International Transactions and Domestic Cyclical Behavior

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I. Introduction

By analogy with the phenomenon of "induced vibration" in physics, international transactions should affect domestic cyclical fluctuations and economic stability via two international economic channels: the market for goods and services, and capital flows. Clearly, this mechanism of international relationships is dependent upon the proper functioning of these channels. Much attention has recently been given to theoretical and empirical investigations in this area.[1] But as far as we know, no satisfactory efforts have been made to explore the relationships between international transactions and economic stability and fluctuations in a dynamic context.

The purpose of this paper is to examine the unilateral dynamic effects of the international transactions of both goods and services and capital of seven developed countries (Canada, France, Germany, Italy, Japan, the Netherlands, and the United Kingdom) in relation to the United States by making monetary and external factors integral parts of the Hansen-Samuelson interaction model. More specifically, this paper focuses on the effects of parameters associated with the external sector on the critical values for domestic stability and oscillation, which indicate to what degree the cyclical fluctuations and instability in a country is indigenous or imported. Two-stage least squares is employed to estimate five simultaneous equations together

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1 The theory of the international transmission of cyclical fluctuations has been dealt with by means of the LINK system. However, the application of LINK models is based on the static multiplier concept. See Ball (1973) and Hickman (1974), pp. 201-231.

with two equilibrium conditions for the real and monetary sectors and a definition in the foreign sector for each country. The empirical results for the sample period, which covers the early 1950's through 1973 (the years from 1950 to 1973 for Canada and the Netherlands, from 1951 to 1973 for France, Germany, Italy and the United Kingdom, and from 1953 to 1973 for Japan), are, in general, quite satisfactory for all countries. In particular, the parameter estimates for the foreign sector are significant and consistent with the postulated hypotheses, which suggests that some of the external parameters played a substantial role in dampening the cyclical fluctuations and instability, while others exhibited a strong influence in accelerating the degree of fluctuation and instability.

Tht remainder of this paper consists of three sections and two appendices. The following section is concerned with three macro-sectors from which a second-order difference equation is derived. The third section presents empirical results for the various countries. Concluding remarks are given in the last section. Finally, the derivation of the second-order difference equation and the sources of the data are shown in appendices I and II, respectively.

II. Formulation of the Basic Theoretical Model

The basic theoretical model from which the second-order difference equation is derived can be specified as follows:[2]

The real sector

$$C_t=\alpha_o+\alpha_1 Y_t+\alpha_2 Y_{t-1}+e_{1t} \qquad (0<\alpha_1 \text{ and } \alpha_2<1) \qquad (1)$$

$$I_t=\beta_o+\beta_1(Y_t-Y_{t-1})+\beta_2(Y_{t-1}-Y_{t-2})-\beta_3 i_t+e_{2t} \qquad (2)$$
$$(\beta_1,\ \beta_2 \text{ and } \beta_3>0)$$

$$G_t=G_o \qquad (3)$$

$$Y_t=C_t+G_t+I_t+X_t-(M_t+\tilde{M}_t) \qquad (4)$$

The monetary sector

2 The classification of the theoretical model is basically similar to the classification employed in Stern (1973), pp. 313-314. At the end of the theoretical equations (1), (2), (5), (8), and (11), there are disturbance terms (the e's) which include the corresponding lagged dependent variables and all of the other exogeneous variables included in a specific equation. They should not be confused with the disturbance terms in the empirical model.

$$M_{dt}=\kappa_o+\kappa_1 Y_t+\kappa_2 Y_{t-1}-\kappa_3 i_t+e_{3t} \qquad (\kappa_1,\ \kappa_2 \text{ and } \kappa_3>0) \qquad (5)$$

$$M_{st}=M_o \qquad (6)$$

$$M_{dt}=M_{st} \qquad (7)$$

The foreign sector

$$M_t=\delta_o+\delta_1 Y_t+\delta_2 Y_{t-1}+e_{4t} \qquad (0<\delta_1 \text{ and } \delta_2<1) \qquad (8)$$

$$\tilde{M}_t=M_o \qquad (9)$$

$$X_t=X_o \qquad (10)$$

$$F_t=\rho_o+\rho_1 Y_t+\rho_2 Y_{t-1}+\rho_3 i_t+e_{5t} \qquad (\rho_1, \rho_2, \rho_3, \text{ and } \rho_4>0) \qquad (11)$$

$$\tilde{F}_t=\tilde{F}_o \qquad (12)$$

$$B_t \equiv X_t-(M_t+\tilde{M}_t)+(F_t+\tilde{F}_t) \qquad (13)$$

where

Endogeneous variables:

