The Transmission of Fluctuations in Economic Activity: Some Recent Evidence

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I. Introduction

The purpose of this paper is to consider recent evidence on the synchronization of cyclical movements, and the implications of this evidence for the transmission of fluctuations in real economic activity among countries. Greater exchange-rate flexibility affects the channels of transmission. Whether its net effect is to strengthen the impact that is transmitted, weaken it, or leave it unchanged depends on the determinants of capital flows and price movements, on the formation of expectations about exchange rates and prices, and the speed of adjustment in the markets for assets, goods and factors.

A severe recession affecting all industrial and most primary producing countries has characterized the period of managed floating. Even at this time, many countries are experiencing low levels of capacity utilization. The extent of unused capacity is difficult to quantify, and comparisons across countries as to the degree of slack must be viewed as approximate. Recent calculations made at the IMF suggest that for 1977 the degree of slack in the manufacturing sector of the industrial countries ranged from a low of 6 percent in the United States to a high of about 20 percent in Sweden and Japan.[1] Little increase in activity levels in many of the industrial countries is foreseen for 1978 on the basis of data from the first half year; indeed, for a few countries, the gap could even widen in 1978.

Over the last few years there has been a great deal of discussion of the need for policy coordination under the regime of managed floating. The need to avoid large exchange-rate changes and restrictive demand management policies in response to the common oil shock was widely espoused.[2] As the recession's scope and duration increased, the locomotive policy prescription

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[1]See Jacques R. Artus and Anthony G. Turner, "Measures of Potential Output in Ten Industrial Countries, 1955-1980". mimeographed.

[2]The arguments for sharing the deficit, and possible patterns for allocation are discussed in Andrew D. Crockett and Duncan M. Ripley, "Sharing the Oil Deficit", *IMF Staff Papers*, July 1975.

merged into the convoy prescription, and has now evolved into the concerted action program according to which an expansion path for each country is geared to its internal situation and its external constraints.[3] The policy prescriptions now recommending deliberate synchronization of cyclical activity through coordinated expansion indicate a continuing awareness of the importance of the transmission mechanism.

Clearly, one of the reasons for the prescriptions for coordinated action is that an expansion in domestic demand in a single country tends to have important implications for the country's trade balance. Rough estimates from using coefficients obtained from the "World Trade Model" suggest that the income effects alone, abstracting from price and exchange-rate effects, resulting from a 1 percent change in domestic demand in the United States cause a deterioration of the U.S. trade balance of more than $1 billion at the scale of 1977 trade flows.[4]

In the absence of stabilizing capital flows, isolated expansionary measures (a lack of synchronization) have important exchange-rate implications which adversely affect domestic price and wage formation and may even adversely affect activity levels through their impact on real balances. Such effects could make expansion in isolation for the more open economies, particularly those with weak external positions, unacceptable.

An abrupt and very widespread decline in activity levels followed the common oil shock and the restrictive demand management policies undertaken in response to rapid inflation. The period since 1975 has been characterized by continuing low levels of activity reflecting the inability or unwillingness of countries to extricate themselves from their current situations because of the price consequences of expansion, and because of external constraints. Coordinated growth could moderate in large part the exchange-rate implications (and price implications) of the desired expansionary stimuli and thus contribute to a transmission mechanism more similar to the one existing under fixed rates.

This paper first reviews briefly the channels of transmission under fixed- and flexible-exchange rates, and considers recent evidence on the degree of synchronization that has evolved. It then tries to evaluate the information these data provide on the evolution of the transmission mechanism under managed floating.

[3]See, for example, "Need for Coordinated Strategy Clearer, Economic Counsellor Says at ECOSOC," *IMF Survey,* July 17, 1978 and "Interim Committee Agrees on Coordinated Strategy," *IMF Survey,* May 8, 1978. Calls for coordinated expansion are discussed in Marina v.N. Whitman, "Coordination and Management of the International Economy: A Search for Organizing Principles," in William Fellner, editor, *Contemporary Economic Problems 1977,* (Washington, D.C.: American Enterprise Institute, 1977) and "The Locomotive Approach to Sustained World Recovery: Has it Run Out of Steam" in William Fellner, editor, *Contemporary Economic Problems 1978,* (Washington, D.C.: American Enterprise Institute, 1978).

[4]See Michael C. Deppler and Duncan M. Ripley, "The World Trade Model: Merchandise Trade," *IMF Staff Papers,* March 1978, for a description of the model.

