JAPAN AND THE UNITED STATES: ECONOMIC POLICY AND INTERDEPENDENCE

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I. JAPANESE-U.S. INTERDEPENDENCE

A. *Interdependence and Foreign Trade*

THE GROWING importance of international trade in the world economy has caused a resurgence of interest in the phenomena of economic interdependence and the international transmission of economic fluctuations.[1] The events of the early 1970s, with worldwide stagflation following oil embargoes, huge jumps in oil prices, and the breakdown of the international monetary system signalled by the U.S. departure from full convertability of the dollar, have provided dramatic if unwelcome evidence of the problems of interdependence. These problems have proved especially troublesome, not only for the developing nations, but also for the resource poor entrepôt nations such as Japan and the United Kingdom, whose vulnerability lies in the relative inelasticity of their demand for imports with respect to changes in price as compared with that of the foreign demand for their exports, and in the increasing dependence on imports that has accompanied economic and population growth. As a consequence, increases in the world prices of raw materials and other vital imports exert a strong inflationary pressure, relative to other countries, leading to the possibility of reduced competitiveness in export markets at the same time that the total value of imports is driven up by increasing prices.

Yet economic theory has long taught us the benefits of free international trade, which maximizes the consumption possibilities of all countries for a given expenditure of resources (including both capital and labor as well as raw materials). Some caveats are admitted to justify protectionist policies (import duties or quotas) when there are differences in capital accumulation, technology, or

The results given in this paper are based on my unpublished Ph.D. dissertation at Boston College. I am grateful to a number of individuals both in Japan and the United States for help given at various stages of the project including the supply of data and unpublished reports and to the members of the Japan Economic Seminar, New Haven, February 15, 1975 for their interest and helpful comments. I am also particularly indebted to Professors Ann F. Friedlaender, Kōzō Yamamura, William J. Duffy, and Kenneth A. Lewis for support and advice during the progress of my dissertation research and to Boston College for financial support via a University Fellowship.

[1] The measures of interdependence between Japan and the United States reported in this paper were made for a period during which the exchange rate was held rigidly to 360 yen per dollar. The international interdependence of economic policy is actually related to the flexibility of exchange rates, so current interdependence between the two countries may be less than reported here by an amount dependent on the degree to which the yen/dollar rate is permitted to float freely by the authorities of the two countries.

labor skills, i.e., in the amounts of "disembodied" or augmentable resources, between countries. This "infant industry" protection case is simply a modification of the dicta of comparative advantage theory to a dynamic framework in which a society is willing to trade present consumption for a higher future consumption by a process of resource creation. But even in this instance, international trade is recognized to be frequently necessary as a source of capital or technology for this resource accumulation.

The benefits to be obtained from international trade are real, but also have costs which are principally associated with the inability of supply conditions to adjust as rapidly as variations in demand. Thus, for example, the labor force made idle by a reduction in the foreign demand for Japanese automobiles cannot normally be easily or rapidly absorbed in other industries; the reduction of aggregate disposable income which accompanies this unemployment ricochets around the economy, causes a reduction in demand for other goods and services, and finally leads to further decreases in income.

The existence of the phenomenon of interdependence automatically raises the question as to its quantitative importance, since it follows that a causal factor for domestic business fluctuations may be outside the direct control of the government—such as changes in tax rates or the rate of growth of the money supply in one of the direct or indirect trading partners. Further, if it is possible to predict the course of economic policy (or other determinants of the economic state) in one's trading partners, a knowledge of the magnitude and time pattern of its impact on the economy will enable compensatory economic policies to be initiated.

The measurement of economic interdependence is complicated by the fact that any given country normally trades with many others. Thus the impact of economic fluctuations in one country will not only be transmitted by direct trade but will also work indirectly through intermediate trading partners. One simple approach to this problem would be to perform a series of regression analyses with appropriate domestic economic variables (such as GNP) as dependent variables, and domestic and foreign policy variables (tax rates, money supply, government spending, and the like) as independent variables. This procedure, the estimation of a "reduced form" model of the linked economies, is a simplification of the true simultaneous interaction of the many sectors in the economies of the trading nations. But there are at least two major disadvantages to this approach: firstly, there is the important statistical problem that a linkage of several countries may require the use of so many independent variables in the regressions that insufficient observations are available to ensure the model is identified, and secondly, the reduced form model precludes the analysis of the dynamic properties of the linkages.

A full analysis requires that we represent each of the interacting economic sectors by an appropriate model, and simulate the behavior of the linked economies in response to alternative choices of economic policy in one of them. It is only in this way that we can properly trace the dynamic process of adjustment. But if we represent the linked economies by a set of simultaneous equations

of the kind now extensively used for economic forecasting, we are now faced with the task of accurately specifying and estimating very large numbers of equations; we must not only estimate equations to represent each of the linked economies, but also equations for imports and exports between each pair of countries. Improvements in techniques and data sources, and experience with large econometric models in recent years has given many economists confidence in the appropriateness and feasibility of such linked systems. An early attempt to measure interdependence in this way was published by Resnick who examined the effects of fiscal policy implemented by individual members of the European Common Market on the other four major economic areas [11]. Currently, economists in several countries are cooperating in the linkage of many of the large national econometric models that have been developed over the last decade, and it is to be hoped that these researchers will furnish answers to some of the major questions about the interdependence between industrialized nations.[2] The work reported here must be considered at most a preliminary effort in that direction.

B. *Japan's Interdependence with the United States*

"The Japanese have always tended to regard their country's lack of essential natural resources as an Achilles' heel, a weakness which could topple the entire industrial structure if outside conditions ever turned unfavorable . . . and Japanese people are still inclined to view their dependence on international trade as a special weakness. . . ."[3] Japan may have superficially appeared to be, in fact, less critically dependent on international trade than many countries, with a volume of trade representing only about 10 per cent of GNP over at least two decades, and a recent strong and persistent demand for her exports. But foreign trade has been both an important source and a stimulus for economic growth in Japan. The commitment to growth implied the need to earn foreign exchange sufficient to buy capital goods and the associated raw materials, including these required for the manufacture of the exported commodities. The sought for economic growth has now largely been achieved, and as a consequence the need for imported capital goods has been reduced; but, concomitantly, an industry structure has arisen which depends heavily on the imported raw materials and other producer goods, and the increasing real income of the Japanese has led to a revealed preference for many imported foodstuffs. The need for imports, has in some cases, now become embedded in the economy to an extent that can best be illustrated by the fact that 99.7 per cent of Japanese oil consumption is currently imported [14]. Evidently, shortages and increasing prices of imported commodities can have serious consequences for the Japanese economy since substitute materials, even when available, often require major, expensive, and time consuming alterations of plant and equipment. On the other hand, Japanese exports are largely final manufactured goods, such as automobiles, and electronic and optical goods, for which foreign demand may be expected to be fairly

[2] This work has been coordinated as Project Link. A collection on some researches by members of this project have been published recently as [3].

[3] [8, p. 52]. The same theme has been reiterated by Professor Kazuo Satō in [14].

elastic.[4] If demand for these goods falls, the capital employed in their manufacture is rarely usable for other products still in adequate demand, and the affected enterprises sustain low profits, losses, or fail. Labor is somewhat more flexible in the event that it becomes unemployed, but poor information and relocation difficulties and costs add substantially to the readjustment time.

One can infer, therefore, that interdependence effects might indeed be significant for Japan, and Japanese concern about them justified; but to what degree? In one approach to answering this question we observe that since World War II, Japan's pattern of international trade has been strongly bilateral, with the United States as the major trading partner. In 1960, as illustrated in Table I, Japanese exports and imports were each about 12 to 14 per cent of GNP, and approximately one-third of each category was contributed by trade with the United States; the share of Japan's next largest trading partners was only about one-fifth as large. Conversely, U.S. exports and imports were each only about 6 per cent of GNP, and Japan's share of each category was only in the neighborhood of one-tenth.

TABLE I

Country	Totals as % of GNP		Main Trading Partners			
			Imports		Exports	
	Imports	Exports	Country	% of Imports	Country	% of Exports
Japan	14.1	12.8	U.S.A.	34.8	U.S.A.	27.3
			Australia	7.8	U.S.A.	3.9
U.S.A	5.6	6.6	Canada	19.6	Canada	18.2
			Japan	8.9	U.K.	7.6
			U.K.	7.1	Japan	7.6

Sources: Japan, Office of the Prime Minister, Bureau of Statistics, *Monthly Bulletin of Statistics* (Tokyo). U.S., Department of Commerce, Office of Business Economics, *Survey of Current Business* (Washington, D.C.).

These findings suggest that one useful approach to quantifying Japanese interdependence might be to construct a small linked model of the Japanese and U.S. economies of the type used by Resnick for the EEC. Further the bilateral pattern of Japanese trade with the United States, as contrasted with the more complex trade linkages within the Common Market, allows the use of more complex models for the individual economies than those used in the Resnick model, without inflating the overall system of equations to unmanageable proportions. The results presented here were obtained in this way; an outline of the model and the results of validation tests are given in Section II of this paper.

[4] See [8], Kazuo Satō, "Japan's Foreign Trade—Retrospect and Prospect," in *Pacific-Partnership: United States–Japan Trade,* ed. Jerome B. Cohen (Lexington, Mass.: Lexington Books for The Japan Society, 1972), pp. 81–115, and Leon Hollerman, *Japan's Dependence on the World Economy* (Princeton: Princeton University Press, 1967), for more detailed discussions of Japan's international trade. An article in a recent edition of the *Wall Street Journal* (January 22, 1975) has also linked the deterioration in Japan's export position to the depressed state of business activity in her trading partners.

C. *Measures of Japanese Interdependence*

The economies of Japan and the United States are assumed to be linked via their trade with each other and all trade with other countries is aggregated in a "Rest-of-the-World" sector. There are forty-two statistical equations in the model and a number of technical and definitial relations which allow the effects of changes in several U.S. economic policy instruments, the levels of personal income tax receipts (*USTP*), receipts of indirect taxes net of customs duties (*USTIN*), and customs duties (*UNTIC*), the levels of real government consumption expenditures (*USCG*) and social insurance contributions (*USSI*), and the Federal Reserve discount rate (*UNRD*), on the Japanese economy to be investigated.[5] This system of simultaneous equations was solved for each quarter from the second quarter of 1967 through the first quarter of 1969 (*kaikei nendo* Shōwa 42, 43) using actual values for one of the policy variables and for all other variables except those determined by the solution itself. The policy variable was then changed by a fixed increment and new solutions obtained for all eight quarters. This process was then repeated for the remaining five policy "instruments" and the values of the multipliers were computed in each case.[6] The levels of the multipliers reached after eight quarters for sixty-three key variables in the Japanese and U.S. economies are shown in Tables II and III for all six policy experiments.

Within the two year time span of the simulations, the monetary policy variable, the Federal Reserve discount rate (*UNRD*) and the level of indirect taxes net of customs duties (*USTIN*), had the weakest effects. One reason for the small effect of the U.S. discount rate is the one year delayed response of aggregate investment expenditures to changes in interest rates in the model, thus the

[5] The results obtained apply directly to a wider range of instruments than this, for example, instead of a change in government expenditures one might read a change in residential investment. Also, a change in the level of contributions for social insurance has the same effect as a change in wage accruals less disbursements, or an equal but opposite change in dividend payments, consumer interest payments, or net government interest payments. A useful interpretation of this experiment might view the instrument as the difference between social insurance contributions and government transfers to persons.

[6] Let the initial value of the first policy variable (such as the level of personal income tax receipts) be $X_{11}{}^{i}$, and the solution values of the dependent variables (for example, gross national product, balance of trade) $Y_{11}{}^{i}$, $Y_{12}{}^{i}, \ldots, Y_{1N}{}^{i}$ for the i'th quarter of simulation. Let the final values of the policy variable be $X_{11}{}^{i}+\Delta$, and the solution values of the dependent variables be $Y_{21}{}^{i}$, $Y_{22}{}^{i}, \ldots, Y_{2N}{}^{i}$. Then the multiplier for the j'th dependent variable in the i'th quarter is simply the ratio

$$M_j{}^{i}=(Y_{2j}{}^{i}-Y_j{}^{i})/\Delta .$$

The multiplier is therefore simply a measure of the change in the dependent variable due to a unit change in one of the policy instruments, for example, a multiplier of -0.03 for the GNP of Japan with respect to changes in *USTP* in the eighth quarter of simulation means that a 1 billion dollar increase in personal income taxes in the U.S. due, perhaps, to a reduction in personal exemptions, and which was sustained for two years, would cause Japanese GNP to decrease by 10.8 billion yen (annual rate) at the end of the two years.

