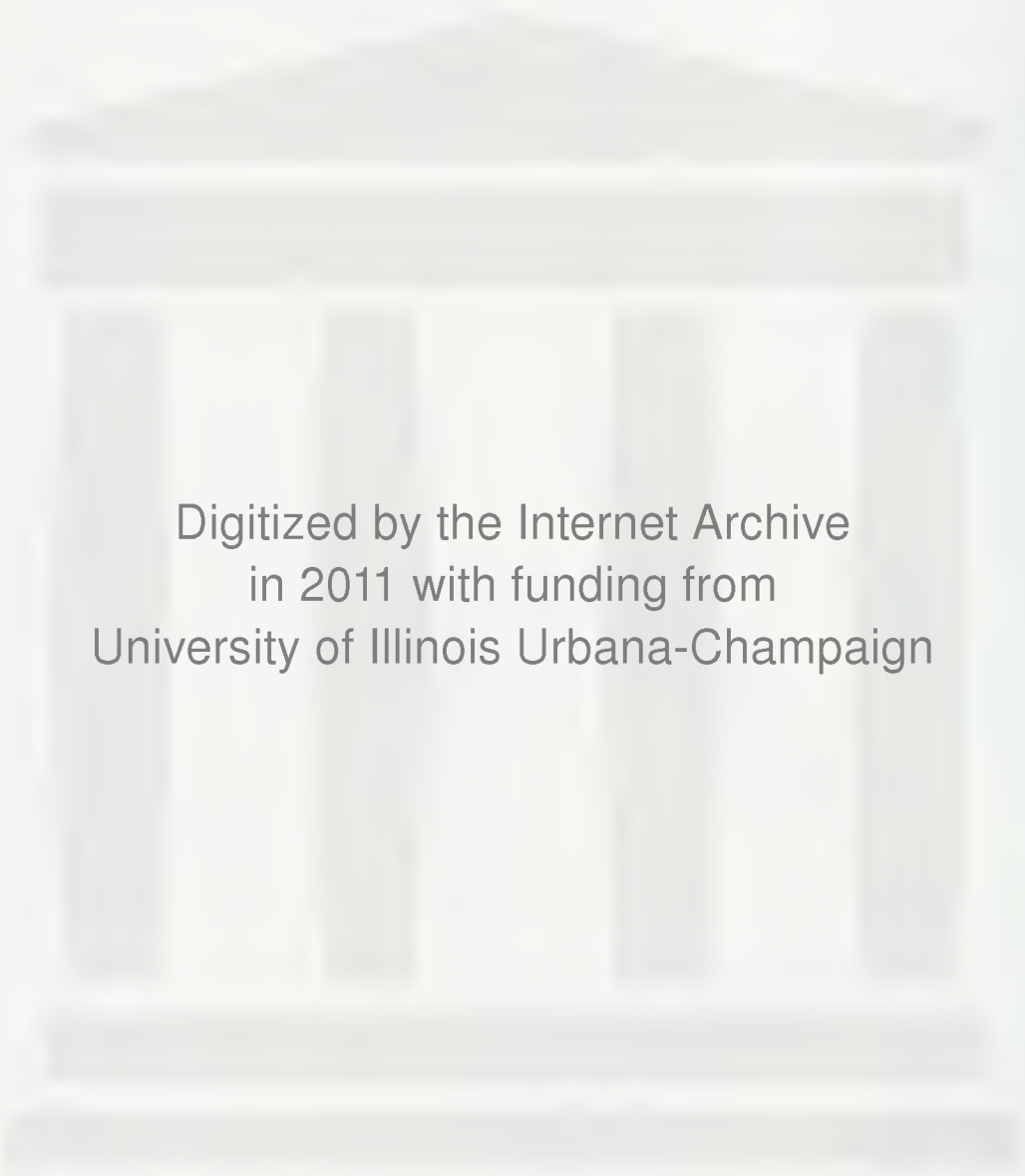

Faculty Working Papers

INVESTIGATING THE STRUCTURE OF INTERNATIONAL INTEREST RATES WITH SIMULTANEOUS EQUATION MODELS

Cheng F. Lee and Jacobus T. Severiens

#354

College of Commerce and Business Administration
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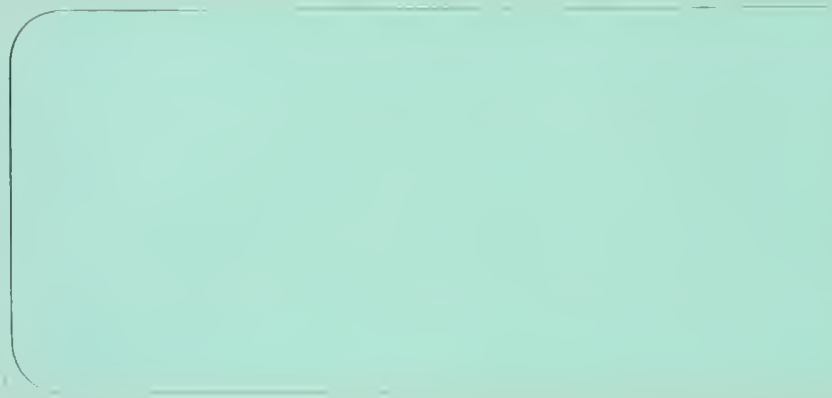

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INVESTIGATING THE STRUCTURE OF INTERNATIONAL INTEREST RATES WITH SIMULTANEOUS EQUATION MODELS

by

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International capital market theory postulates that national interest rates are in some way co-determined through the influence of international funds movements upon domestic markets. Given capital mobility in an open world economy, an interrelationship exists among short-term interest rates. Predicting foreign rate behavior can thus enhance the effectiveness of monetary policy.

Empirical verification of the co-determination hypothesis is sparse for want of complete formal model. The few current econometric studies in the field are constrained in scope and methodology. Equations warrant refinement and expansion. Particular stress must be placed upon the explicit role of co-determination and market dominance.

This paper seeks to extend the econometric treatment of international/short-term interest rate relationships. It introduces two alternative simultaneous equation models for use in specifying statistical estimators in a number of selected national markets. The one provides for a study of structural interdependence. The second model employs a recursive equation. By this means it explores the direction and degree of dominance and influence.

The following section begins by noting some current studies in the field. The models developed therein become the bases for further econometric investigation. The number of explanatory variables is increased, and data are subjected to a series of simple correlations and ordinary least squares analyses. As shall be shown, however, merely adapting of established techniques will not suffice. The second section develops the new approach.