- **Y=Gross national product**
- **C=Private consumption**
- **I =Private investment**
- M_d **=Demand for money**
- **M=Imports from the United States**
- **F=Net capital inflow from the United States**
- **B=Balance of payments**
- **i =Rate of interest**

Exogeneous variables:

- **G=Government expenditures**
- M_s **=Supply of money**
- $\tilde{M}$ **=Imports from areas other than the United States**
- **X=Exports to the United States**
- $\tilde{F}$ **=Net capital inflow from areas other than the United States**

The real sector (including import and export functions, which are classified in the foreign sector for convenience) and the monetary sector are basically specified in terms of the conventional Keynesian system. Taxes and inventories, however, are not considered because of lack of data. Money supply is treated as an exogeneous variable to reduce complexity. In the capital flow model, income-sensitive capital movements are incorporated in the model on the basis of the theoretical point of view of Johnson (1966), Baggott and Flanders (1969), and on empirical confirmation by Rhomberg (1964), Caves and Reuber (1971), and Miller and Whitman (1970).

The model contains thirteen equations and thirteen variables (i.e., Y, C, G, I, i, M_d, M_s, M, M X, F, $\bar{F}$ and B), ignoring the lagged variables.

From equations (1) through (13), the following second-order difference equation may be derived:[3]

$$Y_{t+2}-\Gamma Y_{t+1}+\Pi Y_t=A \tag{14}$$

where

$$\Gamma=[\alpha_2-\beta_1+\beta_2-\delta_2-\beta_3\{(\kappa_2-\kappa_1)/\kappa_3+(\delta_1-\rho_1)/\rho_3\}]/$$
$$[1-\alpha_1-\beta_1+\delta_1+\beta_3(\kappa_1/\kappa_3)]$$

$$\Pi=[\beta_2+\beta_3\{(\kappa_2/\kappa_3)+(\rho_2-\delta_2)/\rho_3\}]/[1-\alpha_1-\beta_1+\delta_1+\beta_3(\kappa_1/\kappa_3)]$$

A = constant term.

Regarding the values of the characteristic roots, the following three possible cases can be examined: (1) $[-\Gamma]^2>4\Pi$, (2) $[-\Gamma)^2=4\Pi$, and $[-\Gamma]^2<4\Pi$. For each of the first two cases, two distinct real roots are obtained, yielding the non-oscillatory pattern, and conjugate complex roots are obtained in the third case, implying oscillation. In addition, stability exists if $\sqrt{\Pi}<1$. For our purposes, it sufficies to confine attention to the question of how the critical values for the conditions of oscillation and stability are affected by inclusion of the foreign sectors. Obviously, with otler parameters held constant, the higher δ_1 and ρ_2 are, and the lower ρ_1 and ρ_3 are, the greater is the possi-

3 The derivation of equation (14) is shown in Appendix I.

bility of oscillation, and vice versa. On the other hand, the higher δ_1 and δ_2 are, and the lower ρ_2 is, the greater is the possibility of stability, and vice versa. The role of δ_2 in the condition of oscillation is not clear because it appears on both sides of the inequality and has the same sign on each side.

III. Estimation of the Model

The foregoing theoretical equations, (1), (2), (5), (8), and (11) were estimated by two-stage least squares. The data were gathered from the IMF (GNP accounts, demand for and supply of money, domestic and import prices, interest rates, the spot foreign exchange rates), the U.S. Bureau of the Census (imports from and exports to the U.S.), the U.S. Bureau of Economic Analysis (long-term capital movements) and the Board of Governors of the Federal Reserve System (short-term capital flows). A detailed discussion of the nature and sources of the data may be found in Appendix II.

The methodology for estimation is briefly discussed below and is followed by the empirical analysis.

(a) *Specification of the Price Variables*

Domestic and import prices are included in the regression equation as a linear deflation device. But since they are treated as exogeneous variables within the system of equations, these variables are included with a one-period lag.[4] Furthermore, as pointed out by Krause (1970), one of the essential ingredients in a portfolio shift between foreign and domestic assets is the difference in risk. The foreign exchange rate is employed as a proxy for such risk and is introduced in the model of capital mobility. However, the exchange rate was also treated as an exogeneous variable reflecting, basically, the fixed exchange rate system in existence for most of the period since the establishment of the I.M.F.

