	.426[.671]
TW-ROW	Σßi	16.0	399.8	.040[.968]
	Σγj	10.7	225.1	.048[.962]
	Σγ*j	367.4	353.0	1.041[.302]
KR-ROW	Σßi	445.7	12572.8	.035[.972]
	Σγj	1478.3	7779.9	.190[.850]
	Σγ*j	4661.6	10442.6	.446[.657]

1. A + indicates that the coefficient is significant at the 95% level.

TABLE 15

TESTS OF SIGNIFICANCE OF CUMULATIVE
EXCHANGE RATE (OUTPUT) COEFFICIENTS
WITH TWELVE LAGS OF EXCHANGE RATE
1973Q1-1991Q4

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	$\Sigma\beta i$	264138.0	155506.0	1.699[.094]
	$\Sigma\Gamma j$	-56772.8	79968.3	-.710[.480]
	$\Sigma\Gamma^* j$	103443.9	124405.0	.832[.408]
TW-JP	$\Sigma\beta i$	13063.4	23999.3	-.544[.588]
	$\Sigma\Gamma j$	-13747.4	13711.2	-1.003[.319]
	$\Sigma\Gamma^* j$	5985.9	18483.1	.324[.747]
KR-US	$\Sigma\beta i$	994267.4	2094936.0	.475[.637]
	$\Sigma\Gamma j$	-3462740.0	2197562.0	-1.576[.120]
	$\Sigma\Gamma^* j$	2347819.0	2363907.0	.993[.324]
KR-JP	$\Sigma\beta i$	352256.5	1023083.0	.344[.732]
	$\Sigma\Gamma j$	46267.6	885987.7	.052[.959]
	$\Sigma\Gamma^* j$	301001.5	854328.9	.352[.726]
TW-ROW	$\Sigma\beta i$	-238.4	1338.0	-.178[.859]
	$\Sigma\Gamma j$	-321.0	507.1	-.633[.529]
	$\Sigma\Gamma^* j$	-403.0	760.5	-.530[.598]
KR-ROW	$\Sigma\beta i$	4791.7	28443.7	.168[.867]
	$\Sigma\Gamma j$	-27494.2	23887.0	-1.151[.254]
	$\Sigma\Gamma^* j$	1046.9	23865.2	.044[.965]

TABLE 16

TESTS OF SIGNIFICANCE OF CUMULATIVE
EXCHANGE RATE (OUTPUT) COEFFICIENT
WITH FOUR LAGS OF OUTPUT
1973Q1-1991Q4

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σβi	152558.6	163413.6	.934[.354]
	Σγj	-112615.2	177120.6	-.636[.527]
	Σγ*j	186320.6	240322.5	.775[.441]
TW-JP	Σβi	-9623.8	23709.3	-.406[.686]
	Σγj	12293.4	25290.7	.486[.628]
	Σγ*j	-26845.0	30058.9	-.893[.375]
KR-US	Σβi	2349332.0	1477228.0	1.590[.116]
	Σγj	-2243170.0	2401182.0	-.934[.353]
	Σγ*j	4591166.0	2974425.0	1.544[.127]
KR-JP	Σβi	218569.6	1302399.0	.168[.867]
	Σγj	-471815.6	1604622.0	-.294[.770]
	Σγ*j	788425.7	1877820.0	.420[.676]
TW-ROW	Σβi	580.3	1344.6	.432[.667]
	Σγj	299.8	1085.8	.276[.783]
	Σγ*j	-1368.6	1749.8	-.782[.437]
KR-ROW	Σβi	655.4	25316.2	.026[.979]
	Σγj	1962.5	30590.8	.064[.949]
	Σγ*j	15355.2	36535.6	.420[.676]

TABLE 17

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS USING OLS WITH FIRST-DIFFERENCED DATA 1973Q1-1991Q4[1]

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σβi	74905.9	44136.8	1.697[.094]
	Σγj	-6411.9	25050.7	-.256[.779]
	Σγ*j	36581.2	42223.8	.866[.389]
TW-JP	Σβi	-606.0	11219.1	-.054[.957]
	Σγj	-24105.7	7129.4	-3.381[.001]+
	Σγ*j	8723.1	9616.3	.907[.367]
KR-US	Σβi	1350510.0	619790.5	2.179[.033]+
	Σγj	-1039450.0	580370.9	-1.791[.077]
	Σγ*j	1820834.0	700911.5	2.598[.011]+
KR-JP	Σβi	409066.5	321016.2	1.274[.207]
	Σγj	-398854.5	375797.2	-1.061[.292]
	Σγ*j	619501.0	399749.3	1.550[.126]
TW-ROW	Σβi	503.1	338.2	1.488[.145]
	Σγj	32.5	177.8	.183[.856]
	Σγ*j	24.1	325.7	.074[.941]
KR-ROW	Σβi	5349.9	6088.0	.879[.382]
	Σγj	-4709.1	4447.0	-1.059[.293]
	Σγ*j	1525.4	6259.5	.244[.808]

1. A + indicates that the coefficient is significant at the 95% level.

(not reported in this study) show some lagged exchange rates are randomly significant in several cases. But again, none of the exchange rate coefficients exhibits a J-curve effect.

Use of Real Imports and Exports as Regressands and the Use of Partial Adjustment Equations

Because this study uses the net trade balance as the dependent variable, the effects of the real exchange rate on import and export values separately (e.g., the perverse effect of real depreciation on import value as described by the J-curve effect) may be disguised. For this reason, we have re-estimated the equations with real exports and imports as separate regressands.[34] Tables 18 and 19 report the cumulative effect of exchange rate and domestic and foreign output on exports and imports respectively. Table 18 shows that real depreciation (and increase of foreign output) has the expected (positive) effect on the domestic

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[34] There is another advantage to using imports and exports separately as regressands. Since both Taiwan and South Korea are small countries, most of their exports are denominated in foreign currencies (especially in U.S.$) [see Krugman and Baldwin (1987)]. If Taiwan's and South Korea's exports are denominated in U.S.$, the real depreciation of N.T.$ and Won against U.S.$ shall increase their export value (in domestic currencies) in the short run. This is different from what the J-curve effect predicts, because it is based on the assumption that exports are denominated in domestic currency. Testing imports and exports separately should tell us whether Taiwan's and South Korea's export value increases in the short run following a real depreciation. If this is the case, we may conclude that (part of) the reason that we fail to find a J-curve effect is because both Taiwan and South Korea are small countries.

TABLE 18

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS BY USING EXPORT AS REGRESSAND 1973Q1-1991Q4

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σßi	101106.3	92929.6	1.088[.280]
	ΣΓj	-47920.6	60245.3	-.795[.429]
	ΣΓ*j	124555.9	93846.9	1.327[.189]
TW-JP	Σßi	26721.2	15754.2	1.696[.094]
	ΣΓj	10473.4	11047.9	.948[.346]
	ΣΓ*j	4433.2	14173.2	.313[.755]
KR-US	Σßi	1051187.0	1574704.0	.668[.507]
	ΣΓj	-725425.4	1132936.0	-.640[.524]
	ΣΓ*j	1954336.0	1756066.0	1.113[.269]
KR-JP	Σßi	211525.4	759072.9	.279[.781]
	ΣΓj	779521.5	800068.1	.974[.338]
	ΣΓ*j	182477.9	680060.6	.268[.789]
TW-ROW	Σßi	826.6	559.2	1.478[.144]
	ΣΓj	-35.7	269.5	-.132[.895]
	ΣΓ*j	240.7	397.7	.605[.547]
KR-ROW	Σßi	18431.4	21389.7	.862[.392]
	ΣΓj	-3138.8	12979.2	-.242[.810]
	ΣΓ*j	12393.0	16174.1	.766[.446]

TABLE 19

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS BY USING IMPORT AS REGRESSAND 1973Q1-1991Q4[1]

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σβi	-89317.0	120318.9	-.742[.460]
	Σγj	113728.6	78001.6	1.458[.149]
	Σγ*j	-120712.3	121506.7	-.993[.324]
TW-JP	Σβi	23602.0	17286.7	1.365[.176]
	Σγj	31995.9	12122.6	2.639[.010]+
	Σγ*j	-722.9	15551.9	-.046[.963]
KR-US	Σβi	-128814.8	818893.2	-.157[.875]
	Σγj	982203.6	589161.0	1.667[.100]
	Σγ*j	-886408.3	913207.2	-.971[.335]
KR-JP	Σβi	413090.6	857090.0	.482[.631]
	Σγj	601361.4	903378.5	.666[.508]
	Σγ*j	1008.7	767874.6	.001[.999]
TW-ROW	Σβi	-353.4	596.6	-.592[.556]
	Σγj	271.6	287.5	.945[.348]
	Σγ*j	200.6	424.3	.473[.638]
KR-ROW	Σβi	848.6	16864.3	.050[.960]
	Σγj	7866.1	10233.2	.769[.445]
	Σγ*j	475.5	12752.2	.037[.970]

1. A + indicates that the coefficient is significant at the 95% level.

country's exports in the long run in all cases, but none of the effects is significant. Table 19 shows that an increase in domestic output has the expected (positive) effect on imports in the long run in all cases, but the effect is significant only in the TW-JP (Taiwan-Japan) case. The long-run effects of changes in the real exchange rate on imports are disappointing. It shows that in only three cases (TW-US, KR-US, and TW-ROW) does a real depreciation has negative effect on imports in the long run, and in none of these cases is the effect significant.

Table 20 reports the cumulative effect of the exchange rate and foreign output on exports and Table 21 reports the cumulative effect of the exchange rate and domestic output on imports respectively.[35] Except the output coefficient in Taiwan-Japan case, Table 20 shows all of the exchange rate and foreign output coefficients have the expected sign, but only one is significant (i.e., the exchange rate coefficient in Taiwan-Japan case). Except the exchange rate coefficient in Taiwan-Japan case, Table 21 also shows all the exchange rate and domestic output coefficients have the expected sign, but again, only one is significant (i.e. the output coefficient in Taiwan-Japan case).

Finally, from the individual coefficient results for

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[35] Dropping the domestic (foreign) output in the export (import) case is because domestic (foreign) output does not have a significant impact on domestic country's exports (imports).

TABLE 20

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE AND FOREIGN OUTPUT COEFFICIENTS BY USING EXPORTS AS REGRESSAND[1] 1973Q1-1991Q4

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σβi	68612.9	104223.2	.658[.512]
	Σγ*j	31858.5	63911.8	.498[.620]
TW-JP	Σβi	56517.1	23764.5	2.378[.020]+
	Σγ*j	-1538.5	17198.6	-.089[.929]
KR-US	Σβi	2068698.0	1985209.0	1.042[.301]
	Σγ*j	1735346.0	1846647.0	.940[.350]
KR-JP	Σβi	643481.3	522984.3	1.230[.222]
	Σγ*j	500737.4	514945.6	.972[.334]
TW-ROW	Σβi	843.6	815.9	1.034[.305]
	Σγ*j	100.8	418.6	.241[.810]
KR-ROW	Σβi	16920.9	31654.2	.535[.595]
	Σγ*j	11045.2	21046.4	.525[.601]

1. A + indicates that the coefficient is significant at the 95% level.

TABLE 21

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE AND DOMESTIC OUTPUT COEFFICIENTS BY USING IMPORTS AS REGRESSAND[1]
1973Q1-1991Q4

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	$\Sigma\beta i$	-80842.7	87661.2	-.922[.359]
	$\Sigma\Gamma j$	48537.5	35103.7	1.383[.171]
TW-JP	$\Sigma\beta i$	11286.5	19975.3	.565[.574]
	$\Sigma\Gamma j$	42213.1	13141.1	3.212[.002]+
KR-US	$\Sigma\beta i$	-258835.0	979407.0	-.264[.792]
	$\Sigma\Gamma j$	784073.5	603102.9	1.300[.198]
KR-JP	$\Sigma\beta i$	-1253036.0	1720075.0	-.728[.469]
	$\Sigma\Gamma j$	1886713.0	1581101.0	1.193[.237]
TW-ROW	$\Sigma\beta i$	-119.1	529.5	-.225[.823]
	$\Sigma\Gamma j$	242.5	173.2	1.400[.166]
KR-ROW	$\Sigma\beta i$	-2450.4	17928.4	-.137[.892]
	$\Sigma\Gamma j$	8017.2	9314.2	.861[.392]

1. A + indicates that the coefficient is significant at the 95% level.

both exports and imports (not reported in this study), we do not find, as predicted by the J-curve effect, any significant import value increase (decrease) in the short run (long run) or export value increase in the long run. These results further support our findings of no J-curve effect in previous section.[36] In order to check the sensitivity of results to the alternative dynamic specification of the trade balance equation, Rose and Yellen have re-estimated their model with four lags of the Dependent variable. They claim this partial adjustment equation is appropriate if the trade balance is characterized by a partial adjustment mechanism (i.e., the trade balance adjust only slowly to the exchange rate and output changes). Following their approach, we have also re-estimated equation [1] with four lags of the dependent variable. Table 22 shows the cumulative impact of the exchange rate and output on the trade balance. We find that the real exchange rate has a significant long-run effect on the trade balance in only one case (Korea-U.S.). Moreover, from the individual coefficient results (not reported in this study), we cannot find the existence of J-curve in any of the cases.

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[36] We also find that neither Taiwan's nor South Korea's export value (in domestic currencies) has increased significantly in the short run after real depreciation. This may imply that the failure to find a J-curve in our study is not because of both Taiwan and South Korea are small countries (See Footnote 34 for a discussion of this issue).

TABLE 22

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS THE PARTIAL ADJUSTMENT MODEL 1973Q1-1991Q4[1]

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σβi	89604.0	519007.7	.173[.863]
	Σγj	-177277.0	220811.6	-.803[.425]
	Σγ*j	270332.5	316982.9	.853[.397]
TW-JP	Σβi	14220.2	21924.0	.649[.519]
	Σγj	-9651.5	16061.8	-.601[.550]
	Σγ*j	-3150.6	18829.4	-.167[.868]
KR-US	Σβi	3514030.0	1699699.0	2.067[.042]+
	Σγj	-742190.6	869115.8	-.854[.396]
	Σγ*j	1549085.0	1364259.0	1.136[.260]
KR-JP	Σβi	-264663.7	936615.1	-.283[.778]
	Σγj	350328.3	1203987.0	.291[.772]
	Σγ*j	61189.7	1142173.0	.054[.957]
TW-ROW	Σβi	1812.5	1322.0	1.371[.175]
	Σγj	-64.7	598.6	-.108[.914]
	Σγ*j	-612.3	906.5	-.675[.502]
KR-ROW	Σβi	12618.3	20183.0	.625[.534]
	Σγj	-11561.7	11466.6	-1.008[.317]
	Σγ*j	10145.4	14985.8	.677[.501]

1. A + indicates that the coefficient is significant at the 95% level.

Using the Levels Instead of the Differences

Given that most previous studies used (logs of) levels rather than differences, we have re-estimated equation [1] with level data.[37] Both OLS and TSLS are applied to tests of equation [1]. Tables 23 and 24 report the OLS and 2SLS cumulative effect of exchange rate and output on the trade balance respectively. Despite some wrong signs, they show the long-run effects of the exchange rate have the appropriate sign and are significant in four (three for 2SLS) out of six cases. This finding shows that using the levels (instead of the differences) can alter the results regarding the long-run effects of exchange rate movements. However, when we examine individual exchange rate coefficients, shown in Tables 25 and 26, with the exception of one coefficient in the OLS Korea-Japan case, the exchange rate coefficients are insignificant in both the OLS and the 2SLS cases. Moreover, the J-curve phenomenon is not observable in either case.

The Traditional Test for the J-curve: The Polynomial (Almon) Distributed Lag (PDL) Model

Some previous studies (as example see Bahmani-Oskooee

[37] Examples of previous studies that use levels instead of differences include: Krugman and Baldwin (1987), Helkie and Hooper (1987), Noland (1989), and O'Neill and Ross (1991).