It constructs the full-structure model for investigating simultaneous relationships of international short-term interest rates. The final section builds the recursive model for discerning causality. To demonstrate the practical application of the latter econometric technique, the paper considers some ramification of the empirical findings for the formulation of the U.S. monetary policy.

I

Empirical investigations of international interest rate relationships are of fairly recent origin. Correlation analyses by Hendershott (1967) and Kwack (1971) suggest that U.S. short-term rates explain partially the behavior of euro-dollar yields. A later econometric analysis by Argy and Hodjera (1973) lends support to this hypothesis. That study notes that euro-dollar movements are statistically dominated by conditions in the United States. But the findings also suggest that euro-dollar rates are influenced as well by economic conditions in Europe.

The Hendershott and Kwack studies stopped short of considering foreign influences upon U.S. short-term rates. Argy and Hodjera, however, extended their research to encompass the existence of financial linkages among the short-term rates of ten industrialized nations. One test - a simple correlation analysis of each of a series of national yields with the U.S. rate - produced a strong relationship in most cases.[1)] The data, however, was obtained on a quarterly basis. The use of monthly figures would have improved the predictive power. More important, the methodology neglected the inter-action and interrelationship among various foreign interest

rates. Incorporation of these factors would demand additional econometric considerations with a different set of data.

Table I presents the correlation matrix resulting from a series of regressions taking a group of interest rates into consideration. The sample data comprised short-term yields from seven nations over the period January 1965 - December 1974. The figures were obtained on a monthly basis in order to reduce the time aggregation bias.[2)]

. . . INSERT TABLE I. . .

But even with these added touches the results are similar to those obtained from the Argy and Hodjera tests. The correlation is high for U.S., France, the United Kingdom, and Canada. West German and Japanese statistical relationships with yields from other countries are surprisingly low.