(b) *2SLS Instruments and Identification*

All of the exogeneous variables listed on page 4, including the first-order lagged variables, were used as instruments in the 2SLS estimation procedure. Each structural equation system (equations (1) and (2) in the real sector, equation (5) in the monetary sector, and equations (8) and (11) in the foreign sector) was examined separately to determine its identifiability by the order condition and was found to be identified with or without the lagged variables. The stochastic components of two major explanatory variables, Y_t and i_t associated with the disturbance term were purged at the

4 See Chow (1967) pp. 5.

first stage with repect to the predetermined variables.

(c) *The Lag Struuctures*

As shown in the footnote for Table 2, the typical Koyck lag technique or its variant was applied to all of the regression equations. It is common practice to give the first Y, the major explanatory variable for the entire equation system in this paper, the greatest weight and all subsequent distributions the declining geometric sequence. Since the objective of this paper is to study relationships only between the United States and the seven developed countries, and not among those seven developed countris, the lag structures may be varied from country to country and function to function. In fact, the variants of Koyck lag were often used in this paper.

The estimates of the structural coefficients for each country are shown in Table 1. The summary statistics for goodness of fit indicate that the overall performance of the model is quite satisfactory. Most of the individual tests for the parameter estimates (t-statistics) and all of the joint tests (F-statistics) reject the null hypothesis (H_0: coefficients$=0$ against H_A: coefficients$\neq 0$) at either the 5 or 10 per cent level of significance. Neither the d- nor the h-statistics suggested the presence of autocorrelation among the residuals. The hypotheses converting the Koyck distributed lag and its variants were upheld. The final selection of the lag structure for a specific function in a particular country was made on empirical grounds. Whether or not the applied lag structure was the Koyck type or its variant did not significantly influence the empirical results for the income variable (Y). However, there was not sufficient evidence to substantiate a distributed lag mechanism for the rate of interest in equations (2), (5), and (11). Therefore, the lag structure for these equations was successively modified until the coefficients of the GNP and the rate of interest turned out to be statistically significant. Summaries of the results, including notes on the methods of computing the long-run parameters for the statistically significant terms —those with a t-ratio greater than one, are presented below in Table 2.

The characteristic equations constructed by substituting the estimated parameters presented in Table 2 into the formulas of Γ and Π of equation (14) for each country are stated as follows:

Canada	$b^2+1.539b-0.504=0$	(15)
France	$b^2-0.047b+1.644=0$	(16)
Germany	$b^2-0.617b+0.474=0$	(17)
Italy	$b^2-3.000b+1.971=0$	(18)
Japan	$b^2+0.025b+0.129=0$	(19)
Netherlands	$b^2+0.569b-0.574=0$	(20)
U. K.	$b^2-0.641b+0.404=0$	(21)