TABLE 23

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS USING OLS WITH NON-DIFFERENCED DATA 1973Q1-1991Q4[1]

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σßi	63056.9	9769.9	6.454[.000]+
	ΣΓj	31755.5	7180.8	4.422[.000]+
	ΣΓ*j	22229.9	23820.9	.933[.354]
TW-JP	Σßi	-13810.9	9103.5	-1.517[.134]
	ΣΓj	3392.8	1811.3	1.873[.065]
	ΣΓ*j	-22506.0	4166.9	-5.401[.000]+
KR-US	Σßi	1436957.0	94038.4	15.281[.000]+
	ΣΓj	-12092.1	41818.4	-.289[.773]
	ΣΓ*j	1337684.0	181825.7	.357[.000]+
KR-JP	Σßi	80803.7	93780.9	.862[.392]
	ΣΓj	-248786.0	41053.8	-6.060[.000]+
	ΣΓ*j	439170.5	119060.3	.689[.000]+
TW-ROW	Σßi	148.8	58.5	2.541[.013]+
	ΣΓj	84.8	32.2	.635[.010]+
	ΣΓ*j	126.5	109.0	1.161[.250]
KR-ROW	Σßi	8120.9	1034.5	7.850[.000]+
	ΣΓj	-236.9	406.0	-.584[.561]
	ΣΓ*j	4789.2	1611.6	2.972[.004]+

1. A + indicates that the coefficient is significant at the 95% level.

TABLE 24

TESTS OF SIGNIFICANCE OF CUMULATIVE EXCHANGE RATE (OUTPUT) COEFFICIENTS USING 2SLS WITH NON-DIFFERENCED DATA[1] 1973Q1-1991Q4

Country	Coefficient	Estimate	Standard Error	T-Ratio[Prob]
TW-US	Σβi	79849.6	15637.5	.106[.000]+
	Σγj	24034.7	10508.4	2.287[.025]+
	Σγ*j	65946.6	38891.4	1.696[.094]
TW-JP	Σβi	-37427.3	23733.5	-1.577[.119]
	Σγj	6543.3	2619.9	2.498[.015]+
	Σγ*j	-28712.6	6091.7	-4.713[.000]+
KR-US	Σβi	1435921.0	125350.0	11.455[.000]+
	Σγj	-3296.8	71808.2	-.046[.964]
	Σγ*j	1361064.0	300417.2	4.531[.000]+
KR-JP	Σβi	186243.3	118036.4	1.578[.119]
	Σγj	-231501.5	56343.3	-4.109[.000]+
	Σγ*j	349619.5	162278.4	2.154[.035]+
TW-ROW	Σβi	234.7	140.0	1.677[.098]
	Σγj	53.5	66.6	.804[.424]
	Σγ*j	285.6	259.7	1.100[.275]
KR-ROW	Σβi	8645.7	1253.8	6.895[.000]+
	Σγj	-588.6	673.2	-.874[.385]
	Σγ*j	6455.8	2538.8	2.543[.013]+

1. A + indicates that the coefficient is significant at the 95% level.

TABLE 25

T-RATIOS OF CURRENT AND LAGGED REAL EXCHANGE RATES BASED ON OLS AND NON-DIFFERENCED DATA[1]
1973Q2-1991Q4

Variable	TW-US	TW-JP	KR-US	KR-JP	TW-ROW	KR-ROW
q	-.17	-.35	.31	-2.44+	-.61	.74
q(-1)	.44	.74	-.72	.10	.05	-1.10
q(-2)	-.15	-.83	.35	-.13	1.02	.86
q(-3)	.04	-1.07	1.06	.67	-.60	.05
q(-4)	-.76	-.12	-.06	.30	-.60	.12
q(-5)	1.01	.93	.19	-.50	.65	.44
q(-6)	.24	-.21	.82	.10	.35	.20
q(-7)	.14	.49	1.34	1.65	.24	.75
q(-8)	.23	-1.80	.25	-.22	-.41	.95

1. A + indicates that the coefficient of the variable is significant at the 95% level.

TABLE 26

T-RATIOS OF CURRENT AND LAGGED REAL EXCHANGE RATES BASED ON 2SLS AND NON-DIFFERENCED DATA 1973Q2-1991Q4

Variable	TW-US	TW-JP	KR-US	KR-JP	TW-ROW	KR-ROW
q	.13	-.13	.57	.06	-.76	1.04
q(-1)	-.02	-.00	-1.71	-.74	.43	-1.32
q(-2)	-.07	.19	1.22	.14	.30	.84
q(-3)	.16	-1.17	.74	1.11	-.62	.26
q(-4)	-.17	-.69	-.30	-.56	.56	-.19
q(-5)	.49	1.97	.39	-.38	-.40	-.04
q(-6)	-.30	-1.06	.05	.17	.40	.19
q(-7)	.25	.85	.67	.90	.29	.39
q(-8)	-.03	-1.55	-.45	-.24	-.87	.33

(1985) and Noland (1989)) have imposed smoothness priors on the exchange rate (relative price) lag coefficients. One way of doing this is by constraining the lag coefficients to lie on a polynomial (Almon) distributed lag (PDL).[38] An Almon distributed lag model [Almon(m,r)] has the following form:

$$Y_t = a + \Sigma\ w_i X_{t-i} + u_t \qquad [5]$$

where $i = 0,1,\ldots,m$ is the number of lags and the weights (w_i) are determined by polynomials of order r:

$$w_i = b_0 + b_1 i + b_2 i^2 + \cdots + b_r i^r \qquad [6]$$

Because the multicollinearity between lags of the difference of the (log of the) real exchange rates is not significant, Rose and Yellen are reluctant to use PDLs.[39] However, given the tendency of many previous researchers (e.g., Helkie and Hooper (1987) and Krugman and Baldwin (1987)) to use PDL techniques, Rose and Yellen have incorporated PDLs in the OLS estimation of non-differenced data as one of their robustness checks. Our study also

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[38] An Almon distributed lag model is recommended if the number of lags of the independent variable is large and/or the collinearities between the lags are significant. See Almon (1965) for a discussion of the distributed lag model.

[39] Goldstein and Khan (1985) have pointed out two problems associated with using PDLs in trade models. The first problem is the "subjective prefiltering" by the researchers in choosing the number of lags, the degree of polynomials, and whether the end-point constraints should be imposed. The second problem is when using higher-order polynomials and a large number of lags, the coefficients for some of the lagged variables often have signs that are clearly at variance with theoretical expectations.

applies PDLs to the OLS estimation of non-differenced data.

By imposing PDLs to the non-differenced lagged exchange rates, we observe (a similar) J-curve phenomenon in all cases.[40] Table 27 reports the test statistics and t-ratios of the current and lagged exchange rates of an Almon(8,3) (Almon distribution with eight lags and third degree polynomial) imposed OLS estimation of non-differenced data.[41] It shows that the negative effect of real depreciation lasts from one to five quarters. The positive effect emerges after that and diminishes after the seventh quarters in all cases.[42] In addition to the expected signs, many coefficients are significant as well. When we impose the Almon(8,3) restriction on the first differenced data, however, we find the similar J-Curve phenomenon only appear in the Korea-U.S. and Korea-Japan cases (as shown in Table 28). In order to test for the existence of a J-curve (in the case of non-differenced data) is due to the

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[40] Rose and Yellen (1989) also found the existence of short J-curves when the PDL smoothness priors (with endpoint constraints) are imposed in the aggregate trade cases.

[41] As the AIC criterion has shown that the number of exchange rate lags are less than or equal to eight in all cases (See Footnote 30), we choose eight lags (without endpoint constraints) in our PDL models.

[42] One way of choosing the degree of polynomials is to choose the one with the lowest AIC given the number of lags is fixed. In this study, if we change the degrees of polynomial to two, the AIC is lower in the Korea-U.S., Korea-Japan, Taiwan-ROW, and Korea-ROW cases but is higher in the Taiwan-U.S. and Taiwan-Japan cases. The t-ratios based on the degree of polynomials with the lowest AIC are similar to the ones we report in Table 27.

TABLE 27

TEST STATISTICS OF CURRENT AND LAGGED REAL EXCHANGE RATES BY IMPOSING ALMON (8,3) TO THE NON-DIFFERENCED REAL EXCHANGE RATES 1973Q2-1991Q4[1]

Variable	TW-US	TW-JP	KR-US	KR-JP	TW-ROW	KR-ROW
q	17719	3881	-60178	-272670	34.02	-184.71
	(1.31)	(1.38)	(-.40)	(-3.47)+	(.56)	(-.16)
q(-1)	-3924	-3123	-953	-82855	-.90	25.69
	(-.72)	(-2.87)+	(-.02)	(-2.47)+	(-.04)	(.06)
q(-2)	-10009	-5090	68510	20260	-9.74	272.43
	(-1.19)	(-3.08)+	(.71)	(.43)	(-.27)	(.38)
q(-3)	-5477	-3741	140200	60536	-.91	548.27
	(-.78)	(-2.82)+	(1.66)	(1.58)	(-.03)	(.89)
q(-4)	4728	-801	206100	61836	17.16	845.97
	(.91)	(-.89)	(3.33)+	(2.29)+	(.78)	(1.85)
q(-5)	15667	2007	258200	48025	36.05	1158.30
	(2.11)+	(1.40)	(3.22)+	(1.18)	(1.16)	(1.90)
q(-6)	22396	2961	288490	42966	47.32	1478.00
	(2.62)+	(1.73)	(3.11)+	(.90)	(1.30)	(2.10)+
q(-7)	19973	337	288950	70521	42.56	1797.80
	(3.81)+	(.32)	(5.04)+	(2.43)+	(1.72)	(4.04)+
q(-8)	3456	7588	251570	154550	13.33	2110.50
	(.24)	(-2.56)+	(1.69)	(1.94)	(.21)	(1.78)

1. T-Ratios are in the parenthesis. A + indicates that the coefficient of the variable is significant at the 95% level.

TABLE 28

TEST STATISTICS OF CURRENT AND LAGGED REAL EXCHANGE RATES BY IMPOSING ALMON (8,3) TO THE DIFFERENCED REAL EXCHANGE RATES 1973Q2-1991Q4[1]

Variable	TW-US	TW-JP	KR-US	KR-JP	TW-ROW	KR-ROW
q	20618	243.2	-427540	-125240	74.88	-2344.1
	(1.49)	(.08)	(-1.43)	(-1.22)	(1.12)	(-1.02)
q(-1)	2763	-487.3	-182560	-41203	38.38	-1221.3
	(.38)	(-.30)	(-1.19)	(-.72)	(.99)	(-1.00)
q(-2)	-1558	-392.5	8405	13648	30.93	-399.1
	(-.19)	(-.23)	(.06)	(.21)	(.72)	(-.32)
q(-3)	2928	189.1	152740	47065	41.18	212.0
	(.37)	(.12)	(1.08)	(.77)	(.96)	(.18)
q(-4)	11493	919.2	257830	66802	57.78	701.3
	(1.58)	(.64)	(2.05)+	(1.24)	(1.39)	(.66)
q(-5)	19412	1459.4	331070	80611	69.38	1158.3
	(2.43)+	(.91)	(2.40)+	(1.42)	(1.57)	(1.00)
q(-6)	21956	1471.4	379850	96245	64.62	1672.4
	(2.57)+	(.87)	(2.51)+	(1.64)	(1.42)	(1.33)
q(-7)	14400	616.9	411540	121460	32.17	2333.0
	(1.80)	(.43)	(2.77)+	(2.37)+	(.76)	(1.89)
q(-8)	-7985	-1442.5	433550	164000	-39.33	3229.5
	(-.58)	(-.52)	(1.69)	(1.65)	(-.59)	(1.57)

1. T-Ratios are in the parenthesis. A + indicates that the coefficient of the variable is significant at the 95% level.

restriction imposed by PDLs on the exchange rate, we have conducted an F-test; the null hypothesis is that the PDL restrictions are not responsible for the J-curve effect. Table 29 report the F-statistics for our test. Since the F-statistics are not significant, we conclude that the PDLs restrictions are not responsible for our results.[43]

Conclusion

After a thorough study of Taiwan's and South Korea's trade balances with the United States, Japan, and the rest of the world, we do not find any J-Curve effects. In fact, we do not find that real exchange rate changes have a significant impact on the trade balance in any of cases. The Wald tests show that the hypothesis that the current and lagged (first-differenced) real exchange rates are jointly equal to zero cannot be rejected at the 95% level. The cumulative effects of the real exchange rate and domestic and foreign output have the (correct) *a priori* sign. That

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[43] This finding of a J-curve effect, though confirming traditional wisdom, is inappropriate given the problems mentioned previously. The existence of unit-roots and the simultaneity problems must be resolved in order to make valid statistical inferences. Since our applying of PDLs to the OLS estimation of non-differenced data does not solve either of these problems, the legitimacy of the results from Table 27 is thus questionable. Therefore, the findings of J-curve effects by previous researchers may be questioned since it is possible that they have used inappropriate statistical techniques.

TABLE 29

F - STATISTICS OF THE PDL RESTRICTIONS[1]

Country	F - Statistics
TW-US	.35
TW-JP	.55
KR-US	.37
KR-JP	.58
TW-ROW	.96
KR-ROW	.23

1. The 1% and 5% critical values for $F_{5,59}$ are (approximately) 3.34 and 2.37 respectively. The degree of freedom (5,59) are the number of restrictions (which equal to the number of lags minus the number of polynomials) and the number of observations minus the number of parameters, respectively.

is, a real depreciation and an increase (decrease) of foreign (domestic) output will improve the domestic trade balance in the long run. However, the effects are not significant. A number of robustness tests have been applied to the study. Except when incorporating PDLs to the OLS non-differenced estimation, none of the results reveals the existence of a J-curve. Simply applying PDLs to the OLS non-differenced estimation, however, may give us "spurious" results, as it ignores the unit-root and simultaneity problems. Our finding, which corroborates those of Rose and Yellen (1989a and 1989b) and Rose (1991a and 1991b) for OECD countries, contradicts the traditional view on the J-Curve effect and the effectiveness of exchange rate policies. Finally, the J-Curve effect predicts that after a real depreciation, the import price will increase while import volume, export price, and export volume will stay constant in the short run and import (export) volume will decrease (increase) in the long run. Therefore, it is of interest to examine which of these "sources" of the J-Curve effect are violated. This direction of a future study, as noted by Rose and Yellen, may explain our results.

CHAPTER IV

FINANCIAL MARKET INTEGRATION: THE SOUTH KOREA AND TAIWAN CASES

Since the early 1980s, Taiwan and South Korea have initiated a number of financial liberalization policies. These policies cover the areas of financial institutions and instruments, exchange rates, interest rates, international capital flows, and others. In order to prevent a macroeconomic instability from liberalization, many of the financial liberalization policies were implemented gradually in Taiwan and South Korea. Moreover, because some liberalization measures, such as interest rate liberalization and the relaxation of capital controls, should be implemented only when the financial markets have developed in maturity and flexibility, the liberalization in those areas is incomplete, especially in South Korea.[44]

Interest rate liberalization and the relaxation of capital controls, however, are important in order to

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[44] Previous studies have shown that price stability and a balanced fiscal budget are important preconditions for financial liberalization. Moreover, it is suggested that a country's domestic financial market should be liberalized before capital flows, and that the trade account should also be liberalized before the capital account. For a discussion of these arguments, see Kuo (1990).

increase the integration of domestic financial market into the world financial market. When domestic interest rates and capital flows are fully liberalized, international capital flows should equalize domestic and forward discount adjusted foreign interest rate. Covered interest parity implies that the domestic financial markets are perfectly integrated with the world's financial markets (Frankel 1985, Frankel and MacArthur 1988, and Frankel 1989). Figures 9 and 10 show Taiwan's interbank rate and the depreciation adjusted U.S. Federal Funds rate and Japan's money market rate during the period 1981M3-1991M12.[45] Figure 9 shows that Taiwan's interbank rate and U.S. Federal Funds rate appear to be correlated before 1989. This correlation, however, appears to vanish after early 1989. Figure 10 shows that no apparent correlation between Taiwan's interbank rate and Japan's money market rate during the period can be detected. Figures 11 and 12 display South Korea's money market rate and the depreciation adjusted U.S. Federal Funds rate and Japan's money market rate during the period 1986M12-1992M4. Visual inspection shows no relationship between South Korea's money market rate and U.S. Federal Funds rate in Figure 11.