As Argy and Hodjera point out in their study, however, any statistical correlations under these conditions do not take into account the impact of domestic variables in determining yield levels. They call for a more complex model, one that can link national short-term rates to both indigenous and foreign market influences.

One such model was recently suggested and tested by Marcis and Smith (1974). It employs domestic variables, with foreign rates considered as residuals. A modified version of it is presented below.

Econometric studies abound on U.S. interest rate determinants. While the findings differ in details, there exists a broad consensus

as to the dominant influences. Three domestic variables loom especially important: (1) some measure of income, (2) a measure of liquidity, and (3) some measure of the expected rate of inflation.[3)]

A domestic interest rate equation can therefore be written as:

$$r_{it} = \alpha_0 + \alpha_1 y_{it} + \alpha_2 M_{it} + \alpha_3 P_{it} + e_{it} \qquad (1)$$

This equation indicates that the level of the short-term rate (r) is assumed to be a linear function of the level of income (y) - measures in this case by a proxy - industrial production, the money stock (M), and the retail price index (P). Subscripts i and t refer to country and time period, respectively. This formulation differs slightly from the one employed by Marcis and Smith. Their study incorporated percentage changes in all variables over three-quarter average intervals, rather than monthly levels.

The results of an ordinary least squares regression (OLS) of equation (1) are presented in Table II. Interest rates came from the data set employed in Table I. The figures support the hypothesis that domestic economic indicators are relatively important in explaining movements in a country's short-term rate. Every national

. . . INSERT TABLE II. . .

market is influenced by at least one of the independent variables in the regression equation. In most cases two factors play a statistically significant role. Industrial production is important

for explaining short-term yield behavior in the Federal Republic of Germany, France, and the United Kingdom. Money supply is related to changes in interest rate levels in the United States, France, the Netherlands, the United Kingdom, and Canada. The retail price index determines changes in American, German, and Japanese yields. The significance of all three independent variables can probably be enhanced if some adjustment for time lag is incorporated into the regression.

Marcis and Smith have tried to reduce residual influence and gain greater estimate efficiency by applying Zellner's (1962) Seemingly Unrelated Regression (SUR) simultaneously to the specifications on the order of equation (1). Indeed, their test results have shown some improvement in regression estimate significance.

An SUR application was made to the data set of the study at [illegible] The statistical results are listed in Table II. For comparative purposes they are placed below the corresponding OLS estimates. Note that in this case the SUR method actually reduces estimate significance in several instances. An improvement can be found only in U.S. and Japanese explanatory domestic variables.

Meanwhile, what has happened to foreign interest rates as explanatory variables? The OLS procedure provides for them in residual terms. Their interrelationships can be seen in the residual correlation matrix presented as Table III. Judging from these figures the co-determination is strong, and foreign rate influences are not removed by domestic economic indicators. Netherlands and French yields show a high degree of

interrelationship. As in the previous test, the Federal Republic of Germany and Japan denote the least amount of statistical interdependence with other countries.

. . . INSERT TABLE III. . .

The use of OLS residuals in estimation, however, assumes that such figures relate specifically to foreign interest rates. No allowance is made for additional domestic explanatory variables. The SUR method, on the other hand, hides foreign influence within domestic variables. It cannot identify any interdependent effect associated with international co-movements of interest rates. The stage is thus set for a new approach, a new model, which will patently and directly take both domestic and foreign explanatory variables into account.

II

The interrelationships among international short-term interest rates can be specified statistically with a full-structure simultaneous model. The equation is written as:

$$\text{(i)}\quad R_{at} = \alpha_a + \gamma_{ag}R_{gt} + \gamma_{an}R_{nt} + \gamma_{aj}R_{jt} + \gamma_{ak}R_{kt} + \gamma_{ac}R_{ct} + b_aY_{at} + C_aM_{at} + d_aP_{at} + E_{at}$$

$$\text{(ii)}\quad R_{gt} = \alpha_g + \gamma_{ga}R_{at} + \gamma_{gf}R_{ft} + \gamma_{gn}R_{nt} + \gamma_{gj}R_{jt} + \gamma_{gk}R_{kt} + \gamma_{gc}R_{ct} + b_gY_{gt} + C_gM_{gt} + d_gP_{gt} + E_{gt} \qquad (2)$$