Table 1: Regression Equations for Specific Countries

Country	Equation	Statistics
Canada	$C_t = -1.759 + 0.451Y_t - 0.240Y_{t-1} + 0.621C_{t-1} + 0.032P_{t-1} + \varepsilon_{1t}$ $(-0.327)\ (7.884)\ (-2.637)\ (3.848)\ (0.544)$	$\bar{R}^2 = 0.987$ DW $= 1.778$ SE $= 0.396$
	$I_t = 2.447 + 0.378\Delta Y_t + 0.152\Delta Y_{t-1} - 0.266i_t + 0.864I_{t-1} - 0.010P_{t-1} + \varepsilon_{2t}$ $(0.437)\ (5.353)\ (1.799)\ (-0.959)\ (8.250)\ (-0.137)$	$\bar{R}^2 = 0.993$ DW $= 2.124$ SE $= 0.474$
	$M_{dt} = 1.225 + 0.177Y_t - 0.753i_t + 0.354M_{dt-1} + \varepsilon_{3t}$ $(1.649)\ (4.494)\ (-3.177)\ (1.781)$	$\bar{R}^2 = 0.989$ DW $= 2.150$ SE $= 0.584$
	$M_t = 3.453 + 0.176Y_t - 0.109Y_{t-1} - 3.596P_{mt-1} + 0.737M_{t-1} + \varepsilon_{4t}$ $(0.768)\ (2.651)\ (-1.582)\ (-0.795)\ (1.224)$	$\bar{R}^2 = 0.985$ DW $= 1.617$ SE $= 0.410$
	$F_t = -8.642 + 0.111Y_t + 0.816i_t + 7.001r_t + 0.449F_{t-1} + \varepsilon_{5t}$ $(-1.970)\ (3.255)\ (2.349)\ (1.615)\ (2.548)$	$\bar{R}^2 = 0.994$ DW $= 2.835$ SE $= 0.609$
France	$C_t = 6.434 + 0.633Y_t - 0.197Y_{t-1} + 0.275C_{t-1} - 0.060P_{t-1} + \varepsilon_{1t}$ $(1.709)\ (12.931)\ (-0.722)\ (0.582)\ (-1.373)$	$\bar{R}^2 = 0.989$ DW $= 2.002$ SE $= 1.197$
	$I_t = 1.106 + 0.238\Delta Y_t - 0.002\Delta Y_{t-1} - 0.299i_t + 1.031I_{t-1} + 0.004P_{t-1} + \varepsilon_{2t}$ $(0.381)\ (7.888)\ (-0.052)\ (-0.824)\ (14.418)\ (0.154)$	$\bar{R}^2 = 0.987$ DW $= 2.243$ SE $= 0.710$
	$M_{dt} = 19.742 + 0.316Y_t - 3.385i_t + 0.122M_{dt-1} + \varepsilon_{3t}$ $(6.179)\ (9.879)\ (-5.946)\ (1.206)$	$\bar{R}^2 = 0.994$ DW $= 2.176$ SE $= 1.213$
	$M_t = -1.273 + 0.020Y_t - 0.013Y_{t-1} + 0.130M_{t-1} + 1.279P_{mt-1} + \varepsilon_{4t}$ $(-0.854)\ (1.667)\ (-0.833)\ (0.560)\ (1.123)$	$\bar{R}^2 = 0.656$ DW $= 1.937$ SE $= 0.272$
	$F_t = -0.855 + 0.026Y_t + 0.013Y_{t-1} + 0.024i_t + 0.090r_t + 0.311F_{t-1} + \varepsilon_{5t}$ $(-2.286)\ (3.927)\ (1.849)\ (1.418)\ (1.450)\ (0.815)$	$\bar{R}^2 = 0.922$ DW $= 2.368$ SE $= 0.107$

$\bar{R}^2$ = Coefficient of determination adjusted for degrees of freedom,
DW = Durbin-Watson statistic,
SE = standard error of regression.
t-statistic in parentheses.

(**Table 1** continued)

Germany

$$C_t = -10.351 + 0.489Y_t - 0.127Y_{t-1} + 0.308C_{t-1} + 0.137P_{t-1} + \varepsilon_{1t}$$
(−1.158) (22.963) (−0.856) (1.189) (1.376)

$\bar{R}^2 = 0.979$ DW $= 2.795$ SE $= 0.889$

$$I_t = -6.371 + 0.268Y_t - 0.472Y_{t-1} + 0.166Y_{t-2} - 0.276i_t + 0.059i_{t-1}$$
(−0.258) (5.682) (−1.894) (2.166) (−1.129) (0.361)

$$+1.042I_{t-1} - 1.074I_{t-2} + 0.038P_{t-1} + \varepsilon_{2t}{}^{a}$$
(4.152) (−2.405) (0.146)

$\bar{R}^2 = 0.998$ DW $= 2.375$ SE $= 0.989$

$$M_{dt} = 1.481 + 0.111Y_t - 0.322i_t + 0.326M_{dt-1} + \varepsilon_{3t}$$
(3.232) (8.443) (−3.243) (3.199)

$\bar{R}^2 = 0.939$ DW $= 1.796$ SE $= 0.490$

$$M_t = 1.555 + 0.012Y_t - 0.008Y_{t-1} - 1.016P_{mt-1} + 0.421M_{t-1} + \varepsilon_{4t}$$
(1.608) (2.451) (−1.111) (−1.359) (1.840)

$\bar{R}^2 = 0.944$ DW $= 1.899$ SE $= 0.202$

$$F_t = 16.983 + 0.050Y_t - 0.039Y_{t-1} + 0.146i_t + 4.054r_t + 0.894F_{t-1} + \varepsilon_{5t}$$
(3.099) (2.443) (−2.480) (2.291) (3.089) (12.943)

$\bar{R}^2 = 0.995$ DW $= 2.183$ SE $= 0.168$

Italy

$$C_t = -12.830 + 0.840Y_t - 0.617Y_{t-1} + 0.837C_{t-1} + 0.154P_{t-1} + \varepsilon_{1t}$$
(−1.612) (4.662) (−2.011) (1.449) (1.582)