TABLE II

MULTIPLIERS—JAPANESE VARIABLES, 8TH QUARTER

Series \ Policy Instruments	*USTP*	*USTIN*	*UNTIC*	*USCG/*	*USSI*	*UNRD*
JNIR/	−0.0001	−0.0000	0.0	0.0003	0.0001	0.0
JNIF/	−0.0044	−0.0016	−0.0264	0.0140	0.0038	−0.0008
JNKF	−0.0136	−0.0055	−0.0975	0.0567	0.0117	−0.0009
JNJP/	−0.0079	−0.0030	−0.0167	0.0138	0.0065	−0.0036
JNKJ/	−0.0164	−0.0064	−0.0750	0.0575	0.0134	0.0121
JNCP/	−0.0013	−0.0003	−0.0041	−0.0014	0.0009	0.0062
JNECU	−0.0139	−0.0058	−0.0385	0.0423	0.0114	−0.0019
JNECA	−0.0139	−0.0058	−0.0375	0.0424	0.0114	−0.0019
JNEC	−0.0135	−0.0057	−0.0375	0.0413	0.0111	−0.0019
JNE/	−0.0130	−0.0055	−0.0362	0.0397	0.0108	−0.0018
JNMCU	−0.0002	−0.0001	−0.0015	0.0013	0.0002	0.0005
JNMCW	−0.0001	−0.0000	−0.0014	0.0005	0.0000	0.0007
JNMCA	−0.0003	−0.0001	−0.0015	0.0018	0.0003	0.0012
JNMC	−0.0002	−0.0001	−0.0028	0.0014	0.0002	0.0009
JNM/	−0.0001	−0.0000	0.0	0.0006	0.0001	0.0009
JNV/	−0.0266	−0.0103	−0.0833	0.0656	0.0218	−0.0010
JNV	−0.0302	−0.0117	−0.0944	0.0746	0.0248	−0.0012
JNYN	−0.0277	−0.0107	−0.0861	0.0677	0.0228	−0.0012
JNYC	−0.0069	−0.0027	−0.0208	0.0169	0.0056	−0.0003
JNYP	−0.0209	−0.0081	−0.0625	0.0507	0.0171	−0.0009
JNYD	−0.0183	−0.0071	−0.0555	0.0446	0.0150	−0.0008
JNYD/	−0.0156	−0.0061	−0.0473	0.0381	0.0128	−0.0007
JNTIC	−0.0000	−0.0000	0.0	0.0001	0.0	0.0001
JNTI	−0.0022	−0.0009	−0.0069	0.0055	0.0018	0.0
JNTC	−0.0019	−0.0008	−0.0056	0.0047	0.0016	−0.0001
JNTP	−0.0026	−0.0010	−0.0083	0.0062	0.0021	−0.0001
JNRD	−0.0016	−0.0007	−0.0085	0.0045	0.0014	0.0013
JNRL	−0.0007	−0.0003	−0.0050	0.0023	0.0006	0.0
JNB	−0.0133	−0.0056	−0.0361	0.0400	0.0110	−0.0028
JNPE	−0.0000	−0.0000	0.0	0.0001	0.0000	0.0
JNPM	−0.0000	−0.0000	−0.0005	0.0002	0.0000	−0.0000
JNPW	0.0001	−0.0001	0.0005	−0.0005	−0.0001	0.0000

Note: The symbol "0.0" is used for magnitudes less than 0.00005, the entry "0.0000" signifies a magnitude less than 0.0005 and greater than or equal to 0.00005. This convention is used throughout the following tables. All entries are given to four decimal places to show the relative magnitudes and signs of the effects, a corresponding level of accuracy is not implied.

multipliers for this policy variable are zero for all dependent variables in each of the first four simulation quarters. The Japanese variable most sensitive to changes in the U.S. discount rate is the level of inventory stocks—an increase of one percentage point in the discount rate causing stocks to rise by 4.32 billion over the two years. As might be expected, Japan was most strongly affected by changes in the level of customs duties, Japanese GNP decreasing by slightly less

than 10 per cent of the increase in customs tax receipts of the United States. This figure is close to the Japanese share in U.S. imports during this period.

In general, the values of these multipliers for the Japanese variables are small, but increasing over-time. This behavior is illustrated by the graphs of the multipliers for Japanese commodity exports (*JNECA*) and GNP at constant prices (*JNV/*) in Figures 1 and 2. A $1 billion increment to income taxes receipts in the United States in the second quarter of 1967 and continued through the first quarter of 1969 initially causes only a small decrease in the Japanese GNP, which falls by about 10.1 billion over two years and is still falling after that

TABLE III

MULTIPLIERS—U.S. VARIABLES, 8TH QUARTER

Series \ Policy Instruments	*USTP*	*USTIN*	*UNTIC*	*USCG/*	*USSI*	*UNRD*
USIR/	−0.0002	−0.0001	0.0	0.0007	0.0001	−0.0088
USIF/	−0.0014	−0.0006	−0.0015	0.0054	0.0012	−0.0769
USKF/	−0.0024	−0.0012	0.0	0.0300	0.0029	−0.2075
USJP/	−0.0485	−0.0202	−0.0175	0.0659	0.0393	−0.0029
USKJ/	−0.2446	−0.1037	−0.0839	1.0743	0.2039	−0.0451
USCP/	−0.3981	−0.1665	−0.1663	0.1862	0.3252	−0.0056
UNECJ	−0.0001	−0.0000	−0.0005	0.0003	0.0001	0.0003
UNEC	−0.0002	−0.0001	−0.0010	0.0009	0.0002	0.0007
UNE/	−0.0002	−0.0001	−0.0010	0.0007	0.0001	0.0014
USE/	−0.0002	−0.0001	−0.0015	0.0008	0.0002	0.0017
UNMCJ	−0.0130	−0.0055	−0.0365	0.0402	0.0107	−0.0017
UNM/	−0.0105	−0.0044	−0.0295	0.0326	0.0087	−0.0014
USM/	−0.0106	−0.0045	−0.0295	0.0328	0.0088	−0.0014
USV/	−0.4377	−0.1829	−0.1556	1.2255	0.3571	−0.0824
USV	−0.5499	−0.2298	−0.1945	1.5397	0.4487	−0.1035
UNV	−0.5287	−0.2209	−0.1877	1.4806	0.4315	−0.0995
USYN	−0.4666	−1.2294	−1.4030	1.3057	0.3808	−0.0842
USYC	−0.2308	−0.6083	−0.6950	0.6460	0.1883	−0.0417
USYP	−0.2358	−0.6211	−0.7080	0.6597	1.1924	−0.0425
USYD	−1.2358	−0.5001	−0.5699	0.5313	0.9602	−0.0343
USYD/	−1.0179	−0.4120	−0.4692	0.4376	0.7909	−0.0282
UNTIC	−0.0007	−0.0003	1.0000	0.0021	0.0006	−0.0001
USTIC	−0.0008	−0.0003	1.2365	0.0027	0.0007	−0.0001
USTI	−0.0832	0.9996	1.2070	0.2334	0.0679	−0.0156
USTC	−0.1596	−0.4205	−0.4805	0.4465	0.1302	−0.0288
USTP	1.0000	−0.1209	−0.1373	0.1284	0.2322	−0.0083
USD	−0.0001	−0.0000	0.0	0.0007	0.0000	−0.0036
UNRGS	0.0	0.0	0.0	0.0	0.0	1.0000
UNRGL	0.0	0.0	0.0	0.0	0.0	0.4101
UNPE	0.0	0.0	0.0	0.0000	0.0	−0.0001
UNPM	−0.0002	−0.0001	−0.0005	0.0005	0.0001	0.0000

Note: The full set of multipliers from which the results in Tables II and III were drawn is available on request to the author.

Fig. 1. Multiplier for Japanese Commodity Exports with Change in U.S. Personal Income Tax Receipts

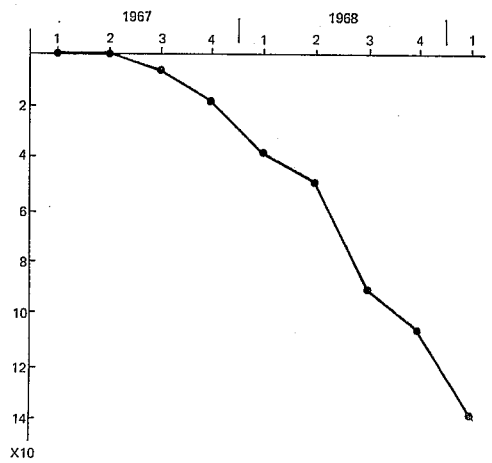
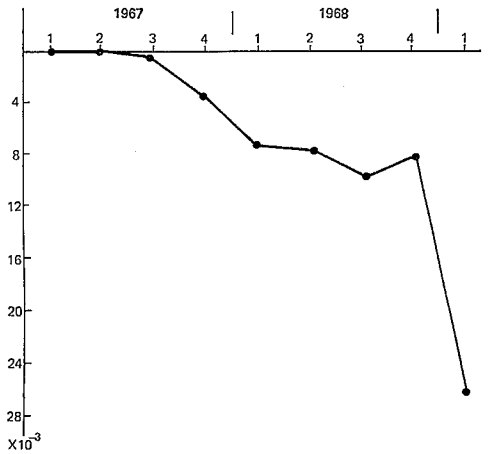


Fig. 2. Multiplier for Japanese GNP at Constant Prices with Change in U.S. Personal Income Tax Receipts



time. The economic adjustments following the imposed change of policy do not occur smoothly; this is largely the result of seasonal factors, especially in relation to changes in inventories.

While the absolute values of the changes in the various economic variables that follow changes in the policy variables are of some interest, they are not suitable as measures of the strength of interdependence because of the difference in absolute size of the two economies. A better measure uses the elasticity of the dependent variable to changes in the policy instrument, i.e., the ratio of the percentage change in the dependent variable to the percentage change in the instrument causing the change. The elasticities for twelve of the major economic

variables, computed for all policy instruments at the ends of the second, fourth, and eighth quarters of simulation, are shown in Tables IV and V. The most visible result is found to be the high level of the elasticities of the Japanese balance of payments (*JNB*) to changes in the U.S. government purchases of goods and services (*USCG/*) when compared with the elasticities for the other fiscal

TABLE IV

ELASTICITIES WITH RESPECT TO CHANGES IN THE INSTRUMENTS *USTP, USSI,* AND *USTIN*

	USTP Time Span			*USSI* Time Span			*USTIN* Time Span		
	2	4	8	2	4	8	2	4	8
JNV/	−0.000	−0.005	−0.018	−0.000	−0.002	−0.007	−0.000	−0.002	−0.006
JNJP/	−0.008	−0.041	−0.245	−0.003	−0.017	−0.099	−0.003	−0.014	−0.074
JNECU	−0.018	−0.090	−0.216	−0.008	−0.040	−0.087	−0.007	−0.032	−0.071
JNYC	−0.001	−0.010	−0.033	−0.000	−0.005	−0.013	−0.000	−0.004	−0.010
JNYD	−0.000	−0.005	−0.019	−0.000	−0.002	−0.008	−0.000	−0.002	−0.006
JNRD	0.0	−0.001	−0.006	0.0	−0.001	−0.003	0.0	−0.000	−0.002
JNB	−0.111	−1.760	−0.921	−0.047	−0.738	−0.374	−0.040	−0.593	−0.303
USV/	−0.008	−0.022	−0.057	−0.004	−0.010	−0.023	−0.003	−0.008	−0.019
USTP	0.959	0.941	0.824	−0.102	−0.093	−0.095	−0.083	−0.077	−0.079
USTI	−0.013	−0.037	−0.094	−0.006	−0.017	−0.038	0.962	0.942	0.883
UNTIC	−0.002	−0.008	−0.032	−0.001	−0.004	−0.013	−0.001	−0.003	−0.011
UNRGS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: Measured in quarters from the start of the simulation. The elasticities are measured at the end of the designated time span using an average value of the instrument over that period. If the computed entry is less than 0.005 but greater than or equal to 0.0001 it is entered as "0.000," entries smaller than 0.0001 are written "0.0."

TABLE V

ELASTICITIES WITH RESPECT TO CHANGES IN THE INSTRUMENTS *UNTIC, USCG/, UNRD*

	UNTIC Time Span			*USCG/* Time Span			*UNRD* Time Span		
	2	4	8	2	4	8	2	4	8
JNV/	−0.000	−0.001	−0.001	0.037	0.090	0.093	0.0	0.0	−0.000
JNJP/	−0.003	−0.007	−0.012	0.821	0.506	0.883	0.0	0.0	−0.023
JNECU	−0.007	−0.017	−0.013	1.995	1.846	1.363	0.0	0.0	−0.006
JNYC	−0.000	−0.002	−0.002	0.079	0.178	0.168	0.0	0.0	−0.000
JNYD	−0.000	−0.001	−0.001	0.038	0.092	0.095	0.0	0.0	−0.000
JNRD	0.0	−0.000	−0.001	0.0	0.012	0.036	0.0	0.0	0.001
JNB	−0.043	−0.318	−0.056	11.665	36.398	5.736	0.0	0.0	−0.040
USV/	0.0	−0.000	−0.001	0.328	0.332	0.329	0.0	0.0	−0.002
USTP	−0.002	−0.003	−0.003	0.261	0.237	0.222	0.0	0.0	−0.001
USTI	0.025	0.033	0.030	0.564	0.561	0.544	0.0	0.0	−0.004
UNTIC	0.996	1.011	1.138	0.174	0.168	0.202	0.0	0.0	−0.001
UNRGS	0.0	0.0	0.0	0.0	0.0	0.0	0.977	0.846	0.809

Note: See note to Table IV.

variables, the elasticity also appears to vary to an unusual degree over the span of the simulation; these features are in fact rather misleading and stem from the variation of the balance of payments round a mean close to zero. We find that Japanese commodity exports to the United States (*JNECU*) and inventory investments at constant prices (*JNJP/*) have elasticities in the region of 1.5 and 0.8 respectively for changes in U.S. government expenditures. Thus, a 1 per cent increase in *USCG/* causes *JNECU* to increase by about 1.5 per cent and *JNJP/* to increase by about 0.8 per cent. U.S. government expenditures have the strongest effect on the Japanese sector, with changes in personal income taxes (*USTP*) and social security contributions following in order of importance.