$$\vdots$$

$$\text{(vii)}\quad R_{ct} = \alpha_c + \gamma_{ca}R_{at} + \gamma_{cg}R_{gt} + \gamma_{cf}R_{ft} + \gamma_{cn}R_{nt} + \gamma_{cj}R_{jt} + \gamma_{ck}R_{kt} + b_cY_{ct} + C_cM_{ct} + d_cP_{ct} + E_{ct}$$

where at time t, R_{at}, R_{gt}, R_{ft}, R_{nt}, R_{jt}, R_{kt} and R_{ct} represent the short-time interest rate of United States, Germany, France, Netherlands, Japan, United Kingdom and Canada, respectively. Y_{it} denotes the industrial production for the ith country, M_{it} represents the money supply for the ith country, while P_{it} denotes the retail price index in each nation (i = a, g, f, n, j, k, and c).

A two-stage least squares (2SLS) procedure can be performed to estimate the related coefficients. The first step regresses the short-term rate of each country on 21 domestic variables (seven nations times three variables). The result is a purified estimate of the short-term rate, which in turn is used in the second step of the equation to obtain full-structure empirical results.

The empirical findings of the 2SLS procedure are listed in Table IV. The figures suggest that the American short-term rate is essentially explained by both the domestic money supply and the U.K. money market rate. Price indices determine West German rates, but so do British and Canadian short-term yields. French rates are statistically accounted for by Dutch, Japanese and British yields, along with the domestic industrial production index. American, West German, and Canadian rates play a role in the Dutch market. The Japanese short-term rate is essentially explained by the West German and French rates, as well as the domestic money supply and price index. In turn, U.S. and Japanese yields are related to British rates. Surprisingly, only West German and Japanese rates are statistically related to Canadian yields.

. . . INSERT TABLE IV. . .

Discerning the interrelationships among short-term rates is helpful. It provides an opportunity to explore financial linkages among national capital markets. Such information, however, does not set forth dominance, or causation.[4] For example, American yields may be statistically related to French ones. But the figures so far do not indicate which of the two is dominant or is a determinant of the other. By itself the evidence is insufficient for the formulation of monetary policies based upon predictive behavior of international interest rates. A different model is needed to provide the additional insight.

III

A recursive model can help establish the presence of causal and dominant relationships. To be operative, however, it must proceed from some a priori statistical ranking of national equations. This initial ordering can be achieved by obtaining the coefficients of determination (R^2) from a multiple regression of all country interest rates. These coefficients are listed in Table V.

. . . INSERT TABLE V . . .

Theoretically, the R^2 integrates the information of the simple correlation coefficients first estimated in Table I [See Anderson (1958)]. The ranking of R^2 from that set of data can be a surrogate measure for degree of interdependence among the seven short-term rates. The ordering method assumes that the country with the highest coefficient is a leader among the selected nations. In other words, the recursive ranking applies to the theory of oligopolistic markets. As may be expected, the American

data has produced the highest coefficient. The United States, therefore, merits the top position in the order of equations in the recursive model. Japan, with the lowest R^2, takes the bottom listing. The ranking, however, is ordinal. For instance, it does not indicate whether U.S. rates have any significant impact, if at all, upon the Japanese capital market. If thus becomes necessary to continue with the recursive extimating procedure.[5)]

The requisite equations can now be formulated and ordered as follows:

$$(1)\quad R_{at} = \alpha_a + b_a Y_{at} + C_a M_{at} + d_a P_{at} + E_{at}$$

$$(2)\quad R_{ft} = \alpha_f + \gamma_{fa} R_{at} + b_f Y_{ft} + C_f M_{ft} + d_f P_{ft} + E_{ft} \qquad (3)$$

$$(3)\quad R_{ct} = \alpha_c + \gamma_{ca} R_{at} + \gamma_{cf} R_{ft} + b_c Y_{ct} + C_c M_{ct} + d_c P_{ct} + E_{ct}$$

$$\vdots \qquad \vdots$$

$$(7)\quad R_{jt} = \alpha_j + \gamma_{ja} R_{at} + \gamma_{jf} R_{ft} + \gamma_{jc} R_{ct} + \gamma_{jn} R_{nt} + \gamma_{jk} R_{kt} + \gamma_{jg} R_{gt} + b_j Y_{jt} + C_j M_{jt} + d_j P_{jt} + E_{jt}$$

Where the definitions of notations are identical to those of the earlier equations.