$\bar{R}^2 = 0.988$ DW $= 2.292$ SE $= 0.777$

$$I_t = -11.112 + 0.448\Delta Y_t - 0.416\Delta Y_{t-1} - 0.316i_t + 0.779i_{t-1} + 1.494I_{t-1}$$
(−3.346) (2.915) (−3.146) (−1.298) (3.427) (5.648)

$$-0.713I_{t-2} + 0.203P_{t-1} + \varepsilon_{2t}$$
(−3.143) (4.448)

$\bar{R}^2 = 0.995$ DW $= 1.829$ SE $= 0.461$

$$M_{dt} = -6.105 + 0.722Y_t - 0.729Y_{t-1} - 0.799i_t + 1.053M_{dt-1} + \varepsilon_{3t}$$
(1.523) (1.447) (−1.357) (−1.098) (9.057)

$\bar{R}^2 = 0.994$ DW $= 1.834$ SE $= 1.991$

[a] The regression equation expressed here in the stock concept was obtained by transformation of the theoretical equation stated in terms of the flow concept. If the lag parameter is different for each variable, say λ and μ, the Koyck lag distribution is written

$$I_t = \beta(1-\lambda)\Delta Y_t - \beta(1-\lambda)\mu\Delta Y_{t-1} - \gamma(1-\mu)i_t + \gamma\lambda(1-\mu)i_{t-1} + (\lambda+\mu)I_{t-1} - \lambda\mu I_{t-2}$$
$$= \beta(1-\lambda)Y_t - [\beta(1-\lambda) + \beta(1-\lambda)\mu]Y_{t-1} + \beta(1-\lambda)\mu Y_{t-2} - \gamma(1-\mu)i_t + \gamma\lambda(1-\mu)i_{t-1}$$
$$+ (\lambda+\mu)I_{t-1} - \lambda\mu I_{t-2}$$

Observe that sum of parameter values of Y_t and Y_{t-2} is close to theparameter value of Y_{t-1}.

(**Table 1** continued)

Country	Equation	Statistics
	$M_t=0.159+0.065Y_t+0.060Y_{t-1}+0.007M_{t-1}+0.196P_{t-1}+\varepsilon_{4t}$ $(0.258)\ (1.838)\ (1.550)\ (0.021)\ (0.438)$	$\bar{R}^2=0.865$ DW $=1.763$ SE $=0.143$
	$F_t=-1.791+0.019Y_t+0.033i_t+0.030i_{t-1}+0.003r_t+0.153F_{t-1}+\varepsilon_{5t}$ $(-1.285)\ (4.509)\ (1.259)\ (1.141)\ (1.156)\ (0.743)$	$\bar{R}^2=0.995$ DW $=2.378$ SE $=0.055$
Japan	$C_t=-26.408+0.329Y_t-0.191Y_{t-1}+0.194Y_{t-2}+0.755C_{t-1}+0.277P_{t-1}+\varepsilon_{1t}$ $(-1.167)\ (4.327)\ (-1.720)\ (1.623)\ (1.992)\ (1.183)$	$\bar{R}^2=0.979$ DW $=1.423$ SE $=1.767$
	$I_t=-6.933+0.164\Delta Y_t-0.137\Delta Y_{t-1}-0.292i_t-1.313i_{t-1}+1.258I_{t-1}-0.054P_{t-1}+\varepsilon_{2t}$ $(-0.439)\ (2.018)\ (-1.376)\ (-5.615)\ (-2.213)\ (11.855)\ (-0.294)$	$\bar{R}^2=0.998$ DW $=2.366$ SE $=1.179$
	$M_{dt}=-2.504+0.533Y_t-0.465Y_{t-1}-2.711i_t+2.959i_{t-1}+1.318M_{dt-1}-0.739M_{dt-2}+\varepsilon_{3t}$ $(-0.458)\ (7.528)\ (-5.789)\ (-4.485)\ (3.424)\ (9.447)\ (-3.393)$	$\bar{R}^2=0.998$ DW $=1.617$ SE $=1.544$
	$M_t=3.896+0.026Y_t-0.006Y_{t-1}-2.575P_{mt-1}+0.466M_{t-1}+\varepsilon_{4t}$ $(1.821)\ (2.276)\ (-0.425)\ (-1.367)\ (1.444)$	$\bar{R}^2=0.950$ DW $=2.322$ SE $=0.413$
	$F_t=-4.962+0.028Y_t-0.027Y_{t-1}+0.194i_t+0.010r_t+0.978F_{t-1}+\varepsilon_{5t}$ $(-1.207)\ (1.652)\ (-1.558)\ (1.407)\ (0.826)\ (4.193)$	$\bar{R}^2=0.984$ DW $=1.563$ SE $=0.305$
Nether lands	$C_t=1.623+0.498Y_t-0.288Y_{t-1}+0.074Y_{t-2}+0.750C_{t-1}-0.017P_{t-1}+\varepsilon_{1t}$ $(1.441)\ (19.326)\ (-1.978)\ (1.472)\ (2.279)\ (-1.323)$	$\bar{R}^2=0.977$ DW $=1.810$ SE $=0.150$
	$I_t=-0.594+0.292\Delta Y_t-0.085\Delta Y_{t-1}-0.245i_t-0.103i_{t-1}+0.887I_{t-1}+0.003P_{t-1}+\varepsilon_{2t}$ $(-0.377)\ (10.009)\ (-1.223)\ (-1.868)\ (-0.990)\ (8.227)\ (0.168)$	$\bar{R}^2=0.909$ DW $=2.693$ SE $=0.162$
	$M_{dt}=1.164+0.106Y_t+0.158Y_{t-1}-0.440i_t-0.256i_{t-1}+0.038M_{dt-1}+\varepsilon_{3t}$ $(1.415)\ (2.638)\ (1.396)\ (-3.589)\ (-1.981)\ (0.070)$	$\bar{R}^2=0.996$ DW $=1.629$ SE $=0.182$
	$M_t=3.631+0.074Y_t-0.036Y_{t-1}+0.528M_{t-1}-3.026P_{mt-1}+\varepsilon_{4t}$ $(6.835)\ (6.206)\ (-1.872)\ (6.609)\ (-2.534)$	$\bar{R}^2=0.991$ DW $=1.962$ SE $=0.058$
	$F_t=-1.029+0.026Y_t+0.040i_t+0.205r_t+0.517F_{t-1}+\varepsilon_{5t}$ $(-2.170)\ (4.182)\ (2.109)\ (1.667)\ (3.701)$	$\bar{R}^2=0.997$ DW $=1.209$ SE $=0.031$