The elasticities are a much preferred measure of the impact of a policy variable on other economic variables in the two countries, but still do not provide a convenient index of the relative impact on the two countries. For this purpose, we simply use the ratio of the elasticity of Japanese GNP to the elasticity of GNP of the United States, both with respect to the same policy variable, and measured in the same quarter. For example, when *USCG/* is the policy variable, the elasticities in the eighth quarter of simulation for *JNV/* and *USV/* are 0.093 and 0.329 respectively; the ratio of these values is 0.28, indicating that the impact of the change in U.S. government expenditures on Japan is about one-third as great as on the United States economy. Table VI contains these ratios for all of the fiscal policy variables, calculated for the second, fourth, and eighth simulation periods. The monetary instrument *UNRD* is not included because the multipliers for this variable were generally too small to give meaningful values.

Two important conclusions may be drawn from these results. First, those U.S. instruments whose primary effect is domestic also have a substantial effect on the Japanese economy equal in magnitude to about one-third of their effect on the U.S. economy. Second, that changes in customs duties, which are primarily directed at the foreign sector, do in fact have a larger proportional effect on the Japanese than on the U.S. economy.

It is instructive to compare the measures of interdependence between Japan and the United States obtained in this study with the results obtained by Resnick

TABLE VI

RATIO OF PERCENTAGE IN CHANGES IN JAPANESE AND U.S. LEVELS OF GNP AT CONSTANT PRICES

Instrument	Time Span		
	2	4	8
USTP	0.04	0.24	0.32
USSI	0.04	0.23	0.32
USTIN	0.04	0.23	0.30
UNTIC	1.67	6.17	2.88
USCG/	0.11	0.27	0.28

Note: These values may not agree exactly with data obtained from earlier tables because of the effects of rounding.

TABLE VII

INTERDEPENDENCE IN THE EEC

Country Changing Policy / Country Affected	Belgium[a]	France	Germany	Italy	Netherlands
Belgium	1.00[b]	0.13(0.13)	0.30(0.30)	0.16(0.15)	0.32(0.33)
France	0.37(0.38)	1.00	0.94(0.93)	0.59(0.59)	0.73(0.73)
Germany	0.16(0.17)	0.34(0.34)	1.00	0.26(0.26)	0.33(0.33)
Italy	0.27(0.26)	0.27(0.27)	0.34(0.34)	1.00	0.93(0.93)
Netherlands	0.19(0.20)	0.08(0.08)	0.15(0.15)	0.12(0.12)	1.00

[a] Belgium here includes Luxembourg.

[b] Entries are ratios of the percentage change of GNP of the row country to the percentage change of GNP of the column country due to a change in tax receipts (or of government expenditures in parentheses) of the latter. Based on data from [11, Table 1, 2].

for the EEC.[7] A simple manipulation of Resnick's results for the European Common Market leads to the statistics shown in Table VII (note that changes in both taxes and government expenditures lead to essentially the same interdependence effects in this table). The results suggest that the Netherlands dominates all other EEC members in the strength of the impact of its economic policies on their economies, Germany dominates all except the Netherlands, Belgium, and Italy follow in that order, and the policies of France always have a smaller impact on its partners than theirs have on France. The magnitudes of interdependence, if we may use the tabulated ratios as an appropriate quantitative measure of this property, range from a low of 0.08 to the very high value of 0.94. The results obtained here for Japan and the United States may be compared with those in Resnick's study of interdependence among the Community members over the years 1948–61.

D. *Recapitulation*

We have described an attempt to measure some repercussions of changes in U.S. economic policy on Japan via the application of a small econometric model linking the two economies. The simulation experiments reported here show that several fiscal instruments primarily related to internal economic adjustments, such as the level of personal income tax receipts or government purchases of goods and services in the United States, have a substantial impact on the Japanese economy, though less than for corresponding increases in customs duties. Except

[7] [11, Table 1, 2]. Direct and indirect taxes are treated symmetrically in this study, hence the word "tax" may be interpreted as applying equally to either. Only those experiments in which aggregate tax receipts or government expenditures were changed in one member country with no contemporaneous policy changes in the others are used for this comparison.

for this latter case, the effects of interdependence appear to be small in magnitude for the first six months or more following a change in U.S. policy, and not to reach their full strength for two years or longer. At the end of the simulations, the perturbation of Japanese GNP was found to be about one-third of that of the GNP of the United States in most cases, with the greatest disturbance to Japanese GNP following a change in customs duties. A comparison of these results with those obtained by Resnick for the European Common Market indicates that Japan's dependence on the U.S. economy falls about midway in the range of interdependence between the EEC partners.

The conclusions support the position that stresses the desirability of cooperative economic policy among trading nations. It is also clear that the importance of such cooperation, and vulnerability in its absence, is greater for the more trade dependent economies such as these of Japan and Britain, for example, and may be an important factor in determining the growth rate potential of developing countries. Certainly such countries cannot afford to initiate beggar-my-neighbor policies to counteract economic disturbances of foreign origin.[8] Our ability to formulate optimal cooperative policies, however, will depend critically on the development of our understanding of the dynamics of interdependence as a result of further research into this area.

It is important that the conclusions of a limited study of this kind should not be accepted uncritically. The relative simplicity of the model necessitates a multitude of simplifying assumptions, some of which are discussed later in this paper. Current research by economists in Japan, the United States and many other countries on the linkage of large national econometric models (Project Link) should remove most of these limitations, increasing both the breadth of our knowledge and confidence in the measures of interdependence.

II. A MODEL OF INTERDEPENDENCE BETWEEN JAPAN AND THE UNITED STATES

A. *Outline*

The results described in the first part of this paper were obtained with a small econometric model linking the Japanese and U.S. economies. Because of a continuing interest in the problems of interdependence and optimal policy in open economies among economists an extensive empirical and theoretical literature has developed in this area.[9] In an important contribution to this literature,

[8] See *The Japan Economic Journal (Nihon Keizai Shimbun International Weekly)*, February 4, 1975, for a report linking restrictions of automobile imports (of which 80 per cent are of Japanese manufacture) to the controls on beef imports instituted by the Ministry of Agriculture and Forestry early in 1974.

[9] As, for example, in the studies by Robert Mundell, "The Appropriate Use of Monetary and Fiscal Policy for Internal and External Stability," *IMF Staff Papers*, March 9, 1962, pp. 70–79; Rudolf R. Rhomberg, "A Model of the Canadian Economy under Fixed and Fluctuating Exchange Rates," *Journal of Political Economy*, Vol. 72 (February 1964), pp. 1–31; Anne O. Krueger, "The Impact of Alternative Government Policies Under Varying Exchange Systems," *Quarterly Journal of Economics*, Vol. 79 (May 1965), pp.

Rhomberg and Boissonneault developed a twenty-nine equation model of joint income and trade determination between the U.S., Western Europe, and the Rest-of-the-World designed to measure the effects of foreign economic disturbances on the U.S. balance of payments [13, pp. 59–124]. In a later study, Rhomberg focused on the transmission of fluctuations of economic activity between developed and developing countries via the relations between imports of the developing countries and their foreign exchange position [12, pp. 1–27]. Bonomo and Tanner have published an empirical study of interdependence between the United States and Canada as revealed by the technique of spectral analysis [4, pp. 1–8].

These studies have generally been incomplete in a policy sense because they have not directly addressed the problem of the international ramifications of changes in economic policy. Cooper has demonstrated the importance of cooperative economic policy among interdependent nations, not only to ensure the realization of a global optimum position, but also to prevent unduly large cycles of activity during the adjustment period and reduce its duration [5] [6, pp. 1–24]. The study of the EEC by Resnick is an early example of an attempt to measure the strength of the effects of interdependence.

The purpose of this essay is to present some estimates of the magnitude of interdependence between Japan and the United States during the 1960s. The model employed is in the same tradition as that used by Resnick, but is rather more detailed in that there are forty-two stochastic equations plus thirty-five identities and definitions.[10] Each country is described by sectors for aggregate demand, prices, interest rates, and the allocation of national income, and a miscellaneous group of equations provides for trade with the rest of the world (ROW), reconciles series compiled on different bases, and adds or subtracts seasonal components where necessary. Because of the difference in size of the foreign sector relative to total domestic activity between the two countries, the model was made asymmetrical, with no attempts to measure the impact of Japanese policy on the United States. Those equations involving jointly determined variables were estimated by the 2SLS technique, using nine principal components of the predetermined variables of the model as instruments. The international and Japanese sectors of the model were estimated in the unadjusted form and

195–208; Thomas D. Willett and Francesco Forte, "Interest Rate Policy and External Balance," *Quarterly Journal of Economics*, Vol. 83 (May 1969), pp. 242–62; and in the collection edited by Emil Claassen and Pascal Salin, *Stabilization Policies in Interdependent Economies* (Amsterdam: North-Holland Publishing Co., 1972).

[10] Tables of the computed multipliers for this model have been omitted from the paper to save space. Copies will be sent to interested persons and requests should be made directly to the author. A more detailed description of the model, including citations of earlier research on the structures used and the above tables, is contained in the author's doctoral dissertation (J. A. Lucken, "Interdependence and Economic Policy: The Case of Japan and the United States," Ph.D. dissertation, Boston College, 1972).

patched to the remaining SA equations for the United States.[11] This approach was adopted partly because of a predilection for using unadjusted data where possible and partly because the data for U.S. international transactions by trading partner or area is published in seasonally unadjusted (NSA) form by the Bureau of Economic Analysis; NSA data was readily available for all Japanese series.

The design of the model is relatively conventional with respect to the commodity markets and price equations, the latter being largely based on neoclassical mark-up-models. It includes a rudimentary monetary sector based on term structure models which is linked with the investment sector through the cost-of-capital. On the Japanese side of the model, the discount rate of the Bank of Japan is endogenous and determined by governmental reactions to changes in the balance of payments and fluctuations in the rate of growth of the economy.

B. *The Demand for Goods and Services*

Aggregate private consumption demand in each country is represented by a version of the nondurables equation in the Wharton-EFU model which incorporates the effects of price changes and seasonality.[12] Investment in fixed plant and equipment and in inventory changes are described by traditional neoclassical and stock-adjustment models respectively.

An overall view of the international sector is shown schematically in Figure 3, and Figure 4 details the treatment of commodity trade. Japanese exports of commodities to ROW (*JNECW*) are described by a simple market share model in which Japan's share is assumed to depend on the level of world export and on relative prices in Japan and the United States; wholesale prices are used as proxies for export prices. The flows of commodities between Japan and the United States depend on the levels of demand in the importing countries through a semi-linearized model in which realized exports (*JNECU, UNECJ*) follow demand after a one period Lundbergian lag. The "propensity to import" is a function of income and the relative prices of imported and import competing goods, with income effects introduced through both level and difference terms.

Japan's imports from ROW (*JNMCW*) are based on a similar model to that for *JNECU* and *UNECJ* with the addition of a term representing the ratio of inventories to gross sales (proxied by GNP) in the last period. Surprisingly, in view of the importance of raw material imports to Japan, the coefficient of this

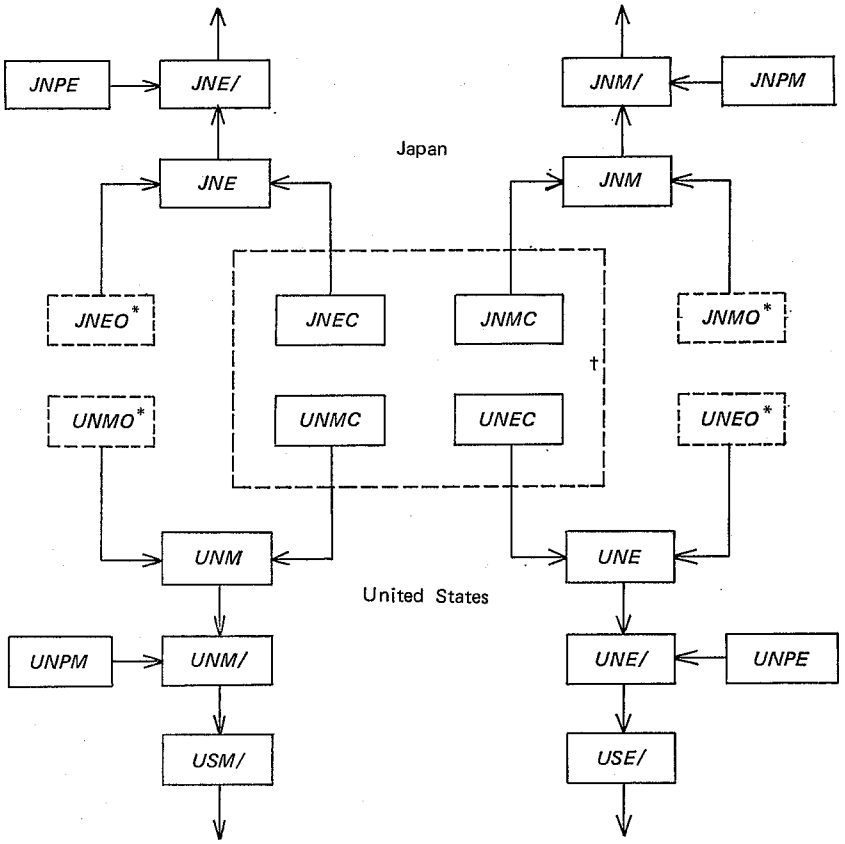
[11] Seasonal dummies were included in the equations based on SA data for a variety of reasons. First, the long-term interest rate series (*UNRGL*) used in the equation for fixed private investment (*USIF/*) is unadjusted. Secondly, some series such as the capital stock (*USKF/*) were constructed by linear interpolation of annual series and thus possess an artificial seasonality. Thirdly, functions of two adjusted series are not necessarily adjusted in the same sense as the component series, as shown by Michael C. Lovell, "Seasonal Adjustment of Economic Time Series and Multiple Regression Analysis," *Journal of the American Statistical Association*, Vol. 58 (December 1963), pp. 993–1010.