II. The Transmission Mechanism[5]

The current account provides a major channel for the transmission of fluctuations in real output among countries.[6] Under a system of fixed-exchange rates a downturn in domestic demand in one country tends to dampen the demand for imports of goods and services and consequently to dampen exports of partner countries. At the same time exports of the first country may become more competitive since export orders can be filled more rapidly, and lagging domestic demand may encourage the search for new markets abroad. The strength of this type of transmission channel increases as the openness of the economy increases, so that the strengthening of the transmission process in the sixties and early seventies is to be expected.

In the absence of capital flows and with rapid adjustment in the goods market, flexible rates may insulate countries from external disturbances. This will depend, however, on the relative strength of price and real balance effects. If expenditure levels decline and there is an incipient move of the current account towards surplus, the exchange rate will appreciate; this in itself will increase real balances in the appreciating country (and decrease those held abroad), which in turn will help to sustain domestic demand while dampening demand abroad. Price effects of an appreciation over the short term will also contribute to balance-of-payments equilibrium by reallocating domestic and foreign demand from domestically produced goods to goods produced abroad. The transmission mechanism described above suggests that under flexible rates movements in real balances are like to play an important role. This simple scenario is not very realistic, however, in that it ignores the slow response of demand to changes in relative prices, particularly when these changes are viewed as transitory, and the impact of exchange-rate movements on the price of domestically produced goods, all of which will dampen the relative price effects of exchange-rate changes. It also ignores the capital account which can be expected to play an important role in exchange-rate determination.

To the extent that a depressed expenditure level contributes to a current account surplus that is viewed as temporary by market participants, and there is a high degree of substitutability between domestic and foreign assets, offsetting (stabilizing) capital outflows may respond to very small exchange-rate or interest-rate movements with the result that the transmission mechanism resembles closely the mechanism existing under fixed rates.[7] To the extent that depressed expenditure levels and exchange-rate appreciations affect market participants' expectations about inflation — with depressed levels and

[5]For a more complete discussion of the transmission process see Edward Tower and Thomas D. Willett, "The Theory of Optimum Currency Areas and Exchange Rate Flexibility," *Special Papers in International Economics,* No. 11, International Finance Section, Department of Economics, Princeton, New Jersey, May 1976.

[6]It is assumed here that the effects of an increase in reserves on the money supply are offset by the authorities.

[7]It is assumed here that the effects of capital inflows on the money supply are sterilized by the authorities.

an appreciating exchange rate suggesting a greater probability of a lower underlying rate of inflation — the exchange-rate appreciation may have to be very large (and clearly excessive) to induce equilibrating capital outflows; the needed appreciation will be further magnified by the J-curve effects on the current account which will accompany it. Very large exchange-rate movements may have important implications, even in the short term, for investment decisions in the traded-goods sector to the extent that the competitiveness of this sector is considered to be affected. They also have important domestic and foreign real-balance implications.[8]

It has traditionally been argued that a move to flexible-exchange rates and the elimination of the balance-of-payments constraint enable the authorities to assign monetary and fiscal instruments to the achievement of demand-management targets. Furthermore, control over the nominal money supply is clearly increased by the move to greater flexibility. However, the authorities may not, in fact, have greater control over real balances because of the rapid and important effects of exchange-rate movements on price formation and price expectations. Exchange-rate flexibility may also impair the effectiveness of fiscal-stimulus measures as instruments of demand management.

III. Measurement Techniques

The observed degree of synchronization in cyclical positions among industrial countries and the extent to which the move to greater exchange-rate flexibility has affected the transmission of fluctuations among these countries are explored in this paper. In considering the empirical evidence it is necessary to select a measure of short-term variations in economic activity. An earlier study focused on movements in industrial production indices about their long-term trend.[9] The sharp structural changes that have occurred in recent years make it less appropriate to apply this technique to the period after 1973.

The measures of economic activity used here represent a substantial improvement over those used in the earlier study for 10 of the 14 industrial countries covered in that estimates of potential output for these countries are now based on estimated Cobb-Douglas production functions.[10] These take into account the capital stock, the labor force, variations in the intensity of use of capital and labor, and the effects of the change in energy prices on productive potential. For four industrial countries, namely, Austria, Denmark, Norway, and Switzerland, it was necessary to estimate "potential manufacturing

[8]If, in contrast to the two scenarios above, the capital flows induced by a change in aggregate demand more than offset the effects of the change in demand on the current account, leading to a perverse exchange-rate effect, the propagation of disturbances could be heightened by the introduction of flexible rates. This would depend on the strength of relative price movements, price elasticities and real-balance effects. However, little empirical evidence of such a relationship was found by Tower and Willett, *Optimum Currency Areas,* p. 53.