(**Table 1** continued)

United Kingdom

$$C_t = \underset{(-0.250)}{-1.712} + \underset{(9.646)}{0.556Y_t} \underset{(-1.473)}{-0.402Y_{t-1}} + \underset{(1.652)}{0.788C_{t-1}} + \underset{(0.550)}{0.058P_{t-1}} + \varepsilon_{1t}$$

$\bar{R}^2 = 0.983$ DW $= 2.070$ SE $= 1.177$

$$I_t = \underset{(-0.633)}{-1.558} + \underset{(7.331)}{0.189\Delta Y_t} + \underset{(1.260)}{0.079\Delta Y_{t-1}} \underset{(-1.637)}{-0.470i_t} + \underset{(3.191)}{0.919i_{t-1}} + \underset{(2.006)}{0.597I_{t-1}} \underset{(-1.308)}{-0.420I_{t-2}}$$
$$+ \underset{(1.068)}{0.040P_{t-1}} + \varepsilon_{2t}$$

$\bar{R}^2 = 0.966$ DW $= 2.513$ SE $= 0.455$

$$M_{dt} = \underset{(1.764)}{7.481} + \underset{(3.285)}{0.647Y_t} \underset{(-2.801)}{-0.474Y_{t-1}} \underset{(-1.126)}{-2.043i_t} + \underset{(5.351)}{0.851M_{dt-1}} + \varepsilon_{3t}$$

$\bar{R}^2 = 0.996$ DW $= 1.993$ SE $= 3.868$

$$M_t = \underset{(-3.035)}{-2.836} + \underset{(0.344)}{0.003Y_t} + \underset{(1.056)}{0.010Y_{t-1}} + \underset{(3.808)}{0.034Y_{t-2}} + \underset{(1.155)}{0.236M_{t-1}} + \underset{(2.722)}{1.863P_{mt-1}} + \varepsilon_{4t}$$

$\bar{R}^2 = 0.991$ DW $= 2.322$ SE $= 0.166$

$$F_t = \underset{(0.979)}{2.262} + \underset{(3.870)}{0.059Y_t} \underset{(-0.052)}{-0.001Y_{t-1}} + \underset{(1.143)}{0.179i_t} \underset{(-1.698)}{-0.067i_{t-1}} + \underset{(1.888)}{1.529r_t} + \underset{(1.487)}{0.349F_{t-1}} + \varepsilon_{5t}$$