[12] For further details see: J. A. Lucken, "Seasonal Consumption Patterns in Japan and the United States: 1961/4–1969/1," *Hitotsubashi Journal of Economics*, Vol. 15 (June 1974), pp. 9–15.

last term was statistically insignificant, probably the result of a conflict between the stock adjustment mechanism and the need for Japanese manufacturers to build inventories during booms in anticipation of later restrictions.

The levels of commodity imports by Japan and the United States from each other (*JNMCU, UNMCJ*) are described by technical equations which explain imports in terms of exports, storage and transportation delays, and differences in valuation basis between countries.[13] These equations are estimated as simple distributed lags of the export series *UNECJ* and *JNECU*. U.S. imports show only a small mean lag (0.04 quarters) behind the Japanese export series and only a small difference in magnitude (3 per cent), Japanese imports, on the other

Fig. 3. Flow Chart: The International Sector

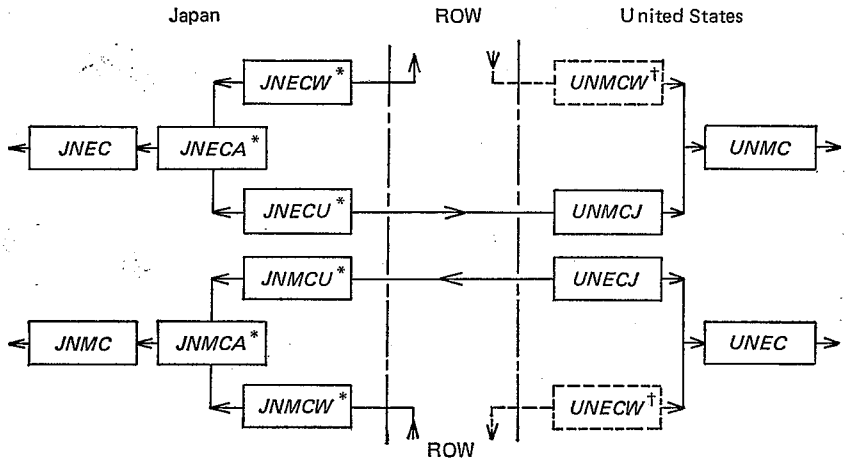


* Exogenous series.

† See Figure 4 for details of the commodity trade sector.

[13] The U.S. data on international commodity transactions is published in balance-of-payments form and is therefore valued f.o.b. by date of sale. The Japanese series are customs data and valued f.o.b. by date of shipment, entry into bond, or issuance of the export permit in the case of exports, and c.i.f. by date of arrival or release from bond in the case of imports.

Fig. 4. Flow Chart: Imports and Exports of Commodities



* Customs basis. All other series are on a national income basis.
† Exogenous series.

hand, lag U.S. exports by about 0.3 quarters and have a substantially greater value (25 per cent) representing both transportation lags and cost. These differences are consistent with the differences in valuation basis between the two countries for commodity imports and exports.

Other equations make adjustments to ensure internal consistency of the model with respect to valuation and seasonal adjustment. On the Japanese side, total exports and imports of commodities are converted to a balance-of-payments valuation by a simple linear model. Exogenous series for exports and imports other than commodities are included to give total trade values at current prices, and these are deflated by the indices for export and import prices. On the U.S. side the values of export and import trade with Japan other than in commodities, and the exogenous series for U.S. trade with ROW, are added to the series for commodity trade with Japan; the resulting totals are deflated by the U.S. indices of import and export prices and seasonally adjusted by the linear regression technique.

C. *Prices*

There are six price equations in the system: two for wholesale prices (*JNPW, UNPW*), two for export prices (*JNPE, UNPE*), and two for import prices (*JNPM, UNPM*). The import series are based on a simple definitial model in which import prices are weighted average of export prices, differences in the base years are absorbed in the magnitudes of the coefficients.

Export and domestic prices of both countries are assumed to be determined in neoclassical mark-up models based on Cobb-Douglas production functions. The Japanese series *JNPW* and *JNPE* are very well described by this model—the substantial economic growth of the Japanese economy during the 1960s appears to have contributed materially to a reduction of the mark-up of prices

over wages in that period. In the case of the United States, demand factors appear to have dominated price movements during this period, since the coefficients of the capital terms are barely significant. In both countries, composition changes provide an additional factor not included in the model for export prices.

D. *Interest Rates*

In both the United States and Japanese sectors of the model long-term interest rates are assumed to affect aggregate demand through their influence as cost-of-capital variables on the level of investment demand. The series used are the average rate on loans by all banks in Japan (*JNRL*) and the yield on U.S. Treasury bonds of maturity greater than ten years (*UNRGL*). A term structure approach is used to relate *UNRGL* to the rate on three month U.S. Treasury bills (*UNRGS*), and to describe the difference between *UNRGS* and the Federal Reserve System discount rate (*UNRD*). The models essentially follow the work of Kane [7, pp. 361–74]. The FRS discount rate is assumed to be exogenous. Similarly, a term structure equation is used to explain the premium of *JNRL* over the discount rate of the Bank of Japan, but in this case the important direct role played by industrial debt in the total volume of bank loans prompted the incorporation of real factors into the equation as in the model by Watanabe and Uchida [16]. Because of the strong links between Japanese monetary policy and economic factors, particularly the balance of payments and the growth of national income, noted by Patrick and Tachi for example, an attempt has been made to endogenize the discount rate of the Bank of Japan [10] [15]. This rate is explained by movements in GNP and the balance of trade in a model related to earlier work by Amano [1].

E. *Income and Tax Equations*

Tax receipts and liabilities are described by simple linear functions of the relevant tax bases. Personal income and corporate profits serve for the income tax equations, GNP is the base for indirect taxes net of customs duties, and the volume of commodity imports is the base for customs revenues, with all series measured at current prices. Dummy variables are included to explain major changes in the tax codes.

Charges for capital consumption depend on the capital stock at the end of the last period. Similar models are used for both countries except that charges for residential housing in Japan are made exogenous. Corporate income is estimated with a conventional share-of-income model. Revenues are proxied by national income in the United States and noncorporate income is taken as the compensation of employees plus proprietors' income. GNP was found to perform better as a proxy for sales revenues in Japan.

F. *Tests of the Model*

Before simulating the effects of policy changes, the overall performance of the model was tested by means of a dynamic simulation over the last eight periods of the data sample, and the principal results are displayed in Tables VIII and IX. In Table VIII, actual and simulated changes in the major variables are

TABLE VIII

TESTS OF AN EIGHT PERIOD DYNAMIC SIMULATION

Series	One Period Changes Ending in:[a]				Percentage Accumulated RMS Error to End of Quarter N			
	1st Quarter		2nd Quarter					
	A[b]	S	A	S	$N=1$	$N=2$	$N=4$	$N=8$
JNIF/	0.039	0.041	0.250	0.249	0.12	0.08	4.19	6.47
JNJP/	0.264	0.275	−0.166	−0.318	2.49	26.19	36.81	102.46
JNKJ/	0.463	0.475	0.297	0.157	0.10	0.81	1.42	5.29
JNCP/	0.265	0.096	0.069	0.106	3.30	2.94	3.02	6.29
JNECU	0.102	−0.246	0.080	0.252	47.17	35.43	28.77	27.44
JNECA	0.097	−0.028	0.066	0.094	13.65	11.78	10.05	9.50
JNEC	0.097	−0.021	0.064	0.092	13.14	11.32	9.73	9.38
JNE/	0.112	0.019	0.065	0.105	8.67	6.85	7.13	7.79
JNMCU	0.029	−0.005	−0.044	−0.063	4.17	5.66	8.41	13.54
JNMCW	0.084	0.046	−0.040	−0.061	4.81	6.46	5.82	7.18
JNMC	0.091	0.038	−0.037	−0.064	6.29	8.25	8.30	7.07
JNM/	0.118	0.048	−0.034	−0.059	6.31	7.63	6.46	5.05
JNV/	0.135	−0.042	0.635	0.582	1.96	2.19	2.82	7.77
JNYC	0.229	0.083	−0.025	0.009	12.19	11.00	10.56	18.94
JNYD	1.325	0.903	0.444	0.254	6.41	7.72	9.17	11.07
JNTIC	0.013	0.007	0.001	−0.002	6.81	9.25	9.90	8.39
JNTI	−0.048	−0.085	0.078	0.104	5.07	3.56	4.11	6.80
JNTC	0.226	0.105	−0.210	−0.033	23.39	22.89	21.65	16.56
JNTP	−0.261	−0.271	0.184	0.163	2.68	4.99	13.86	14.05
JNRD	0.0	−0.016	0.120	0.001	0.30	1.73	6.31	6.34
JNRL	−0.025	−0.019	−0.019	−0.028	0.08	0.06	1.21	1.47
JNB	0.000	−0.065	0.112	0.166	−104.66	−704.83	−249.94	150.72
JNPE	−0.700	−3.100	0.500	−0.500	2.35	2.86	3.20	2.49
JNPM	0.800	1.000	0.200	0.200	1.73	1.71	1.40	2.52
JNPW	0.700	0.500	0.500	0.200	1.09	0.95	2.03	2.45
USIF/	−0.150	−0.344	−0.100	−0.013	1.06	0.86	1.09	1.26
USJP/	−1.350	−1.827	1.075	0.119	61.59	81.37	65.18	47.92
USKJ/	0.720	0.298	1.380	0.417	0.30	0.73	0.96	2.64
USCP/	1.600	2.010	0.300	1.139	0.38	0.86	0.78	0.63
UNECJ	0.002	−0.025	0.0	−0.002	11.24	11.59	11.91	22.81
UNEC	0.329	0.256	−0.774	−0.779	0.92	1.00	1.06	2.02
USE	0.075	−0.090	0.050	0.218	1.57	1.11	1.33	1.72
UNMCJ	0.027	−0.302	0.044	0.217	44.93	34.14	26.89	27.80
USM	−0.025	−0.266	0.075	0.176	2.56	2.08	2.06	1.96
USV/	1.000	0.865	1.875	1.962	0.08	0.06	0.49	0.34
USYN	1.725	1.725	3.075	3.148	0.00	0.03	0.57	0.44
USYC	0.0	0.223	0.200	0.290	1.14	1.38	3.06	3.39
USYP	1.750	1.478	3.075	3.008	0.18	0.20	0.24	0.28
USYD	1.839	2.837	1.910	1.347	0.74	0.57	0.55	0.49
USTIC	−0.031	−0.051	−0.022	0.001	4.19	3.08	2.30	4.79
USTI	0.325	0.112	0.400	0.486	1.23	1.00	1.15	0.83
USTC	0.075	0.340	−0.025	0.027	3.25	3.59	7.27	6.46
USTP	−0.050	−0.941	0.875	1.661	4.42	3.08	2.36	2.72
USD	0.300	0.299	0.300	0.199	0.01	0.42	0.51	0.56
UNRGS	−0.850	−0.809	0.630	0.403	1.13	3.38	2.48	2.19

TABLE VIII (Continued)

Series	One Period Changes Ending in:[a]				Percentage Accumulated RMS Error to End of Quarter N			
	1st Quarter		2nd Quarter					
	A[b]	S	A	S	$N=1$	$N=2$	$N=4$	$N=8$
UNRGL	0.280	0.233	0.210	0.307	1.00	1.01	3.20	3.57
UNPE	0.0	−0.300	1.000	0.400	0.24	0.59	0.62	1.21
UNPM	0.0	−0.500	0.0	0.300	0.49	0.38	0.54	0.85
UNPW	−0.700	−0.500	−0.000	0.400	0.11	0.39	0.97	1.21

[a] Stock and flow data for Japan and the United States are in thousand billions, and billions of dollars, respectively. Interest rate and price index changes are in per cent.

[b] A=actual change; S=simulated change.