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[45] Instead of using the forward discount rate, this study uses the realized depreciation rate to adjust foreign interest rates. See the Financial Market Integration section of this Chapter for a more detailed discussion.

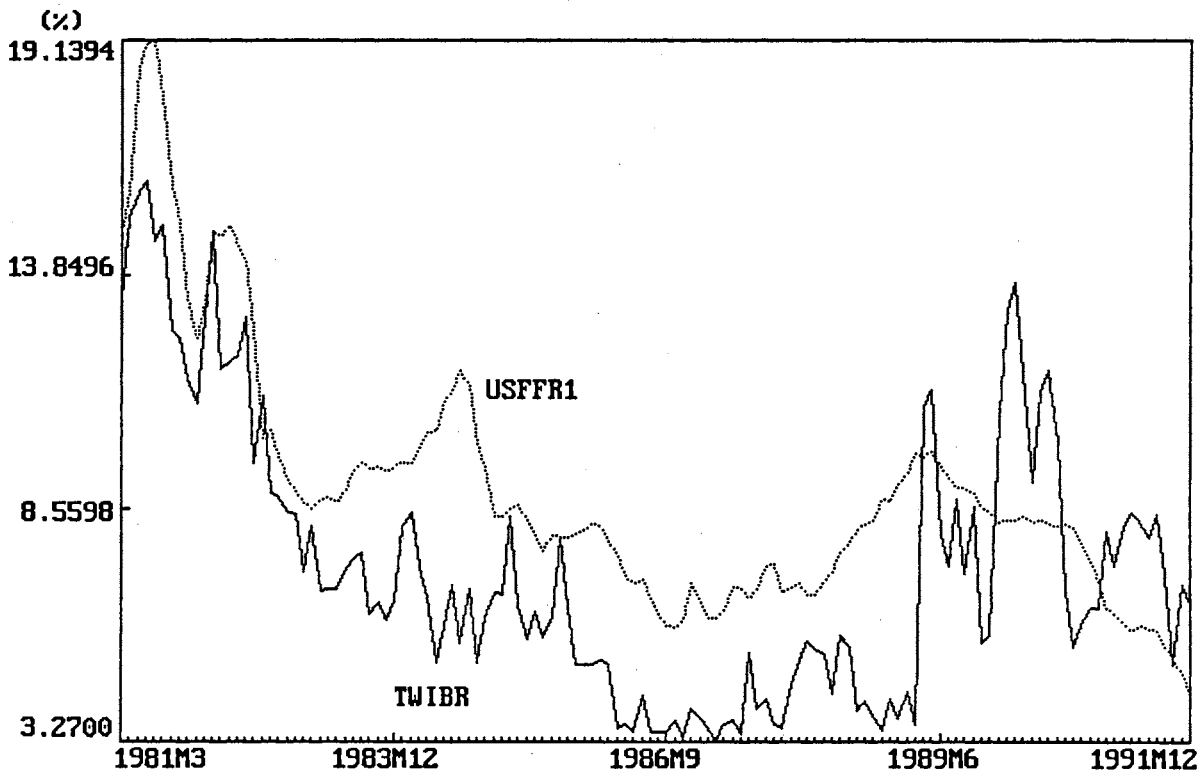

Figure 9. Taiwan Interbank Rate (TWIBR) and Depreciation Adjusted U.S. Federal Fund Rate (USFFR1)
Source: Author's own calculations based on data from Monthly Financial Statistics, Taiwan, ROC, and IMF, International Financial Statistics.

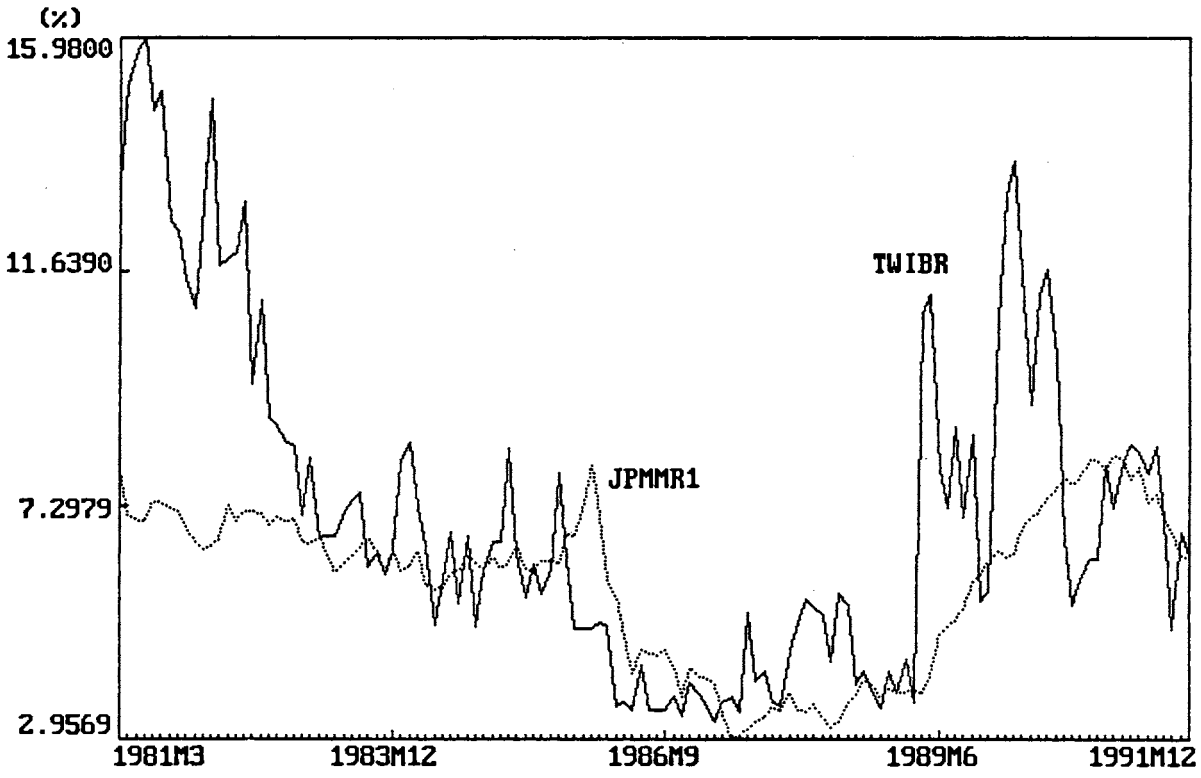

Figure 10. Taiwan Interbank Rate (TWIBR) and Depreciation Adjusted Japan Money Market Rate (JPMMR1)
Source: Author's own calculations based on data from Monthly Financial Statistics, Taiwan, ROC, and IMF, International Financial Statistics.

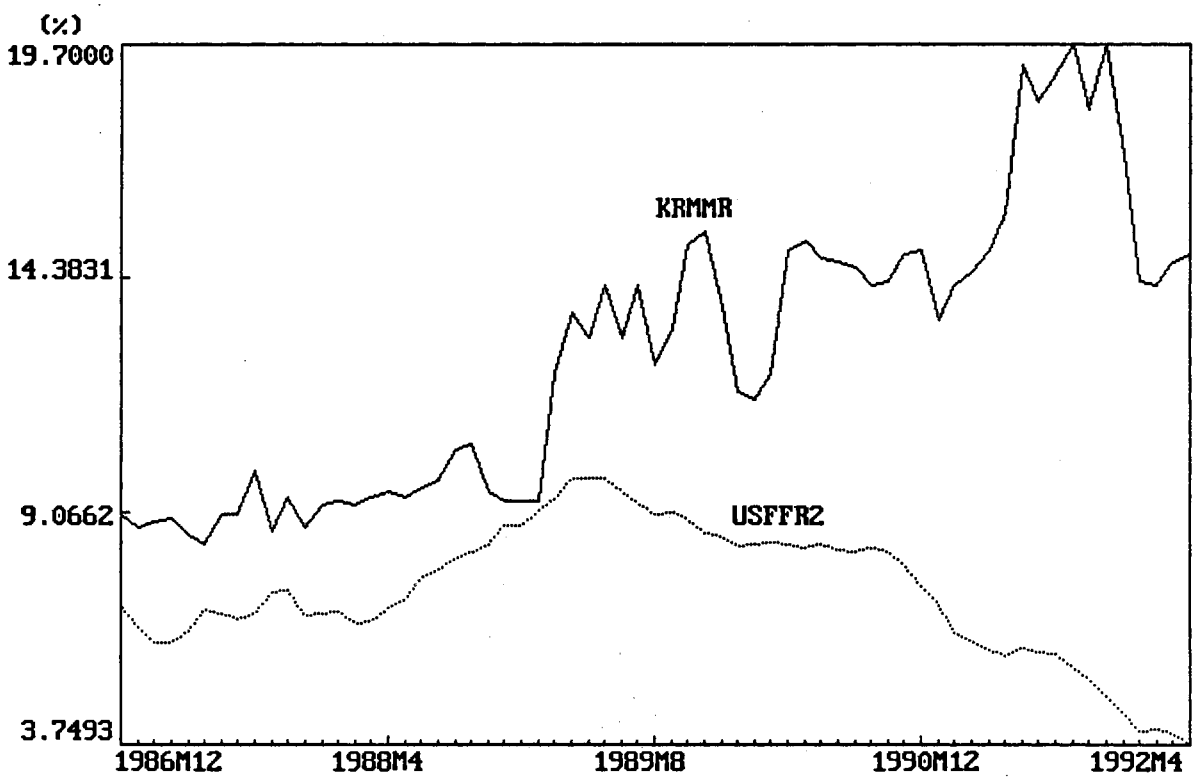

Figure 11. South Korea Money Market Rate (KRMMR) and Depreciation Adjusted U.S. Federal Fund Rate (USFFR2)
Source: Author's own calculations based on data from IMF, International Financial Statistics.

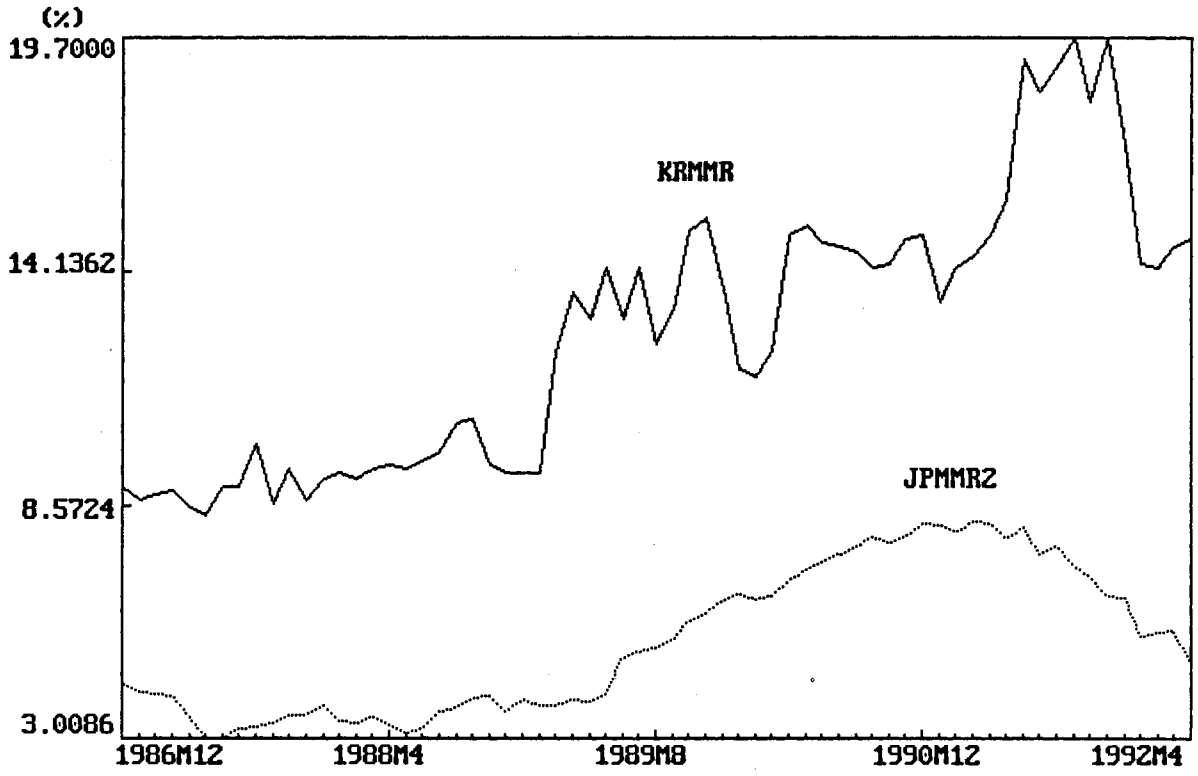

Figure 12. South Korea Money Market Rate (KRMMR) and Depreciation Adjusted Japan Money Market Rate (JPMMR2)
Source: Author's own calculations based on data from IMF, International Financial Statistics.

Before we study the interest rates linkage and financial markets integration in the next section, we will first discuss the financial liberalization policies in South Korea and Taiwan during the 1980s and early 1990s. A more detailed description of policy changes in the financial sector in these two countries appears in Appendix C.[46]

Financial Liberalization in South Korea and Taiwan (1980s and early 1990s)

To clarify the discussion, this section will present South Korea's and Taiwan's financial liberalization in four areas: financial institutions (instruments), interest rates, foreign exchange rates, and international capital flows.

Liberalization of Financial Institutions and Instruments

South Korea. In order to increase the efficiency of the banking industry, the South Korean government began to privatize nationwide commercial banks in 1981; by 1983, the government had privatized all nationwide city banks. In 1982, the South Korean government revised the General Banking Act and abolished various regulations on the

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[46] The sources for South Korea's financial sector policies are: (a) various issues of Exchange Arrangements and Exchange Restrictions Annual Report, IMF; and (b) Kim (1988). The sources for Taiwan's financial sector policies are: (a) Moreno and Yin (1992); (b) Kuo (1990); (c) Chang (1990); and (d) various issues of Central Daily News (in Chinese).

operation and management of banks.[47] Moreover, to increase competition in the commercial banking sector, entry barriers to the banking sector were also lowered. During 1981-1983, two additional nationwide city banks were allowed to be established, which brought the total number of nationwide city banks in South Korea to seven. Entry barriers have been relaxed further in the late 1980s. Since 1988, three new commercial banks, whose main purpose is to serve small and medium-sized enterprises, have been established (Kim 1992). The removal of entry barriers was more significant in the nonbank financial sector. During 1980-1982, the number of investment and finance companies increased from 20 to 32, and the number of savings and finance companies from 191 to 249 (Cho and Khatkhate 1989). In 1989, five regionally-based securities investment trust companies were set up and, in 1987-1990, eighteen life insurance companies were established.[48]

To encourage foreign capital inflow and to improve the

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[47] As examples, in 1982, the Bank of Korea abolished credit ceilings on individual banks and reduced its loans to particular (preferential) sectors.