$\bar{R}^2 = 0.997$ DW $= 2.060$ SE $= 0.212$

Table 2: Estimated Short-run and Long-run Coefficients for the Three Sectors

Countries	Real Sector α_1	α_2	β_1	β_2	β_3	Monetary Sector κ_1	κ_2	κ_3	Foreign Sector δ_1	δ_2	ρ_1	ρ_2	ρ_3
(1) Canada	0.451	0.040	0.378	−0.175	0.000	0.274	0.000	−1.166	0.176	0.021	0.201	0.000	1.481
		(0.491)[a]		(0.203)[b]			(0.274)[c]			(0.197)[a]		(0.201)[c]	
(2) France	0.633	0.000	0.238	0.245	0.003	0.360	0.003	−3.855	0.020	0.000	0.026	0.013	0.024
		(0.633)[a]		(0.483)[b]			(0.360)[c]			(0.020)[a]		(0.039)[b]	
(3) Germany	0.489	0.151	0.263	0.166	−0.276	0.165	0.033	−0.478	0.012	0.000	0.050	0.006	0.146
		(0.640)[a]		(0.464)[c]	(−0.724)		(0.165)[c]			(0.012)[a]		(0.056)[b]	
(4) Italy	0.840	0.036	0.448	−0.416	−0.316	0.722	0.031	−0.793	0.065	0.060	0.019	0.000	0.033
		(0.926)[a]		(1.030)[c]	(−4.451)		(0.753)[b]			(0.125)[a]		(0.019)[b]	
(5) Japan	0.329	0.057	0.164	0.069	−0.292	0.533	0.237	−2.711	0.026	0.012	0.028	0.000	0.194
		(0.623)[d]		(0.233)[c]	(−1.680)		(0.962)[c]	(−6.532)		(0.038)[a]		(0.028)[b]	
(6) Netherlands	0.498	0.086	0.292	0.174	−0.245	0.106	0.158	−0.440	0.074	0.075	0.054	0.000	0.083
		(0.593)[d]		(0.406)[e]	(−0.462)		(0.264)[e]	(−0.256)		(0.149)[a]		(0.054)[e]	
(7) U.K.	0.556	0.036	0.189	0.079	−0.470	0.647	0.077	−2.043	0.003	0.010	0.059	0.021	0.179
		(0.592)[a]		(0.230)[c]	(−0.808)		(0.724)[b]			(0.044)[d]		(0.080)[e]	

Long-run propensities are in parentheses.
The parameter values of each function were computed by the following Koyck lag structure and its variants.

[a] $Y_t=\beta_0X_0+[\beta_1/(1-\lambda D)]X_{t-1}+u_t$
[b] $Y_t=\beta_0X_t+[\beta_1/(1-\lambda D)]X_{t-1}+[\gamma_0/(1-\lambda D)]Z_t+u_t$
[c] $Y_t=[\beta(1-\lambda)/(1-\lambda D)]X_t+[\gamma(1-\lambda)/(1-\lambda D)]Z_t+u_t$
[d] $Y_t=\beta_0X_t+\beta_1X_{t-1}+[\beta_2/(1-\lambda D)]X_{t-2}+u_t$
[e] $Y_t=\beta_0X_t+[\beta_1/(1-\lambda D)]X_{t-1}+\mu_0Z_t+[\mu_1/(1-\lambda D)]Z_{t-1}+u_t$

On the basis of equations (15) through (21), we can examine the various types of characteristic roots and their corresponding implications. Canada and Italy exhibited distinct real roots, while France, Germany, Japan, the Netherlands, and the United Kingdom showed complex roots. The implications of the two different types of roots are self-evident. The former countries experienced a non-oscillatory time path, whereas the latter countries encountered an oscillatory pattern. On the other hand, Canada exhibited convergence without oscillation, while Germany, Japan, the Netherlands, and the United Kingdom evidenced oscillaeion with a dampened amplitude in approaching the equilibrium level. This implies that those countries maintained economic stability in the face of rapid growth during the post-World War II period. Only two countries, France and Italy, experienced instability during this period. France underwent a divergent pattern with oscillation, and Italy showed a divergence without oscillation.

The external parameters listed in Table 2 indicate to what degree the domestic cyclical fluctuations and instability in a country is influenced by the foreign sector. Since δ_1 and ρ_2 turned out to be exceedingly small in all countries, the cyclical fluctuaitons in the countries other than Canada and Italy cannot be attributed very much to these parameters, but are due to the low ρ_1 and ρ_3 instead. However, the non-oscillatory pattern in Canada and Italy was substantially influenced by the small δ_1 and ρ_2, but not by the small ρ_1 and ρ_3. The movement towards stability was clearly inhibited due to the small δ_1 and δ_2, while the small ρ_2 had the effect of reducing instability in France and Italy. In Canada, Germany, Japan, the Netherlands, and the United Kingdom, convergence was accelerated by a small ρ_2, while small values of δ_1 and δ_2 dampened this trend.