TABLE IX

EIGHT PERIOD CUMULATIVE CHANGES

Series	Actual	Simulated	Error (%)[a]	Series	Actual	Simulated	Error (%)
JNIF/	0.778	0.844	8.53	*USIR/*	0.182	0.209	14.65
JNKF/	14.156	14.338	1.28	*USIF/*	1.325	1.490	12.47
JNJP/	−0.004	0.073	[b]	*USKF/*	80.337	80.840	0.63
JNKJ/	3.796	5.157	35.88	*USJP/*	−0.600	−0.829	38.08
JNCP/	0.964	1.695	75.91	*USKJ/*	17.250	10.683	−38.07
JNECU	0.392	0.874	123.10	*USCP/*	9.675	10.006	3.42
JNECA	0.388	0.551	42.13	*UNECJ*	0.016	0.166	974.42
JNEC	0.381	0.544	42.85	*UNEC*	−0.204	0.215	−205.40
JNE/	0.417	0.590	41.67	*UNE/*	−0.080	0.064	−179.46
JNMCU	0.097	0.363	275.02	*USE*	0.150	0.340	126.79
JNMCW	0.218	0.285	30.80	*UNMCJ*	0.193	0.721	273.33
JNMCA	0.252	0.415	64.48	*UNM/*	0.956	1.452	51.89
JNMC	0.217	0.322	48.21	*USM*	1.200	1.571	30.88
JNM/	0.300	0.333	11.12	*USV/*	14.150	14.012	−0.97
JNV/	2.422	3.437	41.90	*USV*	33.625	33.402	−0.66
JNV	3.373	4.529	34.26	*UNV*	31.000	31.370	1.19
JNYN	2.248	2.806	24.79	*USYN*	28.000	27.365	−2.27
JNYC	0.622	0.801	28.91	*USYC*	2.800	1.957	−30.09
JNYP	2.074	3.463	66.99	*USYP*	27.300	27.633	1.22
JNYD	1.676	2.911	73.70	*USYD*	19.369	20.124	3.90
JNTIC	0.018	0.029	62.49	*USTIC*	0.034	0.090	164.61
JNTI	0.325	0.395	21.42	*USTI*	3.850	3.870	0.52
JNTC	0.235	0.316	34.59	*USTC*	2.750	1.984	−27.85
JNTP	0.282	0.436	54.74	*USTP*	8.375	7.927	−5.35
JNRD	0.365	0.643	76.04	*USD*	2.600	2.417	−7.03
JNRL	0.015	0.010	−30.40	*UNRGS*	1.580	1.426	−9.74
JNB	0.126	0.185	46.19	*UNRGL*	1.440	1.225	−14.96
JNPE	2.000	0.800	−59.90	*UNPE*	4.000	6.420	60.37
JNPM	1.800	7.100	294.21	*UNPM*	3.000	3.020	0.57
JNPW	1.530	−2.370	−254.24	*UNPW*	2.300	3.810	65.57

[a] Percentage errors may not agree with changes because of rounding errors.

[b] Greater than 1,000.

compared for the first and second quarters of the simulation, and the percentage accumulated RMS errors for the first, second, fourth, and eighth quarters are given. Table IX shows the actual and simulated accumulated changes over eight periods, and the corresponding percentage errors.[14]

Out of sixty-four variables, the one period changes have the wrong sign in 23 out of 128 possible cases for the first two quarters of simulation, and of these 23 cases, about half are associated with quite small RMS errors or have been transmitted from another variable. The number of wrong signs rises by about 35 per cent over the full eight quarters, but these are mostly associated with the same set of variables as in the early quarters. It is interesting to note that the sign errors generally occur in variables for which the OLS and 2SLS estimates differ considerably, suggesting a possible inappropriate choice of instruments for these equations. Exceptions to this rule are *USIR/* (expenditures for the replacement of fixed capital in the United States), and *UNMCJ* (U.S. imports of commodities from Japan), where the errors arise mainly from errors in *JNECU* (Japanese commodity exports to the United States) and *UNPM* (U.S. import price index). The variables showing the least satisfactory performance assessed in terms of the accumulated RMS errors,[15] are inventory investments in both countries, the Japanese balance of payments, and the commodity trade between the United States and Japan. The errors in the balance of payments arise, of course, through the commodity trade variables.

G. *Concluding Comments*

The actual and relative magnitudes of the multipliers, and hence of the response elasticities and the strength of interdependence found here must be treated with some care. Among the more obvious limitations of this study we may first note the high level of aggregation, particularly in relation to the international sector. Secondly, the model takes no account of changes in non-tariff restrictions on trade between the United States and Japan (or between these countries and the rest of the world). These restrictions were loosened somewhat during the span of the model, possibly causing the income coefficients in the export demand equations to be biased upwards; such a bias would result in some degree of overstatement of the strength of the interdependence between the Japanese and U.S. economies. Thirdly, there is only a rudimentary monetary sector, and international flows of capital are taken as exogenous. This latter omission may be expected to have a substantial downward biasing effect on the multipliers for changes in the U.S. discount rate but, if changes in taxes and other fiscal instruments cause interest rates in the United States to rise, then capital flows from Japan may again serve to increase the apparent degree of interdependence by reducing the U.S. multipliers and increasing those of Japan, and thus at least partly offset the bias due to omitting non-tariff barriers from the model. The

[14] The percentage accumulated RMS error is defined as the accumulated RMS error up to the time of interest as a percentage of the average value of the variable to that time. The results in Table VIII are expressed as percentages of the actual changes in the variables over the eight periods.

[15] See footnote 14.

research of Moriguchi and Tatemoto and of Amano leads us to expect rapid progress in eliminating some of those problems [9] [2]. An additional factor working in the same direction arises from the lack of a mechanism linking movements in the prices of domestically produced import substitutes to changes in quotas or tariffs. Finally, the model has no explicit supply sector. The large number of equations required to relax these constraints significantly suggests that future advances in this area will occur in connection with Project Link, initiated during 1968, under the auspices of which several national econometric models have been added to the existing inventory and experiments on the bilateral and multilateral linkage of these models have been sponsored.[16]

[16] Some of which are described in [3].

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APPENDIX 1

EQUATIONS OF THE MODEL

A. *Stochastic Equations*[a]

The Consumption Function:

1. $$\underset{}{\frac{JNCP/}{JNYD/}} = \underset{0.4861}{0.2882} - \underset{0.1373}{0.0866} QQ2^{b} + \underset{0.6106}{0.7218} \cdot \frac{1}{4}\sum_{i=1}^{4}\left(\frac{JNCP/}{JNYD/}\right)_{-i} - \sum_{i=0}^{3}\left(\frac{4-i}{4}\right)(\underset{0.4012}{0.4614} + \underset{0.0160}{0.6579} Q3 + \underset{0.0026}{0.0613}\dagger Q4)_{-i}\left(\frac{\Delta JNYD/}{JNYD/}\right)_{-i} - \underset{0.6245}{0.3085}\sum_{i=0}^{3}\left(\frac{4-i}{4}\right)\left(\frac{\Delta JNPC}{JNPC}\right)_{-i}.$$

$\bar{R}^2 = 0.997 \qquad DW^{c} = 1.89 \qquad SER = 0.0067$

1a. $$\underset{}{\frac{USCP/}{USYD/}} = \underset{0.2036}{0.5531} + \underset{0.0045}{0.0136} QQ3 + \underset{0.0063}{0.0036}\dagger QQ4 + \underset{0.8044}{0.4094}\dagger \cdot \frac{1}{4}\sum_{i=1}^{4}\left(\frac{USCP/}{USYD/}\right)_{-i} - \sum_{i=0}^{3}\left(\frac{4-i}{4}\right)(\underset{0.3763}{-0.4174}\dagger + \underset{0.9687}{3.0356} Q3 + \underset{1.9140}{1.4726}\dagger Q4)_{-i}\left(\frac{\Delta USPC}{USPC}\right)_{-i} - \underset{0.8951}{0.5015}\sum_{i=0}^{3}\left(\frac{4-i}{4}\right)\left(\frac{\Delta USYD/}{USYD/}\right)_{-i}.$$

$\bar{R}^2 = 0.633 \qquad DW = 1.76 \qquad SER = 0.0053$

Fixed Private Investment:

2. $$JNIF/ - JNIR/ = -51.87\dagger + 0.3444\Delta\left(\frac{JNV}{JNRLQ}\right)_{-2} + 0.4905\Delta\left(\frac{JNV}{JNRLQ}\right)_{-3} + 0.1428\dagger\Delta\left(\frac{JNV}{JNRLQ}\right)_{-4} + [(0.3370 + 0.2856\dagger Q2 + 1.9729 Q3)(JNIF/ - JNIR/)]_{-1} + [(0.2730 - 1.3267 Q2 + 0.3555 Q3)(JNIF/ - JNIR/)]_{-2}.$$

[a] The first line of each equation is the OLS (or Cochrane-Orcutt) estimate, the second line (where given) is the 2SLS estimate, the coefficients have the same sign unless otherwise indicated. The summary statistics are for the OLS estimate. Parameters (of the OLS estimates) which are not significant at the 5 per cent level are identified with a dagger (†). The sample uses thirty observations plus lags.

[b] The dummy variables $QQ2$, $QQ3$, and $QQ4$ are defined by the relation:

$$QQj = \sum_{i=0}^{3}\left(\frac{4-i}{4}\right)Qj_{-i}.$$

[c] The abbreviations *DW*, *SER*, and *RHO* are, respectively, the Durbin-Watson Statistic, the standard error of the regression, and the estimated first order auto-correlation coefficient.

$\bar{R}^2=0.986 \quad DW=1.87 \quad SER=44.2$

2a. $$USIF/=\underset{}{0.3400}+\underset{}{0.01332}USKF/_{-1}+\underset{}{0.0001355}\Delta\left(\frac{USV}{UNRGLQ}\right)_{-4}$$
$$+[(\underset{}{0.4087}+\underset{}{0.0138}Q3)(USIF/-USIR/)]_{-1}$$
$$+[(\underset{}{0.3187}+\underset{}{0.0480}Q3)(USIF/-USIR/)]_{-2}.$$

$\bar{R}^2=0.986 \quad DW=1.94 \quad SER=0.298 \quad RHO=0.751$

3. $$\frac{JNIR/}{JNKF/_{-1}}=\underset{}{0.00501}+\underset{}{0.00254}Q1+\underset{}{0.00162}Q3+\underset{}{0.00091}Q4.$$

$\bar{R}^2=0.533 \quad DW=1.52 \quad SER=0.00085$

3a. $$USIR/=\underset{2.4492}{2.3419}+\underset{0.2641}{0.3000}Q3+\underset{0.4994}{0.5093}Q4+\underset{0.00492}{0.00521}USKF/_{-1}$$
$$+\underset{0.1059}{0.0983}\dagger USIF/.$$

$\bar{R}^2=0.830 \quad DW=2.08 \quad SER=0.289$

Inventory Investment:

4. $$JNJP/=\underset{578.2}{-614.7}-\underset{0.2832}{0.3540}JNKJ/_{-1}-\underset{9938.7}{8729.8}\Delta JNPJN$$
$$+(\underset{0.4183}{0.5057}+\underset{0.0380}{0.0376}Q2-\underset{0.0704}{0.0777}Q4)JNV/$$
$$-(\underset{0.0438}{0.0582}+\underset{0.5619}{0.4203}\dagger Q2-\underset{0.2722}{0.2341}Q4)\Delta JNV/.$$

$\bar{R}^2=0.964 \quad DW=1.42 \quad SER=61.1$

4a. $$USJP/=\underset{8.0010}{-7.5308}-\underset{0.2130}{0.4286}USKJ_{-1}$$
$$+(\underset{0.2226}{0.3832}+\underset{0.0049}{0.0052}\dagger Q4+\underset{0.0052}{0.0281}UQ6)USV/$$
$$-(\underset{-0.2828}{0.0272}\dagger+\underset{0.0740}{0.1366}\dagger Q4+\underset{0.1697}{0.2167}\dagger UQ6)\Delta USV/.$$

$\bar{R}^2=0.505 \quad DW=1.37 \quad SER=0.566$

Exports:

5. $$\frac{JNECW^{d}}{WNE\cdot E}=\underset{0.000674}{0.000666}WNE+\underset{0.003578}{0.001747}\dagger JQ10+\underset{0.004497}{0.004449}Q3$$
$$+\underset{0.002233}{0.002566}Q4+\underset{0.004828}{0.005136}\cdot\frac{1}{4}\sum_{i=0}^{3}\left(\frac{UNPW}{JNPW}\right)_{-i}.$$

$\bar{R}^2=0.917 \quad DW=1.76 \quad SER=0.00168$

6. $$\Delta\left(\frac{JNECU}{E\cdot UNV_{-1}}\right)=\underset{}{0.0001576}+\underset{}{0.001137}\dagger\Delta\left(\frac{\Delta UNV}{UNV_{-1}}\right)_{-1}$$
$$-\Delta[(\underset{}{171.8}\dagger+\underset{}{40.29}Q1+\underset{}{0.02}\dagger Q3+\underset{}{5.08}\dagger Q4)UNV_{-1}]\cdot 10^{-7}$$

[d] The exchange rate E is incorporatde arbitarily into these equations since there were no revaluations or devaluations of the yen during the period under study.

$$-0.001212\dagger\Delta\left\{\frac{1}{4}\sum_{i=1}^{4}\left(\frac{JNPW}{UNPW}\right)_{-i}\cdot\left[1+\frac{1}{4}\sum_{i=1}^{4}\left(\frac{UNTIC}{UNMC}\right)_{-i}\right]\right\}\cdot$$

$\bar{R}^2=0.911$ $DW=2.03$ $SER=0.000174$ $RHO=0.331$

6a. $$\Delta\left(\frac{UNECJ\cdot E}{JNV_{-1}}\right)=0.001586-\Delta[(25.02-3.85Q1+0.11\dagger Q3-1.04Q4)\times JNV_{-1}/E]\cdot 10^{-4}+0.004602\dagger\Delta\left\{0.4\sum_{i=1}^{4}w_i\left(\frac{JNPW}{UNPW}\right)_{-i}\div\left[1+0.4\sum_{i=1}^{4}w_i\left(\frac{JNTIC}{JNMCA}\right)_{-i}\right]\right\},$$

where $w_i=(5-i)/4$.