[9]See Duncan M. Ripley, "Cyclical Fluctuations in Industrial Countries 1952-1975," in *Proceedings of the Second Pacific Basin Central Bank Conference on Econometric Modelling,* Central Bank of Korea, Seoul, Korea, 1976. This study considered 12 industrial countries.

[10]See Jacques R. Artus, "Measures of Potential Output in Manufacturing for Eight Industrial Countries, 1955-1978," *IMF Staff Papers,* March 1977, for a description of the techniques used to estimate potential output. The data used here are based on an expanded sample of ten industrial countries and are given in Jacques R. Artus and Anthony G. Turner, "Measures of Potential Output in Manufacturing for Ten Industrial Countries, 1955-."

output" by fitting log linear trends to observed series. Countries' cyclical positions are represented by semiannual series of the ratio of actual output to potential output in the manufacturing sector. The semiannual frequency was selected so as to eliminate spurious movements that exist in data for shorter frequencies, and to reduce somewhat the problem of lagged relationships.[11] The time period considered is 1961 to 1977.

Several techniques are used to analyze the observed pattern of covariation indicated by the data. First, weights indicating the relative importance of each of the 13 trading partners for economic activity in the country under consideration are obtained from the World Trade Model[12] and used to construct partner-country indexes of cyclical position for the country under consideration. The index of the country's cyclical position and that of its partner countries taken as an aggregate are then plotted over time in Charts 1-4 to indicate visually the degree to which they moved together. The charts are summarized in Table 1 for five sub-periods by the correlation coefficient between changes in a country's cyclical position and that of its major trading partners. Correlation coefficients for 1961-1965, 1966-1970, 1968-1972, 1973-1977, 1975-1977, and 1961-1977, are compared to see whether the degree of covariation changed during the fixed-rate period, how it may have been affected by the large discrete exchange-rate adjustments that characterized the period 1968-1972, and the extent to which covariation may have been affected by the oil shock and the move to greater exchange-rate flexibility.

A second technique that is used to analyze the degree to which countries' cyclical positions moved together is factor analysis.[13] "Factors" — statistical constructs that summarize the principal patterns of shared movement — are derived and given subjective interpretations depending on their movement over time, and on the countries whose cyclical movements are explained largely by the movement of these factors. This technique is applied to semiannual series on changes in manufacturing activity levels for four of the time periods mentioned above.

To attribute the observed change in patterns of synchronization to a change in the transmission mechanism resulting from greater exchange-rate flexibility could be incorrect since a large number of other factors that influence the observed pattern of cyclical activity may have changed also. For example, fiscal and monetary stances may have become more similar across countries during the flexible-rate period in response to common stimuli such as rapid inflation and substantial external constraints despite "increased flexibility." The strength of common external shocks may also have changed.

[11]In Ripley, "Cyclical Fluctuations," lags were introduced in measuring the degree of synchronization of cyclical movements but were not found generally to be significant.

[12]See Michael C. Deppler and Duncan M. Ripley, "The World Trade Model." The model was solved repeatedly for the increase in the net volume of nonagricultural exports of one industrial country that is implied by a 1 percent increase in activity in a second country, and assuming no change in activity levels in other partner countries. These solutions were then used to construct relative weights for the activity levels in the trading partners of the first country.

[13]For a description of factor analysis see M.G. Kendall, "Factor Analysis as a Statistical Technique," *Journal of the Royal Statistical Association*, Series B., Vol. XII, 1950, pp. 60-73 and T.W. Anderson, "The Use of Factor Analysis in the Statistical Analysis of Multipler Times Series," *Psychometrica*, Vol. 28, No. 1, 1963, pp. 1-25.

To correct for these additional influences, reduced form equations are estimated relating changes in output gaps to: changes in fiscal and monetary stances; changes in common external shocks; and changes in activity levels abroad. The equations are estimated on semiannual data over the period 1963-1977 and the coefficient on the foreign impulse variable is tested for stability. The estimated coefficients for fiscal and monetary stances and common shocks are then used to adjust the actual series for these exogenous influences. The degree of covariation among these "whitened" series is again analyzed for further evidence on the strength of the transmission of fluctuations in real economic activity.

IV. Measures of the Synchronization of Cyclical Fluctuations

For purposes of comparing the dispersion of cyclical movements over time, an index of partner-country activity levels is created for each of the industrial countries based on the importance of the partner countries for the activity level of the country under consideration. These indices are presented visually in Charts 1-4. Correlation coefficients comparing the movements of these series for six time periods covering the fixed- and flexible-rate period are presented in Table 1.