[48] Lindner (1992) notes that the nonbank financial institutions (NBFI) have developed a large market share during the 1980's in South Korea. As she points out, at the end of 1989, 64 percent of deposits were held in nonbank financial institutions, compared with 30 percent in 1980. Moreover, the share of financing for the business sector by nonbank financial institutions was 28 percent in the second half of the 1980s, compared with 20 percent for banks. In the second half of the 1970s, the share of financing by nonbank financial institutions was only 15 percent and the share by banks was 26 percent.

quality of domestic banks' services and operations, entry barriers for foreign banks were also relaxed. In 1987, fifty-five branches of foreign banks were operating in South Korea. This number increased to sixty-nine at the end of December 1990.[49] In 1985, the total assets of the foreign bank operations accounted for 10.6 percent of total deposits of Korean depository banks (Euh and Baker 1990).[50] Along with the rapid expansion of foreign branches in South Korea, in order to keep up with the rapid growth of cross-border transactions, domestic banks' overseas banking networks have also expanded rapidly since late 1970s. At the end of December 1990, domestic banks had a total number of 143 overseas establishments, which included: 48 overseas branches, 33 subsidiaries and 52 representative offices (Kim 1992).[51]

Along with the expansion of financial institutions, a

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[49] These foreign bank branches, together with twenty-four representative offices, come from seventeen countries. The entry barriers were also relaxed for foreign nonbank financial institutions. For example, during the 1987-1990 period, four foreign life insurance companies were allowed to open branches in Seoul (Kim 1992).

[50] Euh and Baker also note that such assets held by foreign bank branches were only 4.3 percent of deposits in Japan, 6.7 percent of deposits in Taiwan, and 2.1 percent in West Germany during the same year.

[51] According to Kim (1992), by establishing merchant banks in addition to branches which engage mostly in commercial banking, the overseas banking networks are extending the scope of their international activities in loan syndication, the underwriting of bonds, securities investment, and so forth.

number of new financial instruments (e.g. commercial paper, certificate of deposits, repurchase agreement and Cash Management Account - a Korean version of the money market fund) were also introduced in South Korea in the 1980s. These new financial instruments were designed to stimulate the development of short-term and long-term financial markets and to enhance the ability of the financial institutions to mobilize savings. Moreover, to promote competition, some of these new instruments were shared by different financial institutions (Kim 1988 and Cho and Khatkhate 1989).

Taiwan. In contrast to the liberalization of South Korea's banking industry that privatized most banks in the early 1980s, most commercial banks in Taiwan were government-owned in the 1980s.[52] The ban on the establishment of new banks was not lifted until 1991, when fifteen private-owned new banks were allowed to be established in Taiwan. Moreover, competition from foreign banks is not as significant in Taiwan as in South Korea. As Euh and Baker (1990) note, domestic commercial banks in Taiwan have provided more than 70 percent of all loan funds through the organized financial system. This is notably greater than in South Korea where foreign bank branches have

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[52] Euh and Baker (1990) note, (in the late 1980s) there were sixteen commercial banks which can perform a full line of banking business in Taiwan. Twelve of them are government owned.

made a significant amount of loans so that domestic banks have been drastically affected by the added competition. Although Taiwan is lagging behind South Korea in liberalizing the banking industry, a number of liberalization measures have increased the competitiveness and efficiency of Taiwan's financial institutions.

In December 1983, in order to enhance local banks' competitiveness with foreign banks (especially the banks from Singapore and Hong Kong), the Taiwanese government authorized banks operating in Taiwan to establish Offshore Banking Units (OBUs). As Euh and Baker (1990) note, the total volume of assets of OBUs has grown significantly in the second half of the 1980s. The number of foreign bank branches in Taiwan also increased significantly in the 1980s. In October 1986, there were 36 local branches of foreign banks in Taiwan, or 23 more than 10 years before. At the same time, foreign banks were allowed to set up second branch in Taiwan (Chang 1990). Moreover, in June 1987, foreign banks were permitted to join the local interbank remittance system and the interbank ATM sharing system (Moreno and Yin 1992). In November 1988, after recognizing the urgent need for domestic financial institutions to penetrate the world market, the Ministry of Finance lifted restrictions limiting the total number of domestic bank branches that can be established in a given foreign city. In June 1991, the Ministry of Finance allowed

15 private-owned banks to be established in Taiwan. The liberalization of the establishment of private-owned banks, which is part of the newly amended Banking Law in Taiwan, lifted the ban, in place for several decades, on establishing new institutions in the banking industry.

Over the last decade, there have also been a number of liberalization measures in the nonbank financial institutions in Taiwan. Among them, the liberalization of the securities and insurance markets are especially significant. The revision of the Securities and Exchange Law in January 1988 lifted restrictions on the establishment of new securities companies in Taiwan. Securities firm licenses are now made available to any firm that meets a basic set of financial and operating requirements. In addition, in order to facilitate the involvement of foreign expertise and to improve the quality of local securities firms, under the revised law, foreign nationals may participate in the securities business through investment in and management of local securities firms (Kuo 1990).[53] The insurance companies in Taiwan have not had a significant influence on financing local business but do have provided

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[53] Some restrictions are still applied on the foreign investment in the securities firms. According to Kuo (1990), total investment by each individual foreign national is limited to 10 percent of the amount of total issued shares of any securities firm. No more than 40 percent of the shares of any securities firm may be held by foreign nationals. No restrictions, however, are applied on foreign investment in local securities investment consulting companies.

some medium- and long-term funds to business firms (Euh and Baker 1990). As part of the government policy to liberalize the financial market in Taiwan, restrictions on the establishment of foreign insurance branches were lifted in the late 1980s. According to Kuo (1990), the two major liberalizations in Taiwan's insurance market were: (a) since 1986, a minimum of two U.S. life insurance firms and two U.S. non-life insurance firms per year have been allowed to enter into the Taiwan market; (b) in February 1989, the "Regulations Governing Securities Investment by Overseas Chinese and Foreign Investors and Procedures for Remittance" were revised to allow branches of foreign insurance companies to invest a maximum of 35 percent of their capital and reserve in local securities companies.

Exchange Rate liberalization

South Korea. The first major exchange rate liberalization in South Korea was initiated in early 1980. In February 1980, South Korea's fixed exchange rate against the U.S. dollar was replaced by a managed floating rate. Under the new system, the Bank of Korea set the mid-rate for the Won against the dollar based on the SDR basket and an unspecified trade-weighted basket of major foreign currencies as well as some unspecified factors, which may include domestic and foreign price trends and the balance of

payments position (Lindner 1992).[54] All other exchange rates were set at small margins from the official mid-rate.[55]

The forward exchange markets were also liberalized in South Korea in the early 1980s. Since July 1980, forward transactions between the Won and foreign currencies have been authorized by the Korean government. Approved forward transactions include those related to export and import as well as some capital transactions (e.g. the payments on long-term foreign currency loans).

South Korea's exchange rate system was further liberalized in the early 1990s. In March 1990, the Korean government introduced a new foreign exchange system which sets the official mid-rate (between Won and U.S. dollar) as a weighted average of the previous day's spot interbank transaction rates. Exchange rates are permitted to float daily within limited margins, which differ by size and denomination of transactions but are generally less than one percent. As the exchange rate is now more flexible and is moving slowly in line with market pressure, it is believed

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[54] According to Lindner, under this system, the U.S. dollar remained the intervention currency in South Korea. The official rates between the Won and other currencies were determined by the cross-rate of the Won-dollar mid-rate and dollar-nondollar rates in international markets.

[55] For example, the buying (selling) rates for the dollar used for official intervention in the interbank market were set by subtracting (adding) a small margin from the mid-rate. In 1989, this margin was 0.4 percent.

that this new exchange rate system will help relieve the external pressures on the money supply from the trade surplus, which South Korea faced in the second half of 1980s (Lindner 1992).

Taiwan. Except for the forward exchange market which is not liberalized in Taiwan, the exchange rate system in Taiwan, like that in South Korea, has been through two major changes. In fact, Taiwan's two major exchange rate liberalization measures happened just before South Korea's two major exchange rate liberalizations.

Taiwan's foreign exchange rate system was converted from a fixed rate system to a managed floating system in February 1979. Following that, the spot central rate between the U.S. dollar and N.T. dollar was set daily by five major authorized banks on the basis of the weighted average of interbank transaction rates on the previous business day. The buying and selling rates for the U.S. dollar between the bank and the customer are set within limits of NT$0.05 above or below the central rate for transactions up to US$30,000. For larger transactions, the limit is NT$0.10 (Moreno and Yin 1992).

In 1989, Taiwan's foreign exchange rate system was further liberalized. In April 1989, a new system for the foreign exchange rate, based on bid-ask quotations, was established in Taiwan. The new system applies to interbank and retail trading above US$10,000. The previous limits on

daily fluctuations of the interbank rate were also removed at the same time (Moreno and Yin 1992).

Interest Rate Liberalization

South Korea. The objectives of interest rate liberalization in developing countries are to promote saving and efficient investment and to deepen financial markets (Tseng and Corker 1991). However, when the countries undergoing financial reforms have shallow financial markets, a sudden deregulation of the interest rate may create disruptive and destabilizing consequences (Kim 1988 and Cho and Khatkhate 1989).[56] Instead of full deregulation of the interest rate, South Korea relaxed controls by allowing more frequent adjustments in the interest rates, wider bands for regulated rates, and the removal of some interest rate ceilings (Tseng and Corker 1991). Some of the major interest rate liberalization policies in South Korea are now presented.

After 1981, the bank loan and deposit rates in South Korea, which were consistently negative in real terms

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[56] Cho and Khatkhate (1989) note that "In the imperfect and oligopolistic money and credit markets characteristic of developing countries, a sudden dose of liberalization (of interest rate) often leads to the overshooting of both nominal and real interest rate." Since real interest rates often exceed the marginal return to capital (as happened in the Latin American countries, the Philippines and Indonesia after their interest rate liberalization), they argue that the complete deregulation of the interest rate is not desirable when the country is facing high and fluctuating inflation rates.

throughout the 1974-1980 period, turned increasingly positive. The positive real interest rates came from a decline in the inflation rate as well as the government commitment of maintaining a positive real interest rate by adjusting the bank loan and deposit rates based on the movement of the inflation rate (Cho and Khatkhate 1989). In 1982, the interest rate differential between general loans and preferential policy loans were eliminated, which was a major step toward the gradual removal of policy loans in South Korea. In January 1984, a narrow band of 0.5 percent (i.e. from 10 to 10.5 percent) in bank loans was introduced in order to permit banks to charge different rates based on a borrower's creditworthiness.[57] In November 1984, the interest rates on long-term deposits were raised by one percentage point in order to narrow the gap between institutional and market interest rates. At the same time, the ceiling on interbank call rates was lifted and the rates on issuance of corporate bonds (except for those guaranteed by banks) were also liberalized (Kim 1988). In December 1988, the liberalization of loan rates, longer-term deposit rates, and money market rates was announced. This major interest rate liberalization policy was expected to improve the distribution of money supply changes (and to reduce the distributional impact of the sterilization measures) due to

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[57] In November 1984, this band was further widened to 1.5 percent (i.e. from 10 percent to 11.5 percent).

the significant current account surplus in the second half of 1980s. However, as South Korea's current account surplus fell dramatically in early 1989, the implementation of this interest rate liberalization plan was delayed and eventually canceled (Lindner 1992).[58] Nevertheless, the interbank call rates and the issuing rates of non-guaranteed corporate bonds were completely liberalized in 1990 (Kim 1992).

Taiwan. Like in South Korea, interest rate liberalization in Taiwan has also been implemented gradually. Currently, however, interest rates are more liberalized in Taiwan than in South Korea.[59] According to Kuo (1990) and Chang (1990), interest rate liberalization in Taiwan can be divided into two stages; the first stage began in 1980 and the second started around 1985.[60] We present

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[58] Similar argument are found in Kim (1992) and Amsden and Euh (1993). Kim notes, "... looking back on three years of experience under the system of the deregulation of interest rates, it would be difficult to say that interest rates have functioned as adequately as was expected in view of financial liberalization." He also notes that the lending, deposit, and money market rates are still controlled, either directly or indirectly, by the monetary authorities in South Korea.

[59] For example, controls on deposit and lending rates do not exist in Taiwan. In South Korea, however, such restrictions still exist.

[60] Kuo argues that the first stage of liberalization was a response to the new circumstances that followed the oil crisis and the accompanying international financial disorder while the second stage was prompted by massive foreign exchange reserves and high money supply growth, caused by a huge trade surplus. She notes, however, the basic purpose for both stages of liberalization was the same, that is, to place a greater reliance on the price

briefly these two stages of interest rate liberalization in what follows.

Based on the Banking Law of the early 1980s, the maximum deposit rates are prescribed by the Central Bank and the maximum and minimum loan rates are proposed by the Bankers' Association and submitted to the Central Bank for confirmation and enforcement. The first stage interest rate liberalization started when Central Bank announced the "Essentials of Interest Rate Adjustment" in November 1980, which permitted a greater range for the difference between maximum and minimum loan rates. In the meantime, the banks were allowed to set their own interest rates on negotiable certificates of deposit, debentures, and bill discounts. Moreover, interest rates on money market instruments (i.e. commercial paper, bankers' acceptances, and Treasury bills) were fully liberalized and the permissible range of the interbank call rate was gradually expanded in the first stage of liberalization.[61]

The second stage of interest rate liberalization started in November 1984 when the range for the maximum and minimum loan rates was widened again by the Central Bank.

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mechanism for adjustment of imbalances. In our study, we include the latest interest rate liberalization measure (i.e., remove all controls on both deposit and lending interest based on the newly revised Banking Law) in the second stage.

[61] The expansion of the range of the interbank call rate implies that the rate reflects the excess reserves in the banking system (Kuo 1990).

Other liberalization measures in the second stage included the following:

1. In March 1985, banks were allowed to set the prime rate as its own minimum loan rate based on market conditions.
2. In August 1985, banks were allowed to set own rates on foreign currency deposits.[62]
3. In September 1985, the "Regulations for Interest Rate Management", which prohibited the maximum deposit rate from exceeding the minimum loan rate and thus created an obstacle to the widening of the range of loan rates, were abolished.
4. In November 1985, the "central interbank call rate system" was abolished, which gave each bank complete freedom in determining its own call rate.
5. In July 1989, according to the newly revised Banking Law, all the remaining regulations controlling maximum deposit rates and maximum and minimum loan rates were eliminated.

Relaxation of Capital Controls

South Korea. Like interest rates, capital flows are not fully liberalized in South Korea. As Tseng and Corker

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[62] As Chang (1990) notes, this change has helped the foreign currency deposit rates in line with those on international financial markets and encouraged foreign exchange earners to hold foreign currency deposits.

(1991) note, although some liberalization measures have been implemented, most controls on capital flows remained in South Korea during the early 1990s. The relaxation of capital controls in South Korea in the 1980s and early 1990s are mainly in the areas of foreign direct investment, overseas investment by residents, and some portfolio investment, particularly, the investments in the securities markets. As these investments are all long term in nature, short-term arbitrage type financial flows are still restricted in South Korea. Policies concerning capital flows in South Korea in the 1980s and early 1990s are described in the following.

Cho and Khatkhate (1989) note, in the early 1980s, because of the public's low confidence in the government's ability to manage the economy, the volatile political situation, and the widespread distrust of the domestic banking system due to scandals and financial vulnerability, capital controls, especially on the outflow of capital, were believed to be necessary to have prevented capital flight. During 1980-1985, all outward remittances of capital from South Korea required approval. The inflows of capital, however, were encouraged and some capital inflow restrictions were relaxed. Some major capital flow liberalization measures during this period includes:

1. In July 1984, a revised Foreign Capital Inducement Act, which expanded the areas for foreign investment in

South Korea, came into effect.

2. In March 1985, the value limit on investment trusts through which foreign residents could indirectly invest in Korean bonds and equity was raised by US$30 million (increases of the same amount were made twice in April 1985, raising the limit to US$200 million).
3. In November 1985, authorization was granted for eligible firms to issue convertible bonds and depository receipts in foreign markets in amounts up to 15 percent of their current market capitalization.
4. In 1985, foreign securities companies were allowed to open representative offices and to own up to 10 percent of the paid-in capital of large Korean securities companies (the ratio was increased to 40 percent in 1989).