The order of national ranking and degree of estimator impact is presented in Table VI. Empirically, the U.S. short-term rate

. . . INSERT TABLE VI. . .

is important in explaining the like yields of all the other countries

in the sample, with the exception of Japan. This result seemingly confirms the oligopoly theory - that U.S. rates play a strong or leadership role in determining yields in other national capital markets. This feature is particularly noteworthy given U.S. attempts to restrict capital outflows during the period under study. The dollar continues to be the most widely-used currency in trade as well as the intervention currency in foreign government monetary transactions. Barring effective internal measures to the contrary by foreign monetary authorities, changes in U.S. rate levels are apt to be followed by modifications in the same direction in yields overseas. This factor does not necessarily denote the absence of a feedback effect. Nor does it preclude substantial capital flows in both directions. Rather the study is concerned co-movements of interest rates. It finds that foreign yields play a minor role in determining U.S. money market rates.

Following the U.S. influence pattern, French yields also play a significant world role. In descending order Canada and the Netherlands have lesser behavior determinant positions.

At first glance the low ranking of British and German interest rates influence upon other countries may come as a surprise. Both nations have efficient and well-integrated capital markets. Speculation, however, suggests that each of these nations has been too busy employing defensive measures with respect to capital flows. The United Kingdom has endured several balance of payments crises. It has not hesitated to intervene in the short-term and forward exchange markets to raise rates to curb outward flows of funds. Apparently, financial decline has accompanied economic and political withdrawal from world influence.

The Federal Republic of Germany has had troubles of a different sort, a persistent balance of payments surplus and desire to hold down inflation rates. Hence, it has adopted defensive policies, employing monetary instruments and controls to discourage an influx of speculative capital. These measures have had partial success. They have not changed the image of Germany as a safe haven for funds. Inflows continue to exceed outflows.

It is interesting to note that the short-term Japanese rate is essentially explained by its own domestic variable. The correlations among the residuals of the recursive regression are trivial. Despite its renown as a world trader, that nation employs extensive controls on capital imports and exports. Little monetary integration exists with the rest of the world.

Turning to degree of impact, it becomes readily apparent that the order of significance does not necessarily follow that of the R^2 coefficients. In the case of the United States the impact, in descending order is as follows: France, the Federal Republic of Germany, Canada, the United Kingdom, the Netherlands (negative relationship) and Japan.

The American determination of French rates may come as a surprise and be contrary to historical observation. France has long been associated with a desire to assert economic and monetary independence from the dollar. Since the devaluation of the franc in 1969, however, it has followed an economic policy which falls within balance of payments constraints. There is evidence that French officials have taken considerations of euro-dollar rate movements into account in setting their interest rate policy.

The U.S. determinant of West German rates also remains strong. As noted above, the Federal Republic of Germany may have little

influence on short-term yields in other parts of the world, but it continues to receive large amounts of dollar inflows. Cutting the deutsche mark loose from par value and the resultant upward float of that currency has not deterred investors from considering the safety and stability of investments that currency.

The strong U.S. influence on Canadian rates is readily understandable. Canada remains a number one trade partner. U.S. corporations and individuals have sizeable investment capital interests north of the border. Canada has also been free from the U.S. export controls on capital over the period under study.

The negative relationship with the Netherlands capital market is of interest. Traditionally, Holland has been open to strong external influences on domestic liquidity. Nevertheless, its heavy dependence upon foreign trade and increased capital mobility have forced an extensive use of monetary instruments to insulate in some degree the domestic economy from exogenous forces. Dutch monetary authorities have followed a policy of frequent intervention in short-term capital markets, especially in forward exchange markets.

In sum, what lessons can be drawn from the models developed in this paper? Certainly U.S. monetary policy, as it affects interest rates, has an influence on short-term yields worldwide, and to a greater overall extent than is the case with other countries. The impact per nation, however, is not spread evenly. Economies are far from open. Some traditionally large capital markets are relatively little affected. On the other hand, American authorities need not fear that foreign interest rates

rates will have a significant impact on the domestic market. The United States remains a leader, not a follower, in world financial markets.