$\bar{R}^2=0.795$ $DW=2.16$ $SER=0.00216$ $RHO=0.226$

7. $$JNEC-JNECA=\underset{9.2053}{9.0910}-\underset{0.0260}{0.0257}JNECA\,.$$

$\bar{R}^2=0.788$ $DW=1.89$ $SER=3.97$ $RHO=0.557$

8. $$USE/=\underset{1.8821}{-1.4285}-\underset{0.2696}{0.9846}\dagger Q2+\underset{0.6203}{1.1000}Q3-\underset{1.0111}{1.1630}\dagger Q4+(\underset{1.2030}{1.1550}-\underset{0.0481}{0.0249}\dagger Q2-\underset{0.0178}{0.0694}\dagger Q3-\underset{0.1665}{0.0521}\dagger Q4)\frac{UNE}{UNPE}\,.$$

$\bar{R}^2=0.992$ $DW=1.54$ $SER=0.124$

Imports:

9. $$\frac{JNMCW}{JNV_{-1}}=\underset{-0.1642}{0.0591}+\underset{-0.00932}{0.002985}\dagger JQ10-\underset{0.1636}{0.04739}\cdot\frac{1}{4}\sum_{i=1}^{4}\left(\frac{JNPW}{WNPE}\right)_{-i}-(\underset{1.1521}{0.6566}\dagger-\underset{1.2180}{0.7982}Q2-\underset{0.2090}{0.6321}Q4)\cdot 10^{-6}\cdot JNV_{-1}+\underset{0.02569}{0.05673}\left(\frac{JNKJ/}{JNV/}\right)_{-1}-\underset{+0.6878}{0.0404}\dagger\left(\frac{JNTIC}{JNMCA}\right).$$

$\bar{R}^2=0.864$ $DW=1.33$ $SER=0.00329$ $RHO=0.596$

10. $$JNMCU/E=\underset{0.0273}{-0.0219}\dagger-\underset{0.1458}{0.0060}\dagger JQ10+\underset{0.6528}{0.3725}UNECJ+(\underset{-0.2612}{0.8020}-\underset{0.0532}{0.0403}\dagger Q1-\underset{0.0932}{0.0662}Q3)UNECJ_{-1}+\underset{0.8808}{0.0881}\dagger UNECJ_{-2}\,.$$

$\bar{R}^2=0.976$ $DW=1.77$ $SER=0.0236$

10a. $$UNMCJ=\underset{0.0095}{0.0117}\dagger-\underset{+0.0208}{0.0396}\dagger JQ10+\underset{0.8717}{0.8739}JNECU/E+(\underset{0.0860}{0.0833}\dagger+\underset{0.0468}{0.0475}Q3)JNECU_{-1}/E\,.$$

$\bar{R}^2=0.983$ $DW=1.54$ $SER=0.0324$

11. $$JNMC - JNMCA = \underset{0.0499}{18.9891}\dagger - \underset{0.2342}{0.2354}JNMCA\,.$$

$\bar{R}^2 = 0.957 \qquad DW = 2.05 \qquad SER = 11.9 \qquad RHO = 0.363$

12. $$USM/ = \underset{0.0521}{0.0724}\dagger - \underset{0.2311}{0.0891}\dagger Q2 - \underset{0.4073}{0.3857}Q3 - \underset{0.1985}{0.2743}Q4 + \left(\underset{1.0077}{1.0049} - \underset{0.0346}{0.0502}Q2 - \underset{0.0423}{0.0441}Q3 - \underset{0.0206}{0.0117}\dagger Q4\right)\frac{UNM}{UNPM}\,.$$

$\bar{R}^2 = 0.999 \qquad DW = 1.42 \qquad SER = 0.0661$

Prices:

13. $$\ln\frac{JNPW}{JNW} = \underset{-1.738}{2.310} + \left(\underset{3.8642}{1.8429} + \underset{-0.0084}{0.0464}\dagger Q2 - \underset{+0.1749}{0.0164}\dagger Q3 - \underset{1.0486}{0.2540}Q4\right)\cdot \ln JNL - \left(\underset{1.6384}{1.2950} + \underset{0.0260}{0.0327}\dagger Q2 + \underset{0.0978}{0.0169}\dagger Q3 - \underset{0.3222}{0.0442}\dagger Q4\right)\ln JNKF/\,.$$

$\bar{R}^2 = 0.999 \qquad DW = 1.99 \qquad SER = 0.0088$

13a. $$\Delta\left(\ln\frac{UNPW}{USW}\right) = \underset{0.0155}{-0.0141} + \underset{0.8980}{0.7412}\Delta(\ln USLC) - \Delta[(\underset{-320.7}{325.0}\dagger + \underset{5.44}{0.08}\dagger Q2 + \underset{5.43}{0.13}\dagger Q3 + \underset{4.00}{0.06}\dagger Q4) \times 10^{-4}\cdot \ln USKF/]\,.$$

$\bar{R}^2 = 0.918 \qquad DW = 1.39 \qquad SER = 0.00626$

14. $$\Delta\left(\ln\frac{JNPE}{JNWE}\right) = \underset{0.0629}{-0.0154}\dagger + \Delta[(\underset{3.4538}{1.2192} - \underset{1.6488}{0.1702}\dagger Q2 - \underset{2.5596}{0.4622}Q3 - \underset{0.8152}{0.5960}Q4)\ln JNLE] - \Delta[(\underset{-0.2892}{0.7570}\dagger - \underset{0.5001}{0.0410}\dagger Q2 - \underset{0.7831}{0.1323}\dagger Q3 - \underset{0.2210}{0.1546}Q4)\ln JNKF/]\,.$$

$\bar{R}^2 = 0.996 \qquad DW = 1.88 \qquad SER = 0.0128$

14a. $$\Delta\left(\ln\frac{UNPE}{USW}\right) = \underset{0.0187}{-0.0209} + \underset{1.1367}{1.1300}\Delta(\ln USLC) + \underset{0.3288}{0.5449}\dagger\Delta(\ln USKF/)\,.$$

$\bar{R}^2 = 0.856 \qquad DW = 1.81 \qquad SER = 0.0103$

15. $$JNPM = \underset{1.5347}{1.2476}\frac{JNMCU}{JNMCA}UNPE + \underset{0.7509}{0.8661}\frac{JNMCW}{JNMCA}WNPE\,.$$

$\bar{R}^2 = 0.713 \qquad DW = 1.43 \qquad SER = 0.0104 \qquad RHO = 0.881$

15a. $$UNPM = \underset{1.1237}{0.9244}\frac{UNMCJ}{UNMC}JNPE + \underset{0.9796}{1.0031}\frac{UNMCW}{UNMC}WNPE\,.$$

$\bar{R}^2 = 0.942 \qquad DW = 2.10 \qquad SER = 0.0082 \qquad RHO = 0.665$

Interest Rates:

16. $$\Delta JNRD = -0.2109\dagger + 0.0001651\dagger\Delta JNB_{-1} - 0.005353\cdot\frac{1}{4}\sum_{i=1}^{4}\Delta JNB_{-i} + 0.2049\dagger\left(\frac{\Delta JNV}{JNV_{-1}}\right)_{-1} + 4.5032\dagger\cdot\frac{1}{4}\sum_{i=1}^{4}\left(\frac{\Delta JNV}{JNV_{-1}}\right)_{-i}\,.$$

$\bar{R}^2=0.497 \quad DW=1.86 \quad SER=0.192$

17. $$JNRL-JNRD=\underset{0.9640}{-1.3339}+\underset{1.0752}{1.1319}(JNRL-JNRD)_{-1}+\underset{0.0931}{0.1323}JNRD$$
$$\underset{0.9878}{-0.9591}\Delta JNRD+\underset{0.2044}{0.1560}\Delta JNRD_{-1}-\underset{0.0531}{0.0254}\dagger\Delta JNRD_{-2}$$
$$+\underset{1.0477}{1.2008}\left(\frac{JNIP/}{JNV/}\right)+\underset{0.6277}{0.7599}\left(\frac{JNJP/}{JNV/}\right).$$

$\bar{R}^2=0.994 \quad DW=2.25 \quad SER=0.0331$

18. $$UNRGS-UNRD=0.0556+0.7341(UNRGS-UNRD)_{-1}+0.4284UQ5$$
$$-0.2418\Delta(UNRGS-UNRD)$$
$$-0.4891\Delta(UNRGS-UNRD)_{-1}$$
$$-0.2114\dagger\Delta(UNRGS-UNRD)_{-2}$$
$$-0.2161\dagger\Delta(UNRGS-UNRD)_{-3}$$
$$+0.2895\Delta(UNRGS-UNRD)_{-4}$$
$$+0.1394\dagger\Delta(UNRGS-UNRD)_{-5}.$$

$\bar{R}^2=0.877 \quad DW=1.60 \quad SER=0.104$

19. $$UNRGL-UNRGS=\underset{1.2857}{0.3512}\dagger+\underset{0.3965}{0.7897}(UNRGL-UNRGS)_{-1}$$
$$\underset{0.2209}{-0.0367}\dagger UNRGS-\underset{0.4449}{0.7549}\Delta UNRGS$$
$$\underset{0.3818}{-0.1879}\Delta UNRGS_{-1}-\underset{0.2662}{0.3278}\Delta UNRGS_{-2}$$
$$\underset{-0.1105}{+0.0453}\dagger\Delta UNRGS_{-3}-\underset{0.1598}{0.2700}\Delta UNRGS_{-4}$$
$$\underset{0.0873}{+0.1678}\dagger\Delta UNRGS_{-5}-\underset{0.1351}{0.1092}\dagger\Delta UNRGS_{-6}$$
$$\underset{0.1668}{-0.1076}\dagger\Delta UNRGS_{-7}.$$

$\bar{R}^2=0.960 \quad DW=2.36 \quad SER=0.108$

Taxes:

20. $$JNTP=\underset{114.73}{-102.20}+\underset{125.85}{105.41}Q2+\underset{114.30}{73.30}Q3+\underset{37.17}{29.18}Q4$$
$$+(\underset{0.1223}{0.1204}-\underset{0.0700}{0.0662}Q2-\underset{0.0496}{0.0430}Q3-\underset{0.0643}{0.0626}Q4)JNYP.$$

$\bar{R}^2=0.997 \quad DW=1.73 \quad SER=9.67 \quad RHO=0.683$

20a. $$USTP=\underset{7.1976}{-7.2539}+\underset{5.0441}{3.8318}Q2+\underset{-2.6525}{0.8953}\dagger Q3+\underset{1.6546}{0.4105}\dagger Q4$$
$$+(\underset{0.1947}{0.1942}-\underset{0.0412}{0.0324}Q2-\underset{+0.0153}{0.0094}\dagger Q3-\underset{0.0145}{0.0056}\dagger Q4)USYP$$
$$\underset{0.0156}{-0.0142}UQ2\cdot USYP.$$

$\bar{R}^2=0.984 \quad DW=1.58 \quad SER=0.519$

21. $$JNTC = \underset{113.20}{70.33} + \underset{-10.20}{49.54}Q2 + \underset{-100.66}{44.28}\dagger Q3 + \underset{168.54}{31.18}JQ4$$
$$+ (\underset{0.2800}{0.2847} - \underset{0.0523}{0.0848}Q3 + \underset{0.0093}{0.0741}Q4)JNYC .$$
$$\bar{R}^2 = 0.935 \quad DW = 1.90 \quad SER = 28.8$$

21a. $$USTC = \underset{2.7324}{1.6876} - \underset{3.9633}{0.5136}\dagger UQ7 - \underset{3.5931}{1.066}\dagger UQ8$$
$$+ [\underset{0.2710}{0.3263} - \underset{0.0126}{0.0117}\dagger Q2 - \underset{0.0180}{0.0149}Q3 + \underset{0.2101}{0.0730}\dagger (UQ7 + UQ8)]USYC.$$
$$\bar{R}^2 = 0.958 \quad DW = 1.76 \quad SER = 0.298$$

22. $$JNTIC = \underset{1.959}{-1.890}\dagger + (\underset{0.0892}{0.0891} + \underset{0.0051}{0.0051}Q2 + \underset{0.0100}{0.0099}Q3 + \underset{0.0165}{0.0165}Q4)JNMC .$$
$$\bar{R}^2 = 0.977 \quad DW = 1.19 \quad SER = 2.75$$

22a. $$\Delta UNTIC = \underset{-0.0002}{0.0159}\dagger - \underset{0.0294}{0.0339}\Delta Q2 - \underset{0.0858}{0.0424}\Delta Q3 - \underset{0.0475}{0.0139}\dagger \Delta Q4$$
$$+ \Delta[(\underset{0.0528}{0.0537} + \underset{0.0091}{0.0070}Q2 + \underset{0.0223}{0.0152}Q3 + \underset{0.0135}{0.0080}Q4)UNMC] .$$
$$\bar{R}^2 = 0.927 \quad DW = 2.24 \quad SER = 0.00876$$