In 1986 South Korea's current account balance turned positive. The positive current account balance kept growing in 1987 and 1988. Because of the relatively inflexible exchange rate, the significant current account surplus tended to cause money supply and the inflation rate to increase in the late 1980s. In order to reduce the external pressure for money growth, a number of capital outflow liberalization measures as well as capital inflow restrictions were implemented in the second half of 1980s

(Lindner 1992).[63] These measures are as follows:

1. In August 1986, eligibility requirements for approval of new foreign commercial loans were tightened to discourage such borrowing.
2. In 1987, large Korean securities companies, investment trust companies, and insurance companies were allowed to make direct investments in foreign capital markets.
3. In May 1987, to encourage overseas investment by Korean firms, the upper limit for overseas investment exempted from prior government screening was raised from US$2 million to US$3 million.
4. In July 1987, certain tax privileges granted to attract foreign direct investment were reduced.
5. In September 1987, restrictions on the purchase by Korean owned companies of foreign real estate were liberalized.
6. In February 1989, requirements, such as the requirement concerning the credit standing of investors, on overseas investment were liberalized.
7. In January 1990, the ceiling on the value of the

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[63] Lindner notes that, in addition to the relaxation (restriction) of capital outflows (inflows), sterilization measures as well as the appreciation of Won were also used by the Korean government to reduce the external pressure for money growth in the 1986-1989 period. Since the liberalization of capital outflows has been reversed in part as the external surplus diminished since 1989, she further notes that the liberalization of capital controls in South Korea were undertaken with the purpose of reducing the inflationary impact of the balance of payment surplus rather than as a plan to improve the efficiency of Korea's economy.

foreign investment subject to automatic approval was raised to US$100 million from US$3 million.

8. In March 1990, the limits on foreign exchange holdings for investment in foreign securities by domestic securities firms authorized to handle international business were increased to US$50 million from US$30 million, and by insurance and investment firms, to US$30 million from US$10 million.

Taiwan. Since July 1987, international capital flows have been significantly liberalized in Taiwan. At present, no permission is required for an individual company or person to remit outward (inward) up to $5 million ($1 million) per year per person.[64] Although capital flows are more liberalized in Taiwan than in South Korea, Taiwan, like South Korea, liberalized capital flows depending on the impact of current account surplus on domestic macroeconomic instability (Cunningham 1991).[65] Before 1987, when the

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[64] As the N.T. dollar was expected to appreciate, the initial (1987) inward remittance is limited at US$50,000 to prevent any significant inflow of "hot money". The restriction on the inflow was released gradually as Taiwan's balance of payments has adjusted satisfactorily and the expectation of further appreciation of N.T.$ was reduced (Chang 1990).

[65] In additional to pressure on the money supply and inflation rate, another external pressure from the trade surplus (accumulation of international reserves) is the possible retaliation from the deficit countries (especially the United States). The relaxation of controls on capital outflows will relieve the accumulation of international reserves and, therefore, the possibility of foreign countries' retaliation.

external pressure from the trade surplus was not significant in Taiwan, capital controls curbed capital outflows but did not effectively restrict capital inflows. Since 1987, as the external pressure grew, capital outflows were liberalized while inflows were restricted (Moreno and Yin 1992). Some of Taiwan's major capital flow liberalizations in the 1980s are:

1. Since late 1983, foreign investors have been allowed to make indirect investments in Taiwan's stock market through purchasing shares in four "Taiwan Funds" issued abroad.
2. In July 1987, current account transactions were completely liberalized. Requirements to surrender export proceeds, advanced import deposits and restrictions on payment for invisibles were lifted. An individual or a company is allowed to purchase and remit outward up to an annual limit of US$5 million. A ceiling on inward remittances for each person or company was set at US$50,000 per year.
3. Since liberalization in July 1987, the government has set up specific channels for people to invest in foreign securities. The transactions conducted through these channels are not subject to the US$5 million outward and US$50,000 inward limitations. One such channel is the so-called "Designated-Purpose Trust Program." Under this program, twelve local banks and

trust companies have been authorized to acquire mutual funds shares issued by foreign securities firms. Private investors can either invest in the foreign mutual funds through these institutions or entrust them to purchase other foreign securities on their behalf (Chang 1990).

4. Another channel through which the public can invest in overseas securities is the purchase of investment fund beneficial certificates. Since the late 1980s, four such funds managed by four local securities investment trust companies have been authorized by the government. The total capitalization for each fund is US$40 million.

5. In July 1989, the ceiling for inward remittances for each person each year was raised to US$200,000 (in September this number increased to US$500,000 and in November increased to US$1 million).

Financial Market Integration

Frankel and MacArthur (1988) and Frankel (1989) point out that the most appropriate way to measure the degree of financial market integration is to use the covered interest differential rather than the real interest rate linkage or the saving and investment rate correlation. However, as the forward discount rate, which is required in measuring covered interest rate differential, is not available for

both Taiwan and South Korea, our study will use the uncovered interest rate linkage to measure how well Taiwan's and South Korea's financial markets are integrated with the United States and Japanese financial markets.[66]

Some Background Notes

According to Frankel and MacArthur (1988) and Frankel (1989), the difference between domestic and foreign real interest rates ($r - r^*$) can be decomposed as,

$$r - r^* = (i - i^* - fd) + (fd - u) + (u - pi + pi^*) \qquad [7]$$

where

i (i^*): the domestic (foreign) nominal interest rate

fd: the forward discount rate on the domestic currency

u: the expected rate of depreciation of the domestic currency

pi (pi^*): the domestic (foreign) expected inflation rate

$(i - i^* - fd)$: the covered interest differential

$(fd - u)$: the (exchange) risk premium

$(u - pi + pi^*)$: the expected real depreciation of the domestic currency.

Frankel and MacArthur (1988) and Frankel (1989) argue that since expected real depreciation ($u - pi + pi^*$) is determined by international goods (not financial) market

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[66] See footnote 6 for a discussion on the issue of unavailability of South Korea's forward discount rate.

integration, the covered interest differential ($i - i^* - fd$) is more appropriate than the real interest differential ($r - r^*$) in measuring financial market integration (or the degree of international capital mobility).[67] Therefore, we conclude that the real interest rates "linkage" does not indicate accurately how the world's financial markets are integrated, because the linkage itself reflects both financial and goods markets integration. The covered interest differential, however, also has its limitation. Many countries, like Taiwan and South Korea, have no official forward markets (or the official forward rate are not available). Therefore, we cannot use the covered interest differential to measure how these countries' financial markets are integrated into the world financial markets. To overcome this problem, we rewrite equation [7] as,

$$r - r^* = (i - i^* - u) + (u - pi + pi^*) \qquad [8]$$

where

$(i - i^* - u)$ is the uncovered interest differential, which

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[67] Frankel and MacArthur (1988) and Frankel (1989) refer to the covered interest differential as the political or country premium and the exchange risk premium and expected real depreciation as currency premium. Since the country premium captures all barriers (e.g. transactions costs, information costs, capital controls, risk of future capital controls, different tax laws across nations, and default risk) to financial market integration, they conclude that the covered interest differential (country premium) is most appropriate in measuring how financial markets are integrated across countries.

is the sum of covered interest differential ($i - i^* - fd$) and risk premium ($fd - u$).

By estimating a value for the expected rate of depreciation, $\hat{u}$, we can calculate the uncovered interest differential. However, because a (significant) risk premium may be included in uncovered interest differential, Frankel and MacArthur (1988) and Frankel (1989) claim that the uncovered interest differential is not as good in measuring financial market integration as covered interest differential.[68] In our study, instead of using the uncovered interest differential, we will use the "linkage" between uncovered domestic and foreign nominal interest rates to measure how well Taiwan's and South Korea's financial markets are integrated with the U.S. and Japanese financial markets. The uncovered interest rate linkage should measure financial markets integration well since the risk premium will be included in the constant or error terms in the regression.[69] More importantly, the uncovered

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[68] They find that the means and variabilities of the exchange risk premia ($fd - u$) are significantly larger than the means and variabilities of the covered interest differentials ($i - i^* - fd$). Because the uncovered interest differential includes significant risk (currency) premium, which, strictly speaking is not related to the financial market integration, they argue that the uncovered interest differential is not as good as covered interest differential in measuring financial market integration [see also footnote 67 for the discussion of covered interest differential].

[69] If the risk premium is constant, it will be captured in the constant term in the regression. If the risk premium is not constant (say it is a random variable), the mean of

interest rates linkage, unlike the real interest rates linkage, will not reflect goods markets integration.

Methodology

The equation that we will use to test for the uncovered interest rate linkage is:

$$i = a + b\ (i^* + u) + e \qquad [9]$$

where i, i*, and u were defined previously and e is a random error term.[70] The difficulty in estimating equation [9] is that the expected rate of depreciation, u, is not observable. In this study, we will use the realized depreciation rate in place of the expected depreciation rate.[71] Assuming rational expectations, we have,

$$u = ru + d \qquad [10]$$

where

ru: the realized depreciation rate

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the risk premia will be captured in the constant term and the random component of the risk premia will be captured in the error terms in the regression.

[70] The term i denotes the nominal interest rate in Taiwan (Korea), i*, the nominal interest rate in the U.S. (Japan), and u is the expected depreciation of N.T.$ (Won) against U.S.$ (Yen). Thus, a total of four equations will be estimated.

[71] For a number of countries, the expected rate of depreciation is available from survey data. For example, Gavaglia, Verschoor and Wolff (1993) use survey data for the expected exchange rate to examine the bias in the forward discount of Asian currencies. However, as such data are not available for Taiwan and South Korea, this study can not apply survey data for the expected rate of depreciation.

d: the expectational error

Equation [10] states that the expected depreciation rate is the sum of the realized depreciation rate and expectational error. To test uncovered interest rate linkage, we substitute equation [10] into equation [9],

$$i = a + b\ (i^* + ru) + (e + bd) \qquad [11]$$

which depends only on observables. However, because the error term (e + bd) is correlated with the explanatory variable (i^* + ru) (i.e. the realized depreciation rate, ru, is correlated with the expectational error, d), two stage least squares method is used in order to obtain consistent estimates. The instruments used must be uncorrelated with the expectational error term, d, and the linkage error term, e. The instruments that we choose here include a constant term, current inflation differential, lagged realized depreciation rate, and the foreign nominal interest rate, i^*.

The hypothesis that domestic and foreign interest rates are not linked (or financial markets are not integrated) implies b = 0. The greater the b coefficient, the higher the degree of domestic and foreign interest rate linkage (financial market integration).

Data and Preliminary Analysis

The nominal interest rate used for each country is: the Federal Funds rate for the United States, the overnight

money market rate for Japan and South Korea, and the (overnight) interbank rate for Taiwan.[72] For Taiwan (South Korea), the overnight interbank rate (money market rate) are the only available market determined interest rates. For South Korea, the United States, and Japan, data on the nominal interest rate, the exchange rate, and the price level are taken from IMF International Financial Statistics. For Taiwan the data are taken either from the Financial Statistics, Taiwan District, R.O.C. or from the Financial Statistics Monthly, Taiwan District, R.O.C. All the data are monthly and span the period November 1986 through April 1992 for South Korea and February 1981 through December 1991 for Taiwan. For the United States and Japan, the data span February 1981 through April 1992.[73]

Given that all the variables in equation [11] are time-series variables, two preliminary tests - unit-roots and co-integration tests - are applied to each variables.[74] [75]

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[72] According to International Financial Statistics (IFS), Japan's and South Korea's monthly Money Market Rates are defined as follows. Japan: From November 1990, lending rate for collateral and overnight loans in the Tokyo Call Money Market. Previously, lending rate for collateral and unconditional loans. South Korea: Average daily rate on call money, weighted by the volume of transactions.

[73] For all countries, the monthly interest rates are the average of daily rates.

[74] See Data and Preliminary Analysis section in Chapter III for the discussion of unit-roots and co-integration tests.

Table 30 reports the ADF tests for unit-roots of domestic and depreciation adjusted foreign interest rate [i.e. the sum of foreign interest rate and realized depreciation rate or the term ($i^* + ru$) in equation (11)]. Because of the monthly nature of our data, twelve augmented lags are chosen for the ADF tests. Moreover, as the variable plots show no trend in all variables, we report only the "without trend" test statistics.

With only one exception (JPMMRK), the test statistics in Table 30 show that most variables have unit-roots (or are not stationary). Therefore, in order to have correct statistical inferences in testing equation [11], it is necessary to take the first differences of all the variables in Table 30.

Given that the variables in Table 30 are found to have a unit-root, we can then examine whether these variables are co-integrated. Table 31 reports the unit-root tests for residuals for four pairs of countries (i.e. Taiwan-U.S., Taiwan-Japan, Korea-U.S., and Korea-Japan). For each pair of countries, since two variables (i.e.

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[75] Tables 29-31 report the unit-roots and co-integration tests for the two variables case (i.e. domestic and depreciation adjusted foreign interest rates) of equation [11]. The unit-roots and co-integration tests for the three variables case (i.e. domestic and foreign interest rates and domestic realized depreciation rate) of equation [11] are reported in Appendix B. Like the two variables case, the three variables case also show that it is appropriate to take the first differences of all variables.

TABLE 30

AUGMENTED DICKEY-FULLER (ADF)
UNIT-ROOT TESTS
(TWO VARIABLES CASE)[1]

Variable[2]	Without Trend
TWIBR	-2.56
USFFRT	-2.60
JPMMRT	-2.53
KRMMR	.10
USFFRK	-.93
JPMMRK	-3.97+

1. For TWIBR, USFFRT, and JPMMRT (which cover the period 1981M5-1991M12), the ADF(12) 95% critical value is -2.89. For KRMMR, USFFRK, and JPMMRK (which cover the period 1986M11-1992M4), the ADF(12) critical value is -2.92. A + indicates that the null hypothesis (i.e., variable has unit-root) can be rejected at the 95% level.

2. TWIBR and KRMMR are Taiwan's interbank rate and South Korea's money market rate, respectively. USFFRT is the sum of the U.S. Federal Funds rate and Taiwan's realized depreciation rate with the U.S. JPMMRT is the sum of Japan's money market rate and Taiwan's realized depreciation rate with Japan. USFFRK is the sum of the U.S. Federal Funds rate and South Korea's realized depreciation rate with the U.S. JPMMRK is the sum of Japan's money market rate and South Korea's realized depreciation rate with Japan.

TABLE 31

CO-INTEGRATION TESTS
UNIT-ROOT TESTS FOR RESIDUALS
(TWO VARIABLES CASE)[1]

Country	Regressand[2]	ADF(12)
Taiwan-U.S.	TWIBR	-1.17
Taiwan-U.S.	USFFRT	-1.36
Taiwan-Japan	TWIBR	-2.56
Taiwan-Japan	JPMMRT	-1.96
Korea-U.S.	KRMMR	-1.10
Korea-U.S.	USFFRK	-1.71
Korea-Japan	KRMMR	-1.73
Korea-Japan	JPMMRK	-1.91

1. The 95% critical value is -3.3903 for the Taiwan-U.S. and Taiwan-Japan cases and is -3.4535 for the Korea-U.S. and Korea-Japan cases.

2. See the notes to Table 30 for the definition and the time period covered by these variables.

domestic interest rate and depreciation adjusted foreign interest rate) can be used as regressands, the unit-root tests can be applied to two sets of residuals. Since the ADF(12) test statistics are not significant (i.e. the null hypothesis that the residuals have a unit-root cannot be rejected) in any cases, we can conclude that the variables i and (i^* + ru) in equation [11] are not co-integrated in any cases. Therefore, taking the first differences of these variables is appropriate.