The results may also be of use to other countries. Their position in the hierarchy may reveal some previous under or over estimations of influence. The figures can also indicate to what extent domestic economies lie exposed to monetary activities initiated in other countries.

In sum, the main thrust of this paper has been the application of new econometric techniques to the topic of co-movements of interest rates. The employment of the models can produce results with implications for the setting of monetary policy. As is typical with studies of this type, the findings are preliminary. More research efforts are needed before any conclusions can leave the tentative stage. Data input from additional nations should be welcomed. A lag effect should be considered for incorporation in the models. Such an adjustment may be difficult within the context of complex simultaneous equations. Nevertheless, this paper hopefully will stimulate sufficient interest to undertaking such additional research in an area of growing importance in international finance.

Footnotes

[1]Argy and Hodjera employed other tests, as well, including one involving bilateral interest differentials and forward exchange discounts. These, however, were all concerned with discerning financial linkage and not the co-determination of interest rates *per se*. In addition the authors acknowledged the limitations of tests in terms of inadequate data and insufficient explanatory variables.

[2]Zellner and Montmarquette (1971) have pointed out that the temporal aggregated data in general will affect the precision of estimation and prediction, the power of tests, the possibility of making short-run forecast and the probability of discovering new hypothesis about the short-run behavior from data.

[3]See Gibson and Kaufman (1968) and Hanburger and Silber (1969).

[4]From the first stage results indicate that the multicollinearity problem associated 2SLS discovered by Klein and Nakamura (1962) is relatively strong in this empirical work. This factor constitutes an additional restriction on the full structural model in this form of empirical study.

[5]The justification of the recursive model and the comparison between the recursive model and the full structural model can be found in Wold (1954), Strotz and Wold (1960) and Liu and Hwa (1974).

Table I

Correlation Coefficient Matrix of Seven Countries
Short-term Interest Rate*
(January 1965 - December 1974)

Country[1)]	United States	Federal Republic of Germany	France	Netherlands	Japan	United Kingdom	Canada
United States	1	.5925	.8507	.6145	.4557	.8033	.8062
Federal Republic of Germany		1	.5142	.5962	.3532	.5208	.3796
France			1	.6563	.3683	.8057	.7281
Netherlands				1	.5829	.5731	.7151
Japan					1	.3222	.5435
United Kingdom						1	.6963
Canada							1

*All figures significant at the 5% level.

Source: OECD, Main Economic Indicators, 1966-1975.

1) United States, Germany, The Netherlands, United Kingdom and Canada: Three-month treasury bill rate.
France and Japan: Call money rate.

Table II - OLS and SUR

Estimates of Determinants of Movements of Short-term Interest Rates in Seven Countries, 1965-1974

Country	Method of Estimation	Constant	Income	Money	Prices	R^2
1. U.S.A.	OLS	7.4220 (4.723)**	-.0186 (-1.223)	.0302 (5.443)**	-.0480 (-2.322)**	.448
	SUR	3.3260 (3.371)**	.0207 (2.561)**	.0294 (8.832)**	-.0562 (-4.675)**	
2. Germany	OLS	-6.6420 (-2.2860)**	-.0124 (-1.8000)*	.0054 (.7823)	.1048 (3.7650)**	.210
	SUR	-1.7920 (-.7777)	.0030 (.4911)	.0127 (2.1600)**	.0401 (1.8540)*	
3. France	OLS	2.3230 (1.3800)	-.0392 (-3.4890)**	.0420 (10.68)**	.0009 (.2368)	.519
	SUR	-1.1270 (-.9304)	-.0007 (-.0925)	.0340 (11.18)**	.0010 (.5120)	
4. Netherland	OLS	6.8060 (4.6830)**	-.0053 (-.4726)	-.0377 (2.8860)**	-.0181 (-.7893)	.183
	SUR	4.0810 (4.3270)**	-.0114 (-1.673)	.0046 (.5056)	.0163 (1.2020)	
5. Japan	OLS	10.600 (8.5220)**	.0019 (.6710)	-.0005 (-.3884)	-.0298 (-2.5580)**	.084
	SUR	11.1300 (12.2900)**	.0066 (3.0870)**	-.0014 (-1.3430)	-.0391 (-4.8120)**	
6. United Kingdom	OLS	20.6500 (7.9450)**	-.1218 (-5.5440)**	.0067 (2.8890)**	.0001 (.5684)	.246
	SUR	17.4400 (8.6240)**	-.0971 (-5.6680)**	.0090 (4.8110)**	.0001 (.7581)	
7. Canada	OLS	3.7190 (1.8630)*	-.0015 (-.5824)	.1679 (2.3570)**	.0010 (.0555)	.059
	SUR	6.1860 (4.5020)**	-.0017 (-1.2870)	.0610 (1.2210)	-.0103 (-.86650)	