23. $$USTIC - UNTIC = \underset{0.0540}{-0.0540} + \underset{0.0533}{0.0533}Q2 + \underset{0.0912}{0.0912}Q3 + \underset{0.0366}{0.0366}\dagger Q4$$
$$+ (\underset{0.2366}{0.2366}Q1 - \underset{0.1343}{0.1343}Q3)\frac{1}{4}\sum_{i=0}^{3} UNTIC_{-i} .$$
$$\bar{R}^2 = 0.737 \quad DW = 1.83 \quad SER = 0.016$$

24. $$JNTIN = \underset{69.15}{90.12} - \underset{+1.97}{42.43}\dagger Q2 - \underset{+5.75}{59.61}\dagger Q3 - \underset{13.61}{6.81}\dagger Q4$$
$$+ (\underset{0.0724}{0.0701} - \underset{0.0145}{0.0092}Q2 + \underset{-0.0074}{0.0002}\dagger Q3 - \underset{0.0169}{0.0170}Q4)JNV .$$
$$\bar{R}^2 = 0.985 \quad DW = 1.65 \quad SER = 21.6$$

24a. $$\Delta USTIN = \underset{0.1530}{-0.0169}\dagger + \underset{1.9279}{0.9939}UQ3 + (\underset{0.1498}{0.1052} - \underset{0.5384}{0.2979}UQ3)\Delta USV .$$
$$\bar{R}^2 = 0.482 \quad DW = 1.95 \quad SER = 0.132$$

Capital Consumption Allowances:

25. $$JNDF = -597.7 + 35.60Q3 + 139.69Q4$$
$$+ [0.0328 - (0.0007\dagger Q3 + 0.0028Q4)JQ1]JNKF/_{-1} .$$
$$\bar{R}^2 = 0.993 \quad DW = 1.40 \quad SER = 27.8$$

25a. $$\Delta USD = 0.0426\dagger + 0.5833\Delta Q3 + 0.7176\Delta Q4 - 0.5916\Delta UQ1$$
$$+ \Delta[(0.0261 - 0.0008Q3 - 0.0010Q4)USKF/] .$$
$$\bar{R}^2 = 0.677 \quad DW = 2.38 \quad SER = 0.075$$

Corporate Profits and Inventory Valuation Adjustment:

26. $$\Delta JNYC = \underset{30.29}{-20.98}\dagger + \Delta[(\underset{0.2271}{0.1905} + \underset{0.3500}{0.4064}Q2 - \underset{0.1968}{0.1243}\dagger Q4)JNV]$$

$$+\Delta[(0.0164\dagger - 0.6538Q2 + 0.1158\dagger Q4)JNW \cdot JNL] .$$
$$\quad 0.0091 \quad 0.5599 \quad -0.1167$$

$\bar{R}^2 = 0.745 \qquad DW = 2.66 \qquad SER = 53.7$

26a. $$\Delta USYC = -0.1296\dagger - 0.8972\Delta(USW \cdot USLC)$$
$$\quad +0.1596 \quad 0.5567$$
$$+\Delta[(0.8680 + 0.0007Q2 + 0.0011Q3 + 0.0010Q4)USYN] .$$
$$\quad 0.4948 \quad 0.0008 \quad 0.0012 \quad 0.0012$$

$\bar{R}^2 = 0.913 \qquad DW = 1.80 \qquad SER = 0.164$

Miscellaneous:

27. $$UNV = -1.3157\dagger - 3.3928\dagger Q2 + 10.3060Q4$$
$$\quad 0.3678 \quad 6.7966 \quad 9.3569$$
$$+(0.9668 + 0.0657Q2 + 0.0248Q3 + 0.0135Q4)USV .$$
$$\quad 0.9616 \quad 0.0848 \quad 0.0248 \quad 0.0368$$

$\bar{R}^2 = 0.999 \qquad DW = 2.19 \qquad SER = 0.939$

B. *Identities and Definitions*

Japan:

28. $JNKF/ = JNKF/_{-1} + JNIF/ - JNIR .$
29. $JNKJ/ = JNKJ/_{-1} + JNJP/ .$
30. $JNECA = JNECU + JNECW .$
31. $JNE = JNEC + JNEO .$
32. $JNE/ = JNE/JNPE .$
33. $JNMCA = JNMCU + JNMCW .$
34. $JNM = JNMC + JNMO .$
35. $JNM/ = JNM/JNPM .$
36. $JNV/ = JNCP/ + JNIP/ + JNJP/ + JNE/ - JNM/ + JNIG/$
$\quad + JNJG/ + JNCG/ .$
37. $JNV = JNV/ \cdot JNPV .$
38. $JND = JNDF + JNDO .$
39. $JNTI = JNTIN + JNTIC .$
40. $JNYN = JNV - JND - JNTI + JNYSU - JNZ .$
41. $JNYP = JNYN - JNYC + JNYDI + JNYFG - JNYG + JNBFI .$
42. $JNYD = JNYP - JNTP - JNSI - JNBFO .$
43. $JNYD/ = JNYD/JNPC .$
44. $JNB = JNE - JNM + JNBFO - JNBFI + JNBFGN .$
45. $JNRLQ = (1 + 0.01JNRL)^{1/4} - 1 .$
46. $JNIP/ = JNIF/ + JNIH/ .$

United States:

28a. $USKF/ = USKF/_{-1} + USIF/ - USIR/ .$
29a. $USKJ = USKJ_{-1} + USJP/ .$
30a. $UNEC = UNECJ + UNECW .$
31a. $UNE = UNEC + UNEO .$

32a. $UNE/ = UNE/UNPE$.
33a. $UNMC = UNMCJ + UNMCW$.
34a. $UNM = UNMC + UNMO$.
35a. $UNM/ = UNM/UNPM$.
36a. $USV/ = USCP/ + USIF/ + USJP/ + USE/ - USM/ + USCG/ + USIH/$.
37a. $USV = USV/ \cdot USPV$.
39a. $USTI = USTIN + USTIC$.
40a. $USYN = USV - USD - USTI - USYFB - USZ + USYSU$.
41a. $USYP = USYN - USYC + USYD1 - USYZ - USSI + USYFG + USCI + USGI$.
42a. $USYD = USYP - USTP$.
43a. $USYD/ = USYD/USPC$.
45a. $UNRLQ = (1 + 0.01 UNRGL)^{1/4} - 1$.

APPENDIX 2

LIST OF VARIABLES AND SOURCES

With the exception of the exchange rate E and the seasonal dummies, the following conventions are used throughout. The first letter of each label denotes the country (J = Japan, U = United States, and W = Rest-of-the-World), the second letter indicates whether (S) or not (N) the data series is seasonally adjusted, or if the series is for a dummy variable (Q). A terminal slash is used for series valued at constant prices, and barred variables are exogenous to the model. These conventions are based on those used by Watanabe and Uchida [16].

E — The exchange rate for the dollar in yen. Assumed to remain constant at the nominal rate of ¥360 per $.

JNB — Net exports of goods and services and factor income received from abroad plus net transfers to government (=balance of payments). *ARNIS*,[e] Part 2, Table 17: Composition of External Transactions, line 10: Net Lending to the Rest-of-the-World. Billions ¥.

$\overline{JNBFGN}$ — Net transfers from the ROW to general government. Ibid., line 9(c) less line 8(c). Billions ¥.

$\overline{JNBFI}$ — Transfers from the ROW to households and private nonprofit institutions. Ibid., line 8(b). Billions ¥.

$\overline{JNBFO}$ — Transfers abroad by households and private nonprofit institutions. Ibid., line 9(b). Billions ¥.

JNCG/ — General government consumption expenditure. *ARNIS*, Part 1, Table 4: Gross National Expenditure at Constant Prices, line 2. Billions ¥ at 1965 prices.

[e] *Annual Report on National Income Statistics* (Tokyo: Economic Planning Agency, 1970) (hereafter cited as *ARNIS*).

JNCP/ Private consumption expenditure. Ibid., line 1. Billions ¥ at 1965 prices.

JND Provisions for the consumption of fixed capital. *ARNIS*, Account 1: Gross National Product and Expenditure, line 1.2. Billions ¥.

JNDF Provisions for the consumption of fixed nonresidential capital by private enterprises.[f] *ARNIS*, Part 2, Table 16: Provisions for the Consumption of Fixed Capital. Billions ¥.

JNDO Provisions for the consumption of other fixed capital. Ibid. Billions ¥.

JNE Exports of goods and services and factor income received from abroad. Ibid., Table 17, line 3. Billions ¥.

JNE/ Exports of goods and services and factor income received from abroad. *ARNIS*, Part 1, Table 4, line 4(1). Billions ¥ at 1965 prices.

JNEC Exports of merchandise f.o.b. *ARNIS*, Part 2, Table 17, line 1(a). Billions ¥.

JNECA Exports of merchandise f.o.b., customs basis. *MSJ*,[g] External Trade by Commodity Groups. Billions ¥, converted from $ values.

JNECU Exports of merchandise to the United States f.o.b., customs basis. *MSJ*, External Trade by Countries of Destination or Origin and Commodities, Billions ¥.

JNECW Exports of merchandise to the ROW f.o.b., customs basis. Billions ¥.

JNEO Other exports. *ARNIS*, Part 2, Table 17, line 3 less line 1(a). Billions ¥.

JNIF/ Gross private fixed nonresidential capital formation. *ARNIS*, Part 1, Table 4, line 3(1)a(b). Billions ¥ at 1965 prices.

JNIG/ Gross domestic capital formation by government. Ibid., line 3(1)b. Billions ¥ at 1965 prices.

JNIH/ Gross private residential capital formation. Ibid., line 3(1)a(a). Billions ¥ at 1965 prices.

JNIR/ Expenditures for the replacement of private fixed capital. Economic Research Institute, Economic Planning Agency.* Billions ¥ at 1965 prices.

[f] The series used in this study differ from those published in the source cited in that they include their appropriate shares of provisions for damage of fixed capital by accidents or forest fire. The adjusted series originate from the National Income Division of the Economic Research Institute and were kindly made available to the author by Professors Tsunehiko Watanabe and Lawrence R. Klein.

[g] *Monthly Statistics of Japan,* various issues (Tokyo: Bureau of Statistics, Office of the Prime Minister) (hereafter cited as *MSJ*).

* These asterisked series were kindly provided by Professors Lawrence R. Klein and Tsunehiko Watanabe.

JNIP/ Gross private domestic fixed capital formation. Equal to *JNIF/* plus *JNIH/*.

JNJG/ Increase in stocks of government enterprises. *ARNIS*, Part 1, Table 4, line 3(2)b. Billions ¥ at 1965 prices.

JNJP/ Increase in stocks of private enterprises. Ibid., line 3(2)a. Billions ¥ at 1965 prices.

JNKF/ Gross capital stock of private enterprises. Economic Research Institute, Economic Planning Agency.* Billions ¥ at 1965 prices.

JNKJ/ Gross inventories of private enterprises. Economic Research Institute, Economic Planning Agency.* Billions ¥ at 1965 prices.

$\overline{JNL}$ Total employment (including self-employed and unpaid family workers), all industries, in million of persons. *MSJ*, Employed Persons by Industry. Quarterly averages of monthly data.

$\overline{JNLE}$ Total employees, all industries. Ibid. Millions of persons, quarterly averages of monthly data.

JNM Imports of goods and services and factor income paid abroad. *ARNIS*, Part 1, Table 3, line 4(2). Billions ¥.

JNM/ Imports of goods of services and factor income paid abroad. *ARNIS*, Part 1, Table 4, line 4(2). Billions ¥ at 1965 prices.

JNMC Imports of merchandise f.o.b. *ARNIS*, Part 2, Table 17, line 4(a). Billions ¥.

JNMCA Imports of merchandise c.i.f., customs basis. *MSJ*, External Trade by Commodity Groups. Billions ¥, converted from $ values.

JNMCU Imports of merchandise from the United States c.i.f., customs basis. *MSJ*, External Trade by Countries of Destination or Origin and Commodities. Billions ¥.

JNMCW Imports of merchandise from the ROW c.i.f., customs basis. Billions ¥.

$\overline{JNMO}$ Other imports. *ARNIS*, Part 2, Table 17, line 6 less line 4(a). Billions ¥.

$\overline{JNPC}$ Implicit deflator for private consumption expenditures. *ARNIS*, Part 1, Table 5 : Implicit Deflators, line 1. Normalized to unity in the calendar year 1965.

JNPE Implicit deflator for exports of goods and services and factor income received from abroad. Ibid., line 4(1). Normalized to unity in the calendar year 1965.

$\overline{JNPJN}$ Deflator for private nonagricultural inventory stocks. Economic Research Institute, Economic Planning Agency.* Normalized to unity in the calendar year 1965.

JNPM Implicit deflator for imports of goods and services and factor income paid abroad. *ARNIS*, Part 1, Table 5, line 4(2). Normalized to unity in the calendar year 1965.

JNPV Implicit deflator for gross national product. Ibid., line 5. Normalized to unity in the calendar year 1965.

JNPW Wholesale price index, all commodities. *MSJ*, Wholesale Price Indexes. Averages of monthly data, normalized to unity in the calendar year 1965.[h]

JNRD Basic rate of the Bank of Japan on discounts of commercial bills. *MSJ*, Money Rates.* Quarterly averages, per cent per annum.