Table 32 reports the number of co-integrating vectors (r) from the Johansen maximum-likelihood-ratio test. The table shows that the hypothesis that the number of co-integrating vectors is equal to zero (less than or equal to one) cannot be rejected at both the 95% and 90% levels in the Korean (Taiwan) cases.[76] This result, which is consistent with the results from the unit-root tests for variables, confirms that the variables i and (i^* + ru) in equation [11] are not stationary. Therefore, we are assured that it is legitimate to take the first differences of these variables in all cases.

Empirical Results

This section presents the results from estimating equation [11]. Since we are using first differenced data,

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[76] At only the 95% level, the number of co-integrating vectors equal to zero cannot be rejected for all cases.

TABLE 32

CO-INTEGRATION TESTS
JOHANSEN MAXIMUM LIKELIHOOD RATIO TESTS
(TWO VARIABLES CASE)[1]

Country	Null	Alternative	Statistic	95% C.V.	90% C.V.
TW-US	$r \leq 1$	$r = 2$	7.27	9.24	7.53
TW-JP	$r \leq 1$	$r = 2$	6.34	9.24	7.53
KR-US	$r = 0$	$r = 1$	11.89	15.67	13.75
KR-JP	$r = 0$	$r = 1$	8.97	15.67	13.75

1. r represent the number of co-integrating vectors.

the constant term is omitted from the estimation.[77] Moreover, in order to resolve the simultaneity problem, two stage least squares is used. Table 33 reports the linkage between domestic (i.e. Taiwan's and South Korea's) and depreciation adjusted foreign (i.e. U.S. and Japan's) interest rates. It shows that, over the period 1981M3-1991M4, Taiwan's interbank rate is significantly correlated with the depreciation adjusted U.S. Federal Funds rate at the 95% level. The estimated coefficient is .429, which implies that for a one percentage point increase in the adjusted U.S. Federal Funds rate, Taiwan's interbank rate will increase by .429 percentage point. Taiwan's interbank rate, however, is not significantly correlated with the depreciation adjusted Japanese money market rate. Table 33 also shows that, over the period 1986M12-1992M4, South Korea's money market rate is not significantly correlated with either the depreciation adjusted U.S. Federal Funds rate or the depreciation adjusted Japan's money market rate. Which means, during this period, neither U.S. nor Japan's interest rate movement will significantly affect South Korea's interest rate movement.

The results of Table 33 imply that, during the 1980s and early 1990s, Taiwan's financial market was significantly

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[77] The test results with the constant term do not show significant difference from what we have reported in this study. In all cases, the constant terms are very small and not significantly different from zero.

TABLE 33

LINKAGE BETWEEN DOMESTIC AND DEPRECIATION ADJUSTED FOREIGN INTEREST RATES (2SLS)
1981M3 - 1991M12[1,2]

Country	Variable	Coefficient	St. Err.	T-Stat. [Prob]
TW-US	USFFRT	.429	.210	2.045 [.041]+
TW-JP	JPMMRT	.088	.399	.221 [.825]
KR-US	USFFRK	.581	.483	1.201 [.234]
KR-JP	JPMMRK	.712	.466	1.528 [.132]

1. For the KR-US and KR-JP cases, the estimating period is 1986M12 - 1992M4.

2. The instruments used include an intercept term, current domestic and foreign inflation differential, three lags of the realized depreciation rate, and current foreign nominal interest rate. All of the variables and the instruments are the first differences. A + indicates that the coefficient is significant at the 95% level.

linked to the U.S.financial market while South Korea's financial market was not significantly linked with either the U.S. or Japan's financial market.[78] This finding is consistent with the process of financial liberalization in Taiwan and South Korea during the 1980s and early 1990s (as we presented previously). That is, since interest rate and capital flows have not been liberalized in South Korea, Korea's short-term interest rate is not linked with foreign interest rates.[79] On the contrary, since Taiwan's interest rate and capital flows have been significantly liberalized, Taiwan's short-term interest rate is linked with foreign (especially, the U.S.) interest rate.[80]

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[78] As both Taiwan's and South Korea's interest rates are not completely linked to foreign interest rates, the monetary policies in these two countries are still effective. This result is similar to Fry (1992), who uses the offset coefficient (between domestic credit and capital flows) to examine the effectiveness of monetary policy in six Pacific Basin developing countries (Indonesia, South Korea, Malaysia, Philippines, Taiwan, and Thailand). Since the joint offset coefficient for these countries is significantly less than one, Fry concludes the monetary authorities in these countries can control their money supplies by control domestic credit in the short run.

[79] As we have noted previously, although a lot of long-term capital flows were liberalized in the late 1980s in South Korea, short-term arbitrage type of capital flows were not liberalized. Since the (short-term) interest rate linkage (and thus the financial market integration) depends mainly on the short-term capital flows, South Korea's interest rate is not linked with foreign interest rates.

[80] One possible reason which may explain why Taiwan's interest rate is significantly linked to the U.S. but not to Japan's interest rate is because Japan's financial market is not as open as the U.S. financial market. Moreover, as the U.S. is the largest export market for Taiwan, the U.S. economic condition (which includes the levels of U.S.

Finally, since the financial markets have been liberalized gradually in both Taiwan and South Korea, it is of interest to test whether the interest rate linkage has increased over the years in both countries. Tables 34 reports part of the Chow test statistics which covers the dates of significant regime shifts for Taiwan-U.S., Taiwan-Japan, Korea-U.S., and Korea-Japan cases.[81] In Table 34, significant regime shifts are shown in early 1987 for the Taiwan-U.S. case and early 1986 for the Taiwan-Japan case. For both the South Korea-U.S. and South Korea-Japan cases, significant regime shifts are shown in mid-1988. Based on these regime shifts, Table 35 reports the linkage coefficients for the periods 1981M3-1987M6 and 1987M7-1991M12 for the Taiwan cases and 1986M12-1988M6 and 1988M7-1992M4 for the South Korean cases.[82] It is shown that, in both South Korean cases, the interest rate linkages are greater in the second period than in the first period. Although none of the linkage coefficient is significant,

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interest rate) "traditionally" has a significant impact on Taiwan's economic condition.

[81] In the Taiwan-US and Taiwan-Japan cases, 130 observations are used in the Chow tests. In the South Korea-U.S. and South Korea-Japan cases, 65 observations are used.

[82] In the two Taiwan cases, we use 1987M7 as the break point is because beginning July 1987 the capital flows were significantly liberalized in Taiwan (see the earlier discussion on financial liberalization in Taiwan). Moreover, this break point is close to the dates of regime shifts for both cases.

TABLE 34

TEST STATISTICS FROM THE CHOW TESTS
(COVERS MAJOR REGIME SHIFTS)[1]

TAIWAN - US		TAIWAN-JAPAN		KOREA - US		KOREA-JAPAN	
Time	Stat.	Time	Stat.	Time	Stat.	Time	Stat.
86M1	.37	85M1	21.77	87M2	.46	87M2	.21
86M2	.51	85M2	20.91	87M3	.52	87M3	.26
86M3	.66	85M3	21.34	87M4	.58	87M4	.25
86M4	.97	85M4	19.84	87M5	.78	87M5	.15
86M5	1.25	85M5	18.35	87M6	1.20	87M6	.04
86M6	1.56	85M6	17.41	87M7	1.45	87M7	.01
86M7	1.79	85M7	15.93	87M8	1.66	87M8	.08
86M8	2.10	85M8	14.84	87M9	1.71	87M9	.34
86M9	2.36	85M9	14.98	87M10	2.30	87M10	.45
86M10	2.60	85M10	13.61	87M11	2.73	87M11	.64
86M11	2.79	85M11	11.62	87M12	3.10	87M12	.71
86M12	3.11	85M12	9.26	88M1	3.39	88M1	.76
87M1	3.50	86M1	6.57	88M2	3.67	88M2	1.00
87M2	3.87	86M2	5.09	88M3	3.87	88M3	1.28
87M3	4.22	86M3	4.43	88M4	4.04	88M4	1.54
87M4	4.66	86M4	3.58	88M5	4.33	88M5	1.97
87M5	5.07	86M5	3.10	88M6	4.78	88M6	2.50
87M6	5.66	86M6	2.83	88M7	5.44	88M7	3.08
87M7	6.39	86M7	2.60	88M8	6.23	88M8	3.51
87M8	6.43	86M8	2.26	88M9	6.99	88M9	4.14
87M9	7.00	86M9	1.96	88M10	7.87	88M10	4.64
87M10	7.75	86M10	1.66	88M11	9.49	88M11	4.58
87M11	8.86	86M11	1.47	88M12	11.92	88M12	4.82
87M12	9.73	86M12	1.35	89M1	14.82	89M1	4.75

1. The critical value of $F_{(1,128,5\%)}$ for the Taiwan-U.S. and Taiwan-Japan cases is around 3.92. The critical value of $F_{(1,63,5\%)}$ for the Korea-U.S. and Korea-Japan cases is around 4.00.

TABLE 35

LINKAGE COEFFICIENTS IN TWO SUBPERIODS
BASED ON SIGNIFICANT REGIME SHIFTS[1,2]

Cty.	Variable	Period	Coeff.	Sd.Err.	T-Stat.	[Prob]
TW-US	USFFRT	81M3-87M6	.504	.166	3.039	[.003]+
TW-US	USFFRT	87M7-91M12	-.297	.901	-.329	[.743]
TW-JP	JPMMRT	81M3-87M6	.107	.363	.296	[.768]
TW-JP	JPMMRT	87M7-91M12	-.031	.968	-.032	[.975]
KR-US	USFFRK	86M12-88M6	-.125	.350	-.359	[.724]
KR-US	USFFRK	88M7-92M4	1.162	.738	1.574	[.123]
KR-JP	JPMMRK	86M12-88M6	.172	.505	.341	[.737]
KR-JP	JPMMRK	88M7-92M4	.808	.596	1.355	[.182]

1. See note to Table 30 and Table 33 for the definition of variables and the instruments used in the tests.

2. A + indicates that the coefficient is significant at the 95% level.

this finding is consistent with our expectation, that is, as South Korea's financial market was liberalized in the second period, the linkage between domestic and foreign rates increased. The case of Taiwan is counterintuitive. Table 35 shows that, in both Taiwan-U.S. and Taiwan-Japan cases, the linkage coefficient in the second period is smaller than in the first period and is negative (but not significant). However, the coefficient for the first period in the Taiwan-U.S. case is significant. Table 36, based on major financial policy changes in Taiwan and South Korea, reports the linkage coefficients for the periods 1981M3-1989M6 and 1989M7-1991M12 for the Taiwan cases and 1986M12-1989M12 and 1990M1-1992M4 for the South Korea cases.[83] The Chow test statistics which covers the dates of major financial policy changes in both Taiwan and South Korea are presented in Table 37. Like the results shown in Table 35, Table 36 exhibits that, in both South Korea cases, the linkage coefficients are greater in the second period than in the first period, but none of the coefficient is significant. In the Taiwan-U.S. case, the second period coefficient is still smaller and negative (but not significant). In the Taiwan-Japan case, the second period coefficient turns to be

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[83] The reason we choose July 1989 as the break point in the Taiwan case is because since July 1989, Taiwan has removed all the maximum and minimum constraints on the bank's loan rate and the maximum constraint on the bank's deposit rate. Choosing January 1990 as the break point in the South Korea case is because in 1990, South Korea has fully liberalized the interbank rate.

TABLE 36

LINKAGE COEFFICIENTS IN TWO SUBPERIODS
BASED ON FINANCIAL POLICIES CHANGES[1]

Cty.	Variable	Period	Coeff.	Sd.Err.	T-Stat.	[Prob]
TW-US	USFFRT	81M3-89M6	.478	.194	2.461	[.016]+
TW-US	USFFRT	89M7-91M12	-.655	1.315	-.498	[.622]
TW-JP	JPMMRT	81M3-89M6	.028	.398	.071	[.944]
TW-JP	JPMMRT	89M7-91M12	.428	1.275	.336	[.740]
KR-US	USFFRK	86M12-89M12	.345	.505	.682	[.499]
KR-US	USFFRK	90M1-92M4	1.067	.971	1.099	[.282]
KR-JP	JPMMRK	86M12-89M12	.273	.589	.464	[.645]
KR-JP	JPMMRK	90M1-92M4	1.019	.733	1.390	[.176]

1. See note to Table 30 and Table 33 for the definition of variables and the instruments used in the tests.

2. A + indicates that the coefficient is significant at the 95% level.

TABLE 37

TEST STATISTICS FROM THE CHOW TESTS
(COVERS POLICY CHANGES)[1]

TAIWAN - US		TAIWAN-JAPAN		KOREA - US		KOREA-JAPAN	
Time	Stat.	Time	Stat.	Time	Stat.	Time	Stat.
89M1	30.34	89M1	.95	89M2	18.87	89M2	4.85
89M2	37.53	89M2	.87	89M3	21.37	89M3	6.35
89M3	45.79	89M3	.85	89M4	23.71	89M4	8.81
89M4	60.26	89M4	.76	89M5	27.25	89M5	11.36
89M5	54.53	89M5	1.33	89M6	29.74	89M6	15.21
89M6	48.54	89M6	2.14	89M7	33.75	89M7	16.45
89M7	50.82	89M7	2.50	89M8	35.71	89M8	19.05
89M8	54.70	89M8	2.73	89M9	40.37	89M9	18.96
89M9	53.88	89M9	3.30	89M10	44.60	89M10	19.32
89M10	58.44	89M10	3.44	89M11	45.03	89M11	21.13
89M11	58.12	89M11	3.89	89M12	44.25	89M12	22.92
89M12	67.58	89M12	3.38	90M1	46.83	90M1	20.48
90M1	78.03	90M1	2.85	90M2	53.26	90M2	15.15
90M2	67.92	90M2	3.75	90M3	62.11	90M3	11.40
90M3	51.52	90M3	5.76	90M4	72.10	90M4	8.75
90M4	36.88	90M4	8.65	90M5	73.82	90M5	8.07
90M5	29.23	90M5	10.89	90M6	75.18	90M6	7.15
90M6	26.83	90M6	11.58	90M7	79.93	90M7	5.73
90M7	21.07	90M7	13.87	90M8	85.55	90M8	4.17
90M8	15.20	90M8	16.90	90M9	93.87	90M9	2.66
90M9	12.10	90M9	18.52	90M10	110.14	90M10	1.19
90M10	13.50	90M10	16.21	90M11	132.96	90M11	.41
90M11	17.22	90M11	13.02	90M12	154.21	90M12	.05
90M12	20.64	90M12	10.38	91M1	169.50	91M1	.11

1. See note to Table 34.

greater than the first period coefficient, but none of them is significant. One possible explanation for the result that the second period coefficients are smaller in most Taiwan cases is, since early 1989, as part of the liberalization process, Taiwan has removed all the maximum and minimum constraints on the bank's loan rate and the maximum constraint on the bank's deposit rate. Since then, Taiwan's interbank rate has fluctuated wildly in response to domestic financial conditions (as shown in Figure 9). If short-term arbitrage type of capital flows are not significant in Taiwan, the interest rate linkage disappears.[84]

Summary and Conclusion

Since the early 1980s, Taiwan and South Korea have initiated a number of financial liberalization policies. As the economy of both countries has grown significantly over the past few decades, liberalization of the financial markets was considered necessary in order to mobilize and

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[84] If the short-term arbitrage type of capital flows are not significant, then the differences between domestic and foreign interest rate will persist and the linkage will be small. This may be the case of Taiwan. Although no sufficient data to support our view in this study, we believe that most of the capital flows in Taiwan are for the purposes of direct foreign investment, overseas investment (e.g. investment in overseas real estate), and long-term portfolio investment (e.g. foreign mutual fund investment). If this is the case, then we can explain why the interest rate linkage disappeared in the second period, when interbank rate fluctuate significantly in Taiwan.

use efficiently financial assets. A successful financial liberalization needs to be carefully planned. The appropriate sequence, speed, and coverage of different types of liberalization are of great importance (Kuo 1990).