*Indicates significant at 5% level

**Indicates significant at 10% level

Source: OECD, Main Economic Indicators, 1968-1975.

Table III

Residual Correlation Matrix*

	U.S.A.	Germany	France	Netherlands	Japan	United Kingdom	Canada
U.S.A.	1	.4449	.7383	.6184	.5468	.5696	.7960
Germany		1	.3712	.5185	.4516	.3786	.2866
France			1	.7292	.5956	.5790	.6897
Netherlands				1	.6481	.4662	.6293
Japan					1	.5293	.6111
United Kingdom						1	.6503
Canada							1

*All figures significant at 5% level.

Table IV

2SLS Structural Estimates of International Short-term Interest Rates
(t-values appear in parentheses beneath coefficients)

Dependent Variables	R_a	R_g	R_f	R_n	R_j	R_k	R_c
Endogenous Variables							
R_a	1	.4859 (1.0620)	.2325 (.4759)	-1.6430* (4.0860)	-.4240 (-.7594)	1.6050* (2.9340)	.7011 (2.2210)
R_g	.0167 (.5361)	1	-.3515 (-1.4150)	.5143* (2.5740)	.5383* (2.2660)	.0788 (.3044)	-.1959 (-1.1730)
R_f	-.0594 (-.3239)	.4778 (.8380)	1	.2877 (1.2410)	.5424* (2.6190)	.1041 (.5007)	-.4094* (-2.3620)
R_n	.2245 (1.339)	-.6614 (-1.1480)	.5593* (2.5030)	1	-.1717 (-.7119)	.1914 (.4588)	.6497* (4.2610)
R_j	.1524 (1.0850)	.1319 (.2777)	.9404* (3.3090)	.2855 (.8986)	1	-.4152* (-2.0830)	.1270 (.5923)
R_k	.3043* (2.6460)	.6416* (2.7930)	.9786* (4.4660)	.2717 (1.7380)	.2548 (1.6980)	1	.4753* (4.2890)*
R_c	-.02132 (-1.2690)	-.9545* (-2.3810)	.0156 (.0445)	.6424* (2.2490)	.1404 (.4524)	-.1080 (-.3392)	1
Exogenous Variables+							
Constant	-1.2420 (-.4785)	-9.5090 (-1.6060)	20.2900* (-5.9290)	5.6800 (1.7000)	7.7240* (2.9470)	1.1360 (.2290)	-7.9950* (-2.1730)
Y_i	.0164 (.7749)	.0058 (.3999)	.0614* (3.4980)	.0046 (.3881)	.0057 (1.6600)	-.0034 (-.1173)	.0007 (.4409)
M_i	-.0229* (2.3490)	-.0752 (-1.2670)	-.0155 (1.7190)	.0285 (.8283)	-.0137* (-2.7970)	-.0085 (1.5760)	-.0879 (-.6432)
P_i	-.0354 (-1.3250)	.1463* (2.9210)	-.0054 (-1.7680)	-.0372 (-1.4920)	-.0351* (-2.0610)	-.0000 (-.0267)	.05514* (3.0350)

+Subscript i, i = 1, 2, 3, 4, 5, 6, 7, denotes variable in second stage of relevant equation.

*denotes significance at 10% level of significance or better for two-tailed test.