IV. Concluding Remarks

The analysis of the conditions for stability and oscillation, conducted within the context of second-order difference equations for seven developed countries, exhibits considerable evidence that international transactions have a strong impact on domestic cyclical fluctuations and instability.

The above empirical results are based on the assumption of no foreign repercussions and are limited to the developed countries. While the findings are, as such, partial, they do shed light on the controversy over the origin of cyclical fluctuations and instability. Any theory which purports to explain the major causes of domestic cyclical behavior, whether in terms of indigenous or foreign economic conditions, must take into account the impact of dynamic external parameters.

Finally, the cyclical behavior of an individual country, described in this paper, should not be construed as the ultimate pattern experienced by that country during the sample period. This paper discusses individual cyclical fluctuations and stability only in relation with the United States.

Appendix I

Derivation of the Second-order Difference Equation

From equation (1) through (4) and (8) through (10), we derive the following equation (22):

$$Y_t = aY_{t-1} - bY_{t-2} - ci_t + \nu_{1t} \tag{22}$$

where $a = [(\alpha_2 - \beta_1 + \beta_2 - \delta_1)/(1 - \alpha_1 - \beta_1 + \delta_1)]$

$b = [\beta_2/(1 - \alpha_1 - \beta_1 + \delta_1)]$

$c = [\beta_3/(1 - \alpha_1 - \beta_1 + \delta_1)]$

ν_{1t} = a composite term containing all of the exogenous variables in the real sector.

We obtain equation (23) by substituting equations (5) and (6) into equation (7), and by substracting the resulting equation, which has a one period lag, from the same equation written without the lag:

$$i_t = dY_t + eY_{t-1} - fY_{t-2} + i_{t-1} + \nu_{2t} \tag{23}$$

where $d = (\kappa_1/\kappa_3)$

$e = [(\kappa_2 - \kappa_1)/\kappa_3]$

$f = (\kappa_2/\kappa_3)$

ν_{2t} = a composite term containing all of the exogenous variables in the monetary sector.

Substituting equations (8) through (12) into equation (13), we have

$$i_{t-1} = gY_{t-1} - hY_{t-2} + \nu_{3t} \tag{24}$$

where

$g = [(\delta_1 - \rho_1)/\rho_4]$

$h = [(\rho_2 - \delta_2)/\rho_4]$

From equations (22), (23) and (24), we get equation (14).

Appendix II

Data Sources

Variable	Definition[a]	Source[b]
Y	Gross national product	1
C	Private consumption	1
I	Private investment	1
G	Government expenditures	1
P	Domestic price index	1
P_m	Import price index	1
M_d	Demand for money	1
M_s	Supply of money	1
M	Imports from the United States	2
M	Imports from areas other than the U.S. It was computed by subtracting imports from the U.S. from the total imports.	2
X	Exports to the United States	3
F	Net capital inflow It is defined as the difference between the sum of short-term (the short-term claims as reported by banks in the United States) and long-term (the U.S. direct investment) inflows and the corresponding outflows for each country. However, since the data for the long-term outflows to the United States and the rest of the world from each country are not available for most of the countries, only the total capital inflows (both short-term and long-term) from the United States were used.	4, 5
i	Rate of interest The rate of government bond yield was used for Canada, France, Italy, the Netherlands and the United Kingdom, while the call money rate	1

	was employed for Germany and the discount rate for Japan.	
r	Foreign exchange rate (spot rate)	1

[a]All data are annual time series covering the years from 1950 to 1973 for Canada and the Netherlands, from 1951 to 1973 for France, Germany, Italy and the United Kingdom, and from 1953 to 1973 for Japan. They are expressed in terms of U.S. dollars.

[b]The data sources are

1. IMF, *International Financial Statistics*
2. U.S. Bureau of the Census, *FT 450 and 455 U.S. Exports*—World Area by Schedule B Commodity Grouping
3. U.S. Bureau of the Census, *FT 150 and 155 U.S. General Imports*
4. Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*
5. U.S. Department of Commerce, *U.S. Direct Investment Abroad* and *U.S. Business Investment in Foreign Countries*

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