Among different liberalization policies, the liberalization of capital flows are imperative to increase the integration of domestic and foreign financial markets. With liberalized interest rates, capital mobility will equalize domestic and forward discount adjusted foreign interest rates. In this study, we have used the uncovered interest linkage to examine how Taiwan's and South Korea's financial markets are integrated with the U.S. and Japan's financial markets. Although many liberalization policies have been implemented in Taiwan and South Korea in the 1980s and early 1990s, the liberalization of interest rates and capital flows is not complete in both countries, especially in South Korea. The empirical test results show that Taiwan's short-term interest rate is linked to the U.S. short-term interest rate but not to Japan's. South Korea's short-term interest rate is not linked to either the U.S. or Japan's short-term interest rate. This finding, is consistent with the degree to which Taiwan and South Korea have liberalized their financial markets. It implies that Taiwan's degree of financial market integration with rest of the world is greater than South Korea's. However, since the linkage between Taiwan's and the U.S. interest rates is not

complete (i.e. less than one), we conclude that Taiwan's monetary and other stabilization policies are still effective.

Finally, since financial liberalization policies are implemented gradually in both Taiwan and South Korea, we have tested how the interest rate linkage has changed over the years in both countries. The break points are determined by both the significant regime shifts (from the Chow tests) as well as by the major financial policy changes in Taiwan and South Korea. We find that, in all the South Korean cases, the linkage coefficients are higher in the second period than in the first period, as expected. However, none of the coefficient is significant. The results for the Taiwan cases are counterintuitive. In most cases, the coefficients are smaller and have a negative sign in the second period. One possible explanation for this finding is that, since early 1989, Taiwan's interbank rate has fluctuated very significantly. This fluctuation may due to the full liberalization of bank deposit and loan rates at the same time. If short-term arbitrage type of capital flows (to capture domestic and foreign interest differential) are not significant in Taiwan, the domestic and foreign short-term interest rate differential will persist and the interest rate linkage will disappear (in the second period).

BIBLIOGRAPHY

Almon, S., 1965, The Distributed Lag Between Capital Appropriations and Expenditures, Econometrica 33, 178-196.

Arize, A. and J. Spalding, 1991, A Statistical Demand Function for Imports in South Korea, Journal of Economic Development 16, 147-164.

Bahmani-Oskooee, M., 1985, Devaluation and the J-Curve: Some Evidence from LDCs, The Review of Economics and Statistics, 500-504.

_____, 1986, Determinants of International Trade Flows: The Case of Developing Countries, Journal of Development Economics 20, 107-123.

Baum, J., 1992, Too Strong Too Long: Taiwan Exporters Rail at Rising Currency, Far Eastern Economic Review 155, July 30, 59-60.

Cavaglia, Stefano, Willem F.C. Verschoor and Christian C.P. Wolff, 1993, Asian Exchange Rate Expectations, Journal of the Japanese and International Economies 7, 57-77.

Chang, C.C., 1990, Financial Liberalization in the Republic of China, in S.G. Rhee and R.P. Chang (eds.), Pacific-Basin Capital Markets Research, Elsevier Science Publishers B.V. (North-Holland), 1-5.

Cheng, H., 1986, Financial Policy and Reform in Taiwan, China, in H. Cheng (eds.), Financial Policy and Reform in Pacific Basin Countries, Lexington Books, Lexington, MA., 143-159.

Cho, Yoon-Je and Deena Khatkhate, 1989, Lessons of Financial Liberalization in Asia - A Comparative Study, World Bank Discussion Papers 50.

Clifford, Mark, 1989, Too High, Too Soon: South Korea Ponders Devaluation of Won to Boost Exports, Far Eastern Economic Review, September 7, 84-85.

Cumby, R.E. and F.S. Mishkin, 1986, The International Linkage of Real Interest Rates: The European-U.S. Connection, Journal of International Money and Finance 5, 5-23.

_____ and M. Obstfeld, 1984, International Interest Rate and Price Level Linkages Under Flexible Exchange Rates: A Review of Recent Evidence, in J. Bilson and R. Marston (eds.), Exchange Rates: Theory and Practice, Chicago: University of Chicago Press for the NBER.

Cunningham, Thomas J., 1991, A liberal Discussion of Financial Liberalization, Federal Reserve Bank of Atlanta Economic Review, November/December, 1-8.

Dornbusch, R., 1975, Exchange Rates and Fiscal Policy in a Popular Model of International Trade, American Economic Review 65, 859-871.

Engle R.F. and C.W.J. Granger, 1987, Co-Integration and Error Correction: Representation, Estimation, and Testing, Econometrica 55, 251-276.

_____ and B.S. Yoo, 1987, Forecasting and Testing in Co-Integrated Systems, Journal of Econometrics 35, 143-159.

Euh, Yoon-Dae and James C. Baker, 1990, The Korean Banking System and Foreign Influence, Routledge, London.

Feldstein, M. and C. Horioka, 1980, Domestic Saving and International Capital Flows, Economic Journal 90, 314-329.

Frankel, J.A., 1985, International Capital Mobility and Crowding Out in the U.S. Economy: Imperfect Integration of Financial Markets or of Goods Markets?, NBER Working Paper # 1773.

_____, 1989, Quantifying International Capital Mobility in the 1980s, NBER Working Paper # 2856.

_____ and A.T. MacArthur, 1988, Political vs. Currency Premia in International Real Interest Differentials, European Economic Review 32, 1083-1121.

Froot, K.A. and J.F. Frankel, 1989, Forward Discount Bias: Is It an Exchange Risk Premium?, The Quarterly Journal of Economics, 139-161.

Fry, Maxwell J., 1992, Financial Opening and Monetary Control in Pacific Basin Developing Market Economies, International Finance Group Working Paper IFGWP-92-03.

Glick, R., 1987, Interest Rate Linkages in the Pacific Basin, Federal Reserve Bank of San Francisco Economic Review, Summer, 31-42.

_____, 1988, Financial Market Changes and Monetary Policy, in H. Cheng (eds.), Monetary Policy in Pacific Basin Countries, Kluwer Press, Boston, 17-42.

_____ and M. Hutchison, 1990, Financial Liberalization in the Pacific Basin: Implications for Real Interest Rate Linkages, Journal of The Japanese and International Economies 4, 36-48.

Goldstein, Morris and Mohsin S. Khan, 1985, Income and Price Effects in Foreign Trade, in R.W. Jones and P.B. Kenen (eds.), Handbook of International Economics (north-Holland, Amsterdam), 1041-1105.

Granger, C.W.J., 1981, Some Properties of Time Series Data and Their Use in Econometric Model Specification, Journal of Econometrics 16, 121-130.

_____ and P. Newbold, 1974, Spurious Regression in Economics, Journal of Econometrics 2, 1111-120.

Helkie, W.L. and Peter Hooper, 1987, The U.S. External Deficit in the 1980s: An Empirical Analysis, International Finance Discussion Papers, no.304.

Hickok, S. and T. Kligaard, 1988, In Brief - Economic Capsules - U.S. Trade with Taiwan and South Korea, Federal Reserve Bank of New York Quarterly Review, Autumn, 60-66.

Hill, J.K., 1990, The Trade Balance and the Real Exchange Rate, Federal Reserve Bank of Dallas Economic Review, Nov., 1-15.

Kim, Kae Sik, 1992, Financial Liberalization and Monetary Control in Korea: An Analytical Framework, Journal of Economic Development 17, 99-130.

Kim, Joong-Woong, 1988, Economic Development and Financial Liberalization in the Republic of Korea: Policy Reforms and Future Prospects, in Miguel Urrutia (eds.), Financial Liberalization and the Internal Structure of Capital Market in Asia and Latin America, The United Nations University, Tokyo, Japan, 137-171.

Kuo, W.Y., 1990, Liberalization of the Financial Market in Taiwan in the 1980s, in S.G. Rhee and R.P. Chang (eds.), Pacific-Basin Capital Markets Research, Elsevier Science Publishers B.V. (North-Holland), 7-26.

Krugman, Paul, 1987, Adjustment in the World Economy, Group of Thirty Occasional Papers, no. 27.

_____, 1989, Exchange Rate Policy: The J-Curve, the Fire Sale, and the Hard Landing, American Economic Review, 79, 31-35.

_____ and R.E. Baldwin, 1987, The Persistence of the U.S. Trade Deficit, Brookings Papers on Economic Activity 1, 1-43.

Layman, T.A., 1988, Monetary Policy and Financial Reform in Korea, in H. Cheng (eds.), Monetary Policy in Pacific Basin Countries, Kluwer Press, Boston, 353-379.

Liang Kuo-shu and Ching-ing Hou Liang, 1990, Taiwan's Economic Development and Its Implications for the Pacific-Asian Region, Paper presented at Walter and Phyllis Shorenstein Symposium on Economic Challenges in the Pacific-Asian Region, held at The Bank of America Center, San Francisco, Ca, March 28, 1990.

Lindner D.J., 1992, Foreign Exchange Policy, Monetary Policy, and Capital Market Liberalization in Korea, International Finance Discussion Papers, no. 435.

Mann, C.L., 1986, Prices, Profit Margins, and Exchange Rates, Federal Reserve Bulletin, 366-379.

Marshall, P.G., 1989, Pacific Rim Challenges, Editorial Research Reports, 182-194.

Meese, Richard an Kenneth Rogoff, 1988, Was It Real? The exchange Rate-Interest Differential Relation Over the Modern Floating-Rate Period, Journal of Finance 43, 933-948.

Mishkin, F., 1984a, The Real Interest Rate: A Multi-Country Empirical Study, Canadian Journal of Economics 17, 283-311.

_____, 1984b, Are Real Interest Rates Equal Across Countries? An Empirical Investigation of International Parity Conditions, Journal of Finance 39, 1345-1358.

Moreno, Ramon, 1989, Exchange Rates and Trade Adjustment in Taiwan and Korea, Federal Reserve Bank of San Francisco Economic Review, Spring, 30-48.

_____, 1990, External Shocks and Adjustment in Four Asian Economies 1978-87, Federal Reserve Bank of San Francisco Economic Review, Winter, 27-41.

_____, and Norman Yin, 1992, Exchange Rate Policy and Shocks to Asset Markets: The Case of Taiwan in the 1980s, Federal Reserve Bank of San Francisco Economic Revies, no. 1, 14-34.

Murphy, K.M. and R.H. Topel, 1985, Estimation and Inference in Two-Step Econometric Models, Journal of Business & Economic Statistics 3, 370-379.

Noland, Marcus, 1989, Japanese Trade Elasticities and the J-curve, The Review of Economics and Statistics, 71, 175-179.

_____, 1990, Pacific Basin Developing Countries: Prospects for the Future, Institute for International Economics, Washington D.C.

O'Neill H.M. and W. Ross, 1991, Exchange Rates and South Korean Exports to OECD Countries, Applied Economics 23, 1227-1236.

Park, Yung Chul, 1991, Liberalization in Korea and Taiwan, in Andras Koves and Paul Marer (eds.), Foreign Economic Liberalization - Transformations in Socialist and Market Economies, Westview Press, Boulder, 147-161.

_____, and Won-Am Park, 1991, Exchange Rate Policies for the East Asian Newly Industrialized Countries, in Emil-Maria Claassen (eds.), Exchange Rate Policies in Developing and Post Socialist Countries, ICS Press, San Francisco, 357-392.

Pesaran, M. Hashem and Bahram Pesaran, 1991, Microfit 3.0: An Interactive Econometric Software Package User Manual, Oxford University Press, Oxford.

Rose, Andrew K., 1991a, The Role of Exchange Rates in a Popular Model of International Trade, Working Paper, Department of Economics, University of California at Berkeley.

Rose, Andrew K., 1991b, The Role of Exchange Rates in a Popular Model of International Trade, Journal of International Economics 30, 301-316.

Rose, Andrew K. and Janet L. Yellen, 1989a, Is There a J-curve?, Working Paper, Department of Economics, University of California at Berkeley.

Rose, Andrew K. and Janet L. Yellen, 1989b, Is There a J-curve?, Journal of Monetary Economics 24, 53-68.

Takagi, Shinji, 1988, Recent Developments in Japan's Bond and Money Markets, Journal of The Japanese and International Economies 2, 63-91.

Tseng, Wanda and Robert Corker, 1991, Financial Liberalization, Money Demand, and Monetary Policy in Asian Countries, International Monetary Fund Occasional Paper 84.

Warner, D. and M.E. Kreinin, 1983, Determinants of International Trade Flows, Review of Economics and Statistics 65, 96-104.

Yoshinari, Kumiko, 1991, Accessing the International Capital Market, Finance & Development 28, 40-41.

APPENDICES

APPENDIX A

INSTRUMENTAL VARIABLE ESTIMATIONS

TABLE 38

INSTRUMENTAL VARIABLE ESTIMATION
TAIWAN - U.S.
1973Q2 - 1991Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
INPT	3428.0	2836.0	1.209[.232]
q	96549.1	99826.1	.967[.337]
q(-1)	-92134.3	120901.4	-.762[.449]
q(-2)	205624.4	169978.0	1.210[.231]
q(-3)	-87428.6	125769.9	-.695[.490]
q(-4)	175516.4	199430.6	.880[.382]
q(-5)	-161859.8	191157.5	-.847[.401]
q(-6)	139350.0	141701.4	.983[.329]
q(-7)	-64751.0	111735.1	-.580[.564]
q(-8)	-20442.9	61960.1	-.330[.743]
Y	-36356.8	55632.6	-.654[.516]
Y(-1)	13406.4	43064.4	.311[.757]
Y(-2)	-138698.8	64189.4	-2.161[.035]
Y*	108741.5	133625.9	.814[.419]
Y*(-1)	66032.0	160283.0	.412[.682]
Y*(-2)	70494.8	119143.4	.592[.556]
DW-statistics	2.512	Sargan's CHI-SQ(11)	.824[1.00]

Note: The q, Y, and Y* are the first-differences of logged real exchange rate and domestic and foreign real output respectively. The DW-statistics show whether the regression residuals have first-order serial correlation. Since the DW- statistics is greater than d_u (the upper bound of Durbin-Watson distribution) at the 95% level, we accept the null hypothesis and conclude there is no positive serial correlation. Sargan's misspecification test is a general test of misspecification of the model and the instruments. This test statistic is asymptotically distributed as a chi-squared variate with s-k degrees of freedom, where s represents the number of instruments and k represents the number of regressors. Since the Sargan statistic is not significant at the 95% level, we conclude that the null hypothesis of correct model specification and valid instruments cannot be rejected.

TABLE 39

INSTRUMENTAL VARIABLE ESTIMATION
TAIWAN - JAPAN
1973Q2 - 1991Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
INPT	231.8	263.2	.881[.382]
q	-2509.7	5862.4	-.428[.670]
q(-1)	4755.7	4497.0	1.058[.295]
q(-2)	-75.6	4337.4	-.017[.986]
q(-3)	-7494.7	4192.6	-1.788[.079]
q(-4)	6404.9	4938.2	1.297[.200]
q(-5)	7882.7	5335.6	1.477[.145]
q(-6)	-4655.5	6265.0	-.743[.460]
q(-7)	4170.3	6245.4	.668[.507]
q(-8)	-703.3	4626.7	-.152[.880]
Y	-11765.1	4419.0	-2.662[.010]
Y(-1)	-8182.4	5311.7	-1.541[.129]
Y(-2)	-1575.0	5346.0	-.295[.769]
Y*	3320.6	15763.0	.211[.834]
Y*(-1)	4951.7	15597.3	.317[.752]
Y*(-2)	-3116.2	13233.4	-.235[.815]
DW-statistics	2.161	Sargan's CHI-SQ(15)	23.93[.066]

Note: See note to Table 38.