JNRL Average interest rate on loans of All Banks. *Indexes of Domestic Economic Trends.** Quarterly averages in per cent per annum.

JNRLQ Equivalent quarterly interest rate on loans by All Banks, computed from *JNRL*, in per cent/100 per quarter.

$\overline{JNSI}$ Social insurance contributions. *ARNIS*, Part 1, Account 3: Households and Private Non-profit Institutions, line 3.3. Billions ¥.

JNTC Direct taxes and charges on private corporations. *ARNIS*, Part 1, Account 2: Distribution of National Income, line 2.5. Billions ¥.

JNTI Indirect taxes. *ARNIS*, Account 1, line 1.3. Billions ¥.

JNTIC Receipts of customs duties and tonnage taxes. *MSJ*, Tax Revenues. Billions ¥, quarterly totals of monthly data.

JNTIN Indirect taxes less customs duties and tonnage taxes. Billions ¥.

JNTP Direct taxes and charges on households and nonprofit institutions plus other current transfers to general government. *ARNIS*, Part 1, Account 3, line 3.2 plus line 3.4. Billions ¥.

JNV Gross national product. *ARNIS*, Part 1, Account 1. Billions ¥.

JNV/ Gross national product. *ARNIS*, Part 1, Table 4, line 5. Billions ¥ at 1965 prices.

$\overline{JNW}$ Average quarterly income per employed person. Defined by the relation: $JNW=(JNY1+JNY2)/JNL$. Thousands ¥.

$\overline{JNWE}$ Average quarterly income of employees. Defined by the relation $JNWE=JNY1/JNLE$. Thousands ¥.

$\overline{JNY1}$ Compensation of employees. *ARNIS*, Part 1, Account 2, line 2.1. Billions ¥.

$\overline{JNY2}$ Income from unincorporated enterprises. Ibid., line 2.2. Billions ¥.

JNYC Income from private corporations. Ibid. Billions ¥.

JNYD Disposable income of persons. *ARNIS*, Part 1, Account 3. Billions ¥.

JNYD/ Disposable income of persons. Defined as *JNYD/JNPC*. Billions ¥ at 1965 prices.

$\overline{JNYDI}$ Dividends plus corporate transfers to households and private nonprofit institutions. *ARNIS*, Part 1, Table 2: Distribution of National Income, line 3.c plus line 4. Billions ¥.

[h] Data for the periods before 1962 and after 1966 were strictly not comparable with those in the intervening period due to changes in coverage and weights.

$\overline{JNYFG}$ Current transfers from general government to households and private nonprofit institutions. *ARNIS,* Part 1, Account 2, line 2.7 less line 2.8. Billions ¥.

$\overline{JNYG}$ General government income from property and entrepreneurship less interest on the public debt. *ARNIS,* Part 1, Account 2, line 2.7 less line 2.8. Billions ¥.

JNYN National income at factor cost. Ibid. Billions ¥.

JNYP Personal income. *ARNIS,* Part 1, Account 3. Billions ¥.

$\overline{JNYSU}$ Current subsidies. *ARNIS,* Part 1, Account 1, line 1.4.

$\overline{JNZ}$ Statistical discrepancy. Ibid., line 1.5. Billions ¥.

$\overline{JQ1}$ Dummy variable for change in regulation for capital consumption allowances. Equal to 1.0 from 1965/2 through the last observation.

$\overline{JQ4}$ Dummy variable for deferred payments of corporate income taxes. Economic Research Institute (1969). Equal to 1.0 in 1965/4, 1966/2, and 1966/4, and to −1.0 in 1966/1, 1966/3, and 1967/1.

$\overline{JQ10}$ Dummy variable for Japanese dock strike. Equal to 1.0 for 1964/4 and zero otherwise.

Q1, Q2, Q3, Q4 Seasonal dummies. Equal to 1.0 in the first through fourth quarters of the calendar year respectively.

UNE Exports of goods and services. *SCB,*[1] U.S. International Transactions, line 1. Billions $.

UNE/ Exports of goods and services. Defined as *UNE/UNPE.* Billions $ at 1958 prices.

UNEC Exports of merchandise, adjusted, excluding military. Ibid., line 3. Billions $.

UNECJ Exports of merchandise to Japan, adjusted, excluding military, *SCB,* International Transaction by Area, line 3. Billions $.

$\overline{UNECW}$ Exports of merchandise to the ROW, adjusted, excluding military. Defined as $UNECW = UNEC - UNECJ$. Billions $.

$\overline{UNEO}$ Other exports of goods and services. Defined as $UNEO = UNE - UNEC$. Billions $.

UNM Imports of goods and services. *SCB,* International Transactions, line 14. Billions $.

UNM/ Imports of goods and services. Defined as *UNM/UNPM.* Billions $ at 1958 prices.

UNMC Imports of merchandise, adjusted, excluding military. Ibid., line 15. Billions $.

UNMCJ Imports of merchandise from Japan, adjusted, excluding military. *SCB,* International Transactions by Area, line 15. Billions $.

[1] *Survey of Current Business,* Office of Business Economics, Department of Commerce (Washington, D.C., U.S. Government Printing Office) (hereafter cited as *SCB*).

$\overline{UNMCW}$ Imports of merchandise from the ROW, adjusted, excluding military. Defined as $UNMCW = UNMC - UNMCJ$. Billions $.

$\overline{UNMO}$ Other imports of goods and services. Defined as $UNMO = UNM - UNMC$. Billions $.

UNPE Index of prices of merchandise exports, excluding military. *Business Statistics,* Foreign Trade of the United States. Unit value index (base years 1957–59) constructed according to Fisher's "ideal" formula; last month of the quarter after 1962, quarterly averages previously.

UNPM Index of prices of general imports. Ibid. Unit value index (base years 1957–59) constructed according to Fisher's "ideal" formula; last month of the quarter after 1962, quarterly averages previously. Beginning January 1965, general imports replaced imports for consumption.

UNPW Index of wholesale prices, all commodities. *Business Statistics,* Commodity Prices. Averages 1.0 in base years 1957–59.

UNRD Discount rate of the Federal Reserve Bank of New York. *FRB,*[j] Discount Rates. Quarterly averages of annual rates in per cent.

UNRGL Yield on long term U.S. government bonds maturing or callable in ten years or more. *FRB,* Bond and Stock Yields. Quarterly averages of the published monthly averages of annual rates.

UNRGLQ Quarterly yield on long term U.S. government bonds. Computed from annual yields, per cent/100.

UNRGS Market yield on U.S. government three-month bills. *FRB,* Money Market Rates. Annual rates in per cent, quarterly averages of daily figures.

UNTIC Net receipts of customs duties. *Treasury Bulletin,* Budget Receipts by Principal Sources. Billions $, quarterly totals.

UNV Gross national product. *SCB,* Table 1.19: Gross National Product, Quarterly Totals Not Seasonally Adjusted, line 1. Billions $.

$\overline{UQ1}$ Dummy variable for change in the regulations for capital consumption allowances. Equal to 1.0 in 1961/4 and zero thereafter.

$\overline{UQ2}$ Dummy variable for personal income tax rate reduction. Equal to 1.0 from 1965/2 through 1968/1 and zero otherwise.

$\overline{UQ3}$ Dummy variable for federal excise tax rate reduction. Equal to 1.0 in 1961/4 and from 1965/3 through 1966/2.

$\overline{UQ5}$ Dummy variable for abnormal conditions in the market for U.S. government short-term securities. Equal to 1.0 in 1966/3 and 1966/4, and to −1.0 in 1967/1 and 1967/2.

[j] *Federal Reserve Bulletin,* various issues (Washington, D.C., Board of Governors of the Federal Reserve System) (hereafter cited as *FRB*).

$\overline{UQ6}$ Dummy variable for changes in the desired ratio of inventory stocks to sales. Equal to 0.25 in 1964/2, 0.50 in 1964/3, 0.75 in 1964/4, and 1.0 thereafter.

$\overline{UQ7}$ Dummy variable for surcharge on corporate income taxes. Equal to 1.0 from 1968/2 through the end of the sample.

$\overline{UQ8}$ Dummy for revocation of the investment credit against corporate income taxes. Equal to 1.0 from 1962/4 through 1966/3 and from 1967/2 through the end of the sample.

$\overline{USCI}$ Interest paid by consumers. *SCB*, Table 2.1: Personal Income and Its Disposition, line 25.[k] Billions $.

USCG/ Government purchases of goods and services. *SCB*, Table 1.2: Gross National Product in Constant Dollars, line 20. Billions $ at 1958 prices.

USCP/ Personal consumption expenditures. Ibid., line 2. Billions $ at 1958 prices.

USD Capital consumption allowances. *SCB*, Table 1.9: Relation of Gross National Product, National Income and Personal Income, line 2. Billions $.

USE/ Exports of goods and services. *SCB*, Table 1.2, line 18. Billions $ at 1958 prices.

$\overline{USGI}$ Net interest paid by government. *SCB*, Table 3.2: Federal Government Receipts and Expenditures, line 14 plus Table 3.4: State and Local Government Receipts and Expenditures, line 10. Billions $.

USIF/ Private domestic fixed nonresidential investment. *SCB*, Table 1.2, line 8. Billions $ at 1958 prices.

USIH/ Gross private domestic investment in residential structures. Ibid., line 11. Billions $ at 1958 prices.

USIR/ Expenditures for the replacement of fixed capital. Computed from the excess of gross investment over changes in the gross capital stock. Billions $ at 1958 prices.

USJP/ Change in business inventories. Ibid., line 14. Billions $ at 1958 prices.

USKF/ Gross stock of structures and equipment, all industries, net of discards and retirements. "Fixed Business Capital in the United States, 1925-68," *SCB*, 49 (February 1969), pp. 20-27. Billions $ at 1958 prices (variant 2). The quarterly series was computed by linear interpolation.

USKJ Inventories in manufacturing and trade. *SCB*, October 1970. Billions $, book value at end of quarter.

[k] All seasonally adjusted data have been converted to quarterly totals for the flow variables.

$\overline{USLC}$ Civilian employment. *BLS*,[1] Employment and Earnings, February 1970. Millions of persons over sixteen years of age, end of quarter.

USM/ Imports of goods and services. *SCB*, Table 1.2, line 19. Billions $ at 1958 prices.

$\overline{USPC}$ Consumer price index. *BLS* index for city wage-earners and clerical workers, all items. Quarterly averages of monthly data, normalized to unity for the base years 1957–59.

USPV Implicit deflator for gross national product. *SCB*, Table 8.1: Implicit Price Deflators for Gross National Product, line 1. Normalized to unity in the calendar year 1958.

$\overline{USSI}$ Contributions for social insurance. *SCB*, Table 1.9, line 10. Billions $.

USTC Corporate profits tax accruals. *SCB*, Table 3.2 line 3 plus Table 3.4 line 3. Billions $.

USTI Indirect business tax and nontax liability. *SCB*, Table 1.9, line 4. Billions $.

USTIC Receipts of customs duties less refunds. Constructed series. Billions $.

USTIN Indirect business tax and nontax liability less net receipts of customs duties. Defined as $USTIN = USTI - USTIC$. Billions $.

USTP Personal tax and nontax payments. *SCB*, Table 2.1, line 21. Billions $.

USV Gross national product. *SCB*, Table 1.1: Gross National Product, line 1. Billions $.

USV/ Gross national product. *SCB*, Table 1.2, line 1. Billions $ at 1958 prices.

$\overline{USW}$ Average quarterly income per employed person. Defined as $USW = (USY1 + USY2 - USY13)/USLC$. Thousands $.

$\overline{USY1}$ Compensation of employees. *SCB*, Table 1.10: National Income by Type of Income, line 2. Billions $.

$\overline{USY2}$ Proprietors' Income. *SCB*, Table 1.10, line 12. Billions $.

$\overline{USY13}$ Wages and salaries, military. *SCB*, Table 1.10, line 5. Billions $.

USYC Corporate profits and inventory valuation adjustment. *SCB*, Table 1.9, line 9. Billions $.

USYD Disposable personal income. *SCB*, Table 2.1, line 22. Billions $.

USYD/ Disposable personal income. *SCB*, Table 2.1, line 28. Billions $ at 1958 prices.

$\overline{USYDI}$ Dividends. *SCB*, Table 1.9., line 14. Billions $.

$\overline{USYFB}$ Business transfer payments. *SCB*, Table 1.9, line 5. Billions $.

$\overline{USYFG}$ Government transfers to persons. *SCB*, Table 1.9, line 12. Billions $.

[1] Bureau of Labor Statistics, Labor Department.

USYN National income. *SCB,* Table 1.9, line 8. Billions $.

USYP Personal income. *SCB,* Table 2.1, line 1. Billions $.

$\overline{USYSU}$ Subsidies less current surplus of government enterprises. *SCB,* Table 1.9, line 7. Billions $.

$\overline{USYZ}$ Wage accruals less disbursements. *SCB,* Table 1.9, line 11. Billions $. Equal to zero through the period under study.

$\overline{USZ}$ Statistical discrepancy. *SCB,* Table 1.9, line 6. Billions $.

$\overline{WNE}$ World exports. *International Financial Statistics.* Billions $ f.o.b.

$\overline{WNPE}$ Index of world export prices of manufactured goods. *Bulletin of Statistics.* Base year 1965.