The charts suggest an extremely high level of covariation between own activity levels and partner-country activity levels for Canada and the Netherlands for the full period, with a high level of dispersion for the United States, Japan, and Italy. The degree of dispersion has clearly varied over time for a number of countries, and certain extreme observations, for example, the precipitous declines in activity levels in 1974 in many countries, or even the strikes in 1968 in France, dominate statistical measures of covariation for particular time periods. These charts help indicate these extreme observations. The correlation measures are useful, nonetheless, as they summarize the data and facilitate comparisons across countries and time periods.

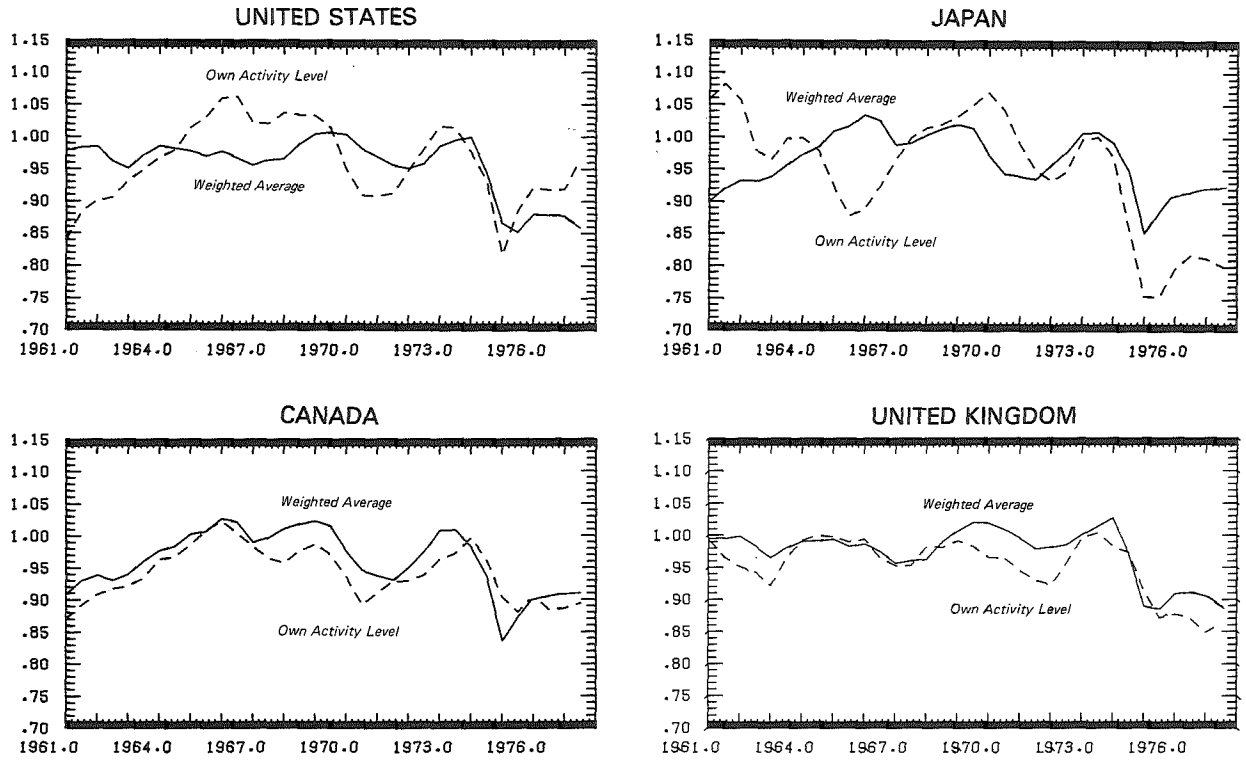
The correlation coefficients between activity levels at home and abroad are presented in Table 1. The high degree of common movement suggested by the charts for Canada and the Netherlands is borne out by the correlation statistics; a high degree of synchronization is also found for Belgium. This seems to reflect the strong Canadian economic linkages with the United States, the strong linkages between Germany, the Netherlands, and Belgium, and the openness of the last two countries. Of the European countries in the sample, only the Nordic countries and Italy do not show an increase in the degree of covariation between 1961-1965 and 1966-1970. For Japan, Norway and Italy there is little synchronization of changes in activity levels with changes in levels in partner countries during the sixties.[14] This outturn probably reflects the relatively small size of the external sector in Japan, the stop-go nature of government growth policies following during the sixties,[15] and the remarkable stability of Norwegian manufacturing activity.

[14]These results are similar to those reported in Duncan Ripley, "Cyclical Fluctuations."

[15]Japanese growth during the sixties was frequently very rapid and resulted in severe balance-of-payments difficulties, restrictive government policies, and very sharp downturns following rapid growth.

CHART 1