Table V

Coefficients of Determination for Seven Countries

1.	United States	.8539
2.	France	.7849
3.	Canada	.7426
4.	Netherland	.7060
5.	United Kingdom	.6965
6.	Germany	.5488
7.	Japan	.3787

Table VI

Recursive System Estimates for International Short-term Interest Rates
(t-values appear in parentheses beneath the coefficients)

Independent Variables / Dependent Variables	R_A	R_F	R_C	R_N	R_K	R_G	R_J
R_A		1.4067* (12.1221)	.7369* (6.6385)	-.2368* (-1.8024)	.3161* (1.9841)	.8093* (5.7838)	.2221 (1.4494)
R_F			.2090* (3.4736)	.3499* (4.8202)	.2611* (3.9478)	-.2746* (-3.1146)	.0687 (.7992)
R_C				.3500* (4.8203)	.1970* (1.6379)	.5043* (-4.3234)	.0355 (.2958)
R_N					.056102 (.4286)	.7869* (6.3366)	.2182 (1.7566)
R_K						.2036* (2.2812)	.1622 (1.6304)
R_G							.1024 (1.1796)
R_J							
Constant	7.4216* (4.7232)	-5.1476* (-4.0261)	3.6943* (2.8439)	2.8691* (2.3448)	10.6952* (6.3458)	-7.4344* (-3.4850)	6.4086* (5.8499)
Y_i	-.0186 (-1.229)	-.0008 (-.0964)	-.0021 (-1.4760)	-.0156* (-1.8932)	-.0746* (-5.9071)	.0174 (2.9081)	.0080* (3.3036)
M_i	.0302* (5.4429)	.0178* (5.4039)	-.2489* (-5.5436)	-.0362* (-2.7056)	.0032 (1.4450)	.0067 (.7086)	-.0059* (-3.1018)
P_i	-.0402* (-2.3229)	.0009 (.3768)	-.0086 (-.7920)	.0153 (.9182)	.0000 (.5934)	.0333 (1.5468)	-.0328* (-3.6158)
$\bar{R}^2$	.4338	.7815	.7330	.5816	.7618	.6120	.5553

*denotes significance at 10% level of significance or better for two-tailed test.

REFERENCES

1. Anderson, T. W. (1958), An Introduction to Multivariate Statistical Analysis. New York: John Wiley and Sons, Inc.

2. Argy, Victor and Zoran Hodjera (1973), "Financial Integration and Interest Rate Linkages in Industrial Countries," International Monetary Fund Staff Papers, Volume XX, 1973, pp. 1-76.

3. Gibson, William E., and George G. Kaufman (1968), "The Sensitivity of Interest Rates to Changes in Money and Income," Journal of Political Economy, 76, pp. 472-478.

4. Hanburger, M. J. and W. L. Silber (1969), "An Empirical Study of Interest Rate Determination," The Review of Economics and Statistics 51, pp. 369-73.

5. Hendershott, P. H., "The Structure of International Interest Rates: The U. S. Treasury Bill Rate and the Eurodollar Deposit Rate," Journal of Finance, September 1967, pp. 455-465.

6. Klein, L. R. and M. Nakamura (1962), "Singularity in the Equation Systems of Econometrics: Some Aspects of the Problem of Multicollinearity," International Economic Review, 3, pp. 274-299.

7. Kwack, Sung Y. (1971), "The Structure of International Interest Rates: An Extension of Hendershott's Tests," Journal of Finance, September 1971, pp. 897-900.

8. Liu, T. C. and E. C. Hwa (1974), "A Monthly Econometric Model of U. S. Economy," International Economic Review, 15, pp. 328-364.

9. Marcis, R. G. and V. Kerry Smith (1974), "Efficient Estimation of Multivariate Financial Relationships," Journal of Finance, Vol. XXIX, pp. 1415-1423.

10. Strotz, R. H., and H.O.A. Wold (1960),"Recursive vs. Nonrecursive Systems: An Attempt at Synthesis," Econometrica, 28, pp. 417-427.

11. Wold, H. (1954), "Causality and Econometrics," Econometrica, 22, pp. 162-177.

12. Zellner, A. (1962), "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias," Journal of the American Statistical Association, 57, pp. 348-368.

13. Zellner, A. and E. Montmarquette (1971), "A Study of Some Aspects of Temporal Aggregation Problems in Economic Analysis," Review of Economics and Statistics, 53, pp. 335-342.