TABLE 40

INSTRUMENTAL VARIABLE ESTIMATION
SOUTH KOREA - U.S.
1973Q2 - 1991Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
INPT	41675.7	32063.1	1.299[.199]
q	-684214.4	790431.6	-.866[.390]
q(-1)	-610651.0	954001.3	-.640[.525]
q(-2)	377437.8	756051.9	.499[.619]
q(-3)	99767.6	689641.4	.145[.885]
q(-4)	-14097.7	698153.3	-.020[.984]
q(-5)	498009.9	698514.1	.713[.479]
q(-6)	844905.9	727617.4	1.161[.250]
q(-7)	272615.4	755352.0	.361[.719]
q(-8)	396228.0	576882.1	.687[.495]
Y	-677433.6	665552.3	-1.018[.313]
Y(-1)	-270165.2	644597.0	-.419[.677]
Y(-2)	-760030.2	646118.3	-1.176[.244]
Y*	3766941.0	1304446.0	2.888[.005]
Y*(-1)	-189876.9	1784783.0	-.106[.916]
Y*(-2)	-736320.1	1434324.0	-.513[.610]
DW-statistics	2.070	Sargan's CHI-SQ(11)	14.65[.199]

Note: See note to Table 38.

TABLE 41

INSTRUMENTAL VARIABLE ESTIMATION
SOUTH KOREA - JAPAN
1973Q2 - 1991Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
INPT	-12134.0	24486.8	-.496[.622]
q	101226.7	280764.2	.361[.720]
q(-1)	-548119.2	406912.9	-1.347[.183]
q(-2)	-96646.0	334213.3	-.289[.773]
q(-3)	489258.0	262465.0	1.864[.067]
q(-4)	-64558.0	343463.4	-.188[.852]
q(-5)	-528491.6	359179.0	-1.471[.147]
q(-6)	-61735.6	330773.2	-.187[.853]
q(-7)	352868.4	252661.2	1.397[.168]
q(-8)	154629.3	236320.5	.654[.515]
Y	78045.2	465113.9	.168[.867]
Y(-1)	-689386.1	476566.5	-1.447[.153]
Y(-2)	789500.9	615330.0	1.283[.204]
Y*	1061577.0	868940.2	1.222[.227]
Y*(-1)	-1626584.0	1015751.0	-1.601[.115]
Y*(-2)	746476.6	729992.8	1.023[.311]
DW-statistics	2.257	Sargan's CHI-SQ(15)	8.650[.895]

Note: See note to Table 38.

TABLE 42

INSTRUMENTAL VARIABLE ESTIMATION
TAIWAN - REST OF THE WORLD
1973Q2 - 1991Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
INPT	15.3	11.2	1.374[.175]
q	79.1	342.9	.231[.818]
q(-1)	-45.0	430.2	-.104[.917]
q(-2)	816.8	516.9	1.580[.119]
q(-3)	-349.7	451.1	-.775[.441]
q(-4)	345.7	640.9	.539[.592]
q(-5)	-215.8	474.7	-.455[.651]
q(-6)	574.0	426.6	1.346[.184]
q(-7)	117.5	311.0	.378[.707]
q(-8)	-142.9	192.6	-.742[.461]
Y	-1.9	200.7	-.009[.993]
Y(-1)	-35.4	148.4	-.238[.812]
Y(-2)	-270.0	192.4	-1.403[.166]
Y*	1022.8	736.1	1.390[.170]
Y*(-1)	-980.0	766.7	-1.278[.206]
Y*(-2)	-2.6	502.1	-.005[.996]
DW-statistics	2.436	Sargen's CHI-SQ(11)	8.507[.667]

Note: See note to Table 38.

TABLE 43

INSTRUMENTAL VARIABLE ESTIMATION
SOUTH KOREA - REST OF THE WORLD
1973Q2 - 1991Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
INPT	316.5	294.6	1.075[.287]
q	1616.0	6881.3	.235[.815]
q(-1)	-10154.8	8899.8	-1.141[.258]
q(-2)	8841.3	7629.7	1.159[.251]
q(-3)	-579.7	6399.3	-.091[.928]
q(-4)	-4799.7	7805.0	-.615[.541]
q(-5)	3631.4	7815.0	.465[.644]
q(-6)	7329.2	6312.6	1.161[.250]
q(-7)	2636.2	6351.6	.415[.680]
q(-8)	9063.1	5303.9	1.709[.093]
Y	6059.2	5834.0	1.039[.303]
Y(-1)	-767.8	6256.3	-.123[.903]
Y(-2)	-16296.4	6462.7	-2.522[.014]
Y*	21830.4	15728.2	1.388[.170]
Y*(-1)	-12995.9	22098.0	-.588[.559]
Y*(-2)	3083.0	15010.3	.205[.838]
DW-statistics	2.352	Sargan's CHI-SQ(11)	18.19[.077]

Note: See note to Table 38.

APPENDIX B

UNIT-ROOTS AND CO-INTEGRATION TESTS

(THREE VARIABLES CASE)

TABLE 44

AUGMENTED DICKEY-FULLER (ADF)
UNIT-ROOT TESTS
(THREE VARIABLES CASE)[1]

Variable[2]	Without Trend
TWIBR	-2.56
USFFR	-2.64
TWRDU	-2.87
JPMMR	-2.66
TWRDJ	-2.99+
KRMMR	.10
KRRDU	-1.00
KRRDJ	-1.37

1. For TWIBR, USFFR, TWRDU, JPMMR, and TWRDJ (which cover the period 1981M5-1991M12), the ADF(12) 95% critical value is -2.89. For KRMMR, KRRDU, and KRRDJ (which cover the period 1986M11-1992M4), the ADF(12) critical value is -2.92. A + indicates that the null hypothesis (i.e., variable has unit-root) can be rejected at the 95% level.

2. TWIBR, USFFR, JPMMR, and KRMMR are Taiwan's interbank rate, U.S. Federal Funds rate, Japan's money market rate, and South Korea's money market rate, respectively. TWRDU, TWRDJ, KRRDU, and KRRDJ are Taiwan's realized depreciation rate with the United States, Taiwan's realized depreciation rate with Japan, South Korea's realized depreciation rate with the United States, and South Korea's realized depreciation rate with Japan, respectively.

TABLE 45

CO-INTEGRATION TESTS
UNIT-ROOT TESTS FOR RESIDUALS
(THREE VARIABLES CASE)[1]

Country	Regressand[2]	ADF(12)
Taiwan-U.S.	TWIBR	-1.10
Taiwan-U.S.	USFFR	-1.34
Taiwan-U.S.	TWRDU	-4.00+
Taiwan-Japan	TWIBR	-3.06
Taiwan-Japan	JPMMR	-1.93
Taiwan-Japan	TWRDJ	-3.47
Korea-U.S.	KRMMR	-1.70
Korea-U.S.	USFFR	-1.70
Korea-U.S.	KRRDU	-1.85
Korea-Japan	KRMMR	-1.75
Korea-Japan	JPMMR	-1.61
Korea-Japan	KRRDJ	-2.35

1. The 95% critical value is -3.8146 for the Taiwan-U.S. and Taiwan-Japan cases and is -3.9053 for the Korea-U.S. and Korea-Japan cases.

2. See the notes to Table 44 for the definition of these variables. Variables for the Taiwan-U.S and Taiwan-Japan cases covers the period 1981M2-1991M12. Variables for the Korea-U.S. and Korea-Japan cases covers the period 1986M11-1992M4. A + indicates that the null hypothesis (i.e. the residuals has unit-root) can be rejected at the 95% level.

TABLE 46

CO-INTEGRATION TESTS
JOHANSEN MAXIMUM LIKELIHOOD RATIO TESTS
(THREE VARIABLES CASE)[1]

Country	Null	Alternative	Statistic	95% C.V.	90% C.V.
TW-US	$r \leq 1$	$r = 2$	12.68	15.67	13.75
TW-JP	$r \leq 1$	$r = 2$	12.86	15.67	13.75
KR-US	$r = 0$	$r = 1$	14.33	22.00	19.77
KR-JP	$r \leq 1$	$r = 2$	11.28	15.67	13.75

1. r represent the number of co-integrating vectors.

APPENDIX C

SOUTH KOREA'S (1980-1990) AND TAIWAN'S (1979-1991) FINANCIAL SECTOR POLICIES

South Korea's Financial Sectors Policies

1980-1990

1980

February. 1. A new exchange rate regime was introduced whereby the won was linked to a multicurrency basket, but other factors would also be taken into account in determining the exchange rate. The U.S. dollar remained the intervention currency. 2. Foreign exchange certificates were abolished.

July. Authorization was granted for forward exchange transactions between the Korean won and specified foreign currencies.

September. Different measures were introduced to encourage foreign direct investment.

October. Foreign exchange control regulations were revised with a view to rationalizing and simplifying various regulations. One of the revisions was the relaxation of the regulations for the purchase of foreign securities.

1982

June. Preferential interest rates applied to various policy loans were abolished to gradually phase out policy loans.

1983

May. Limitations were abolished on the eligibility of foreign currencies for forward transactions against the Korean won. (Previously eligibility was limited to the U.S. dollar, the pound sterling, the deutsche mark, and the Japanese yen.)

1984

January. A narrow band of 0.5 percent (i.e. from 10 to 10.5 percent) in bank loans was introduced in order to permit banks to charge different rates based on a borrower's creditworthiness. In November, this band was further widened to 1.5 percent (i.e. from 10 to 11.5 percent).

April. In a liberalization of the rules under which foreign bank branches could operate in Korea, the Ministry of Finance announced that henceforth foreign banks would be allowed to join the National Bankers' Association.

July. A revised Foreign Capital Inducement Act came into effect. The law expands the industrial sectors for foreign investment.

November. The ceiling on interbank call rate was lifted and the rates on issuance of corporate bonds (except for those guaranteed by banks) were liberalized.

1985

March. The value limit on investment trusts through which foreign residents could indirectly invest in Korean bonds and equity was raised by US$30 million. Increases of the same amount were made on April 19 and April 30, 1985, raising the limit to US$200 million.

October. Authorization was granted for foreign participation in 102 of the 339 previously restricted industrial areas, increasing the number of industrial sectors accessible to foreign investors from 660 to 762, and raising the liberalization ratio for capital from 66.1 percent to 76.3 percent of total.

November. Authorization was granted for eligible firms to issue convertible bonds and depository receipts abroad in amounts up to 15 percent of their current market capitalization.

1986

August. Eligibility requirements for approval of new foreign commercial loans were tightened to discourage such borrowing, while ensuring that Korean borrowers contracted foreign loans on the best possible terms.

1987

May. To encourage overseas investment by Korean firms, the upper limit for overseas investment exempted from prior government screening was raised from US$2 million to US$3 million.

July. Certain tax privileges granted to attract foreign direct investment were reduced and after-investment controls relaxed to put foreign-invested companies and local companies on the same basis.

September. Restrictions on the purchase by Korean-owned companies of foreign real estate were liberalized.

October. The regulations on the duration of forward exchange contracts between the won and foreign currencies, previously limited to one year or less, were abolished.

December. Overseas investments by Korean residents of less than US$1 million were to be automatically approved, compared to US$500,000 in the past, and the upper limit on investment to be free from government screening was increased from US$3 million to US$5 million, regardless of purposes of investment.

1988

January. The restrictions on foreign investment in the Korean insurance industry were liberalized.

March. 1. The limit on foreign exchange holdings for investment in foreign securities by Korean securities firms authorized to handle international businesses was raised from US$10 million to US$30 million. Insurance and investment trust firms were also authorized to hold up to US$10 million for such purposes. 2. The foreign exchange allowance for emigrants was raised to US$200,000 a household for current expenses and to US$300,000 for investment purposes.

November. 1. The limit for overseas investments by Korean residents subject to automatic approval was raised from US$1 million to US$2 million. 2. South Korea formally accepted the obligations of Article VIII, Sections 2-4 of the International Monetary Fund Agreement. This obligated Korea to eliminate its remaining restriction on payments and transfers for current account transactions.

1989

February. Requirements on overseas investment were liberalized. Besides the abolition of the requirement concerning the credit standing of investors, the minimum equity investment ratio was lowered to 20 percent, and the minimum interest rate for long-term loans was removed.

July. Nonresidents received permission to freely invest in six manufacturing sectors, regardless of their equity ratio, and the amount of new foreign investments permitted without reference to the capital review committee was increased to US$5 million from US$ 3 million.

1990

January. The ceiling on the value of the foreign investment subject to automatic approval was raised to US$ 100 million from US$ 3 million.

March. The limits on foreign exchange holdings for investment in foreign securities by domestic securities firms authorized to handle international business were increased to US$50 million from US$ 30 million, and by insurance and investment firms, to US$30 million from US$10 million.

Taiwan's Financial Sector Policies

1979-1991

1979

February. 1. The foreign exchange market was established and a managed float was adopted. 2. The spot central rate of the U.S. dollar against the NT dollar henceforth to be set daily by 5 major authorized banks on the basis of the weighted average of interbank transaction rates on the previous business day.

1980

January. Privately held foreign currency deposits in authorized banks were permitted.

March. Daily exchange rate ceiling was abandoned by Central Bank.

November. 1. A committee of the Banker's Association was authorized to set, on a monthly basis, actual deposit and loan rates within ceilings determined by the Central Bank. The Central Bank set maximum deposit rates and maximum and minimum loan rates. 2. Interest rates on commercial paper, bankers' acceptances and Treasury bills were fully liberalized.

1982

September. Central rate trading system was established in the foreign exchange market with the exchange rate to be based on the daily weighted average exchange rate of interbank trading.

1983

December. Offshore Banking Statutes were established allowing local banks to engage in offshore banking business.

1984

August. Bank restrictions on the holding of long positions in foreign currencies was removed.

November. Range of maximum and minimum loan rates were widened by the Central Bank.

1985

March. Banks were allowed to set prime rate according to market conditions.

August. 1. Banks were allowed to set own rates on foreign currency deposits. 2. Banker's association to set the range of maximum and minimum lending rates while the individual banks were allowed to charge customer rates based on credit rating and loan maturity date.

September. The "Regulations for Interest Rate Management", which prohibited the maximum deposit rate from exceeding the minimum loan rate were abolished.

November. The "central interbank call rate system" was abolished, which gave each bank complete freedom in determining its own call rate.

1986

October. Allowed foreign banks to set up second branches in Taiwan.

1987

May. The Central Bank freezed the outstanding amount of commercial banks' foreign liabilities at US$ 13.8 billion, the level of May 31, 1987.

June. Foreign banks were permitted to join the local inter-bank remittance system and the interbank ATM sharing system.

July. Current account transactions were completely liberalized on July 15. Requirements to surrender export proceeds, advanced import deposits and restrictions on payments for invisibles were lifted. An individual or a company was allowed to purchase and remit outward up to an annual limit of US$5 million. A ceiling on inward remittances for each person was set at US$ 50,000 per year.

October. The Central Bank lifted the freeze on banks' foreign liabilities on October 1, 1987. Following capital inflow of $3 billion, the Central Bank reimposed a freeze at $16.2 billion on October 2. Borrowing of foreign exchange by nonbanks was not subject to the freeze.

1988

January. The revision of the Securities and Exchange Law lifted the restriction on the establishment of new securities companies in Taiwan.

November. The Ministry of Finance lifted restrictions limiting the total number of domestic bank branches that can be established in a given foreign city.

1989

April. A new system of foreign exchange trading was established, based on bid-ask quotations. The new system applies to interbank trading and retail trading over US$ 10,000. The previous limits on daily fluctuations of the interbank rate were rescinded.

July. 1. The ceiling for inward remittances for each person was raised to US$ 200,000 on July 20. 2. All remaining regulations controlling maximum deposit rates and maximum and minimum loan rates were eliminated.

August. Foreign exchange interbank call loan market was established.

September. Annual capital inflow was increased from US$200,000 to US$ 500,000 per person.

November. Capital inflow limitation was increased to US$ 1 million.

1991

June. The Ministry of Finance approved fifteen applications for new banks, which ended a ban of several decades on new institutions in the industry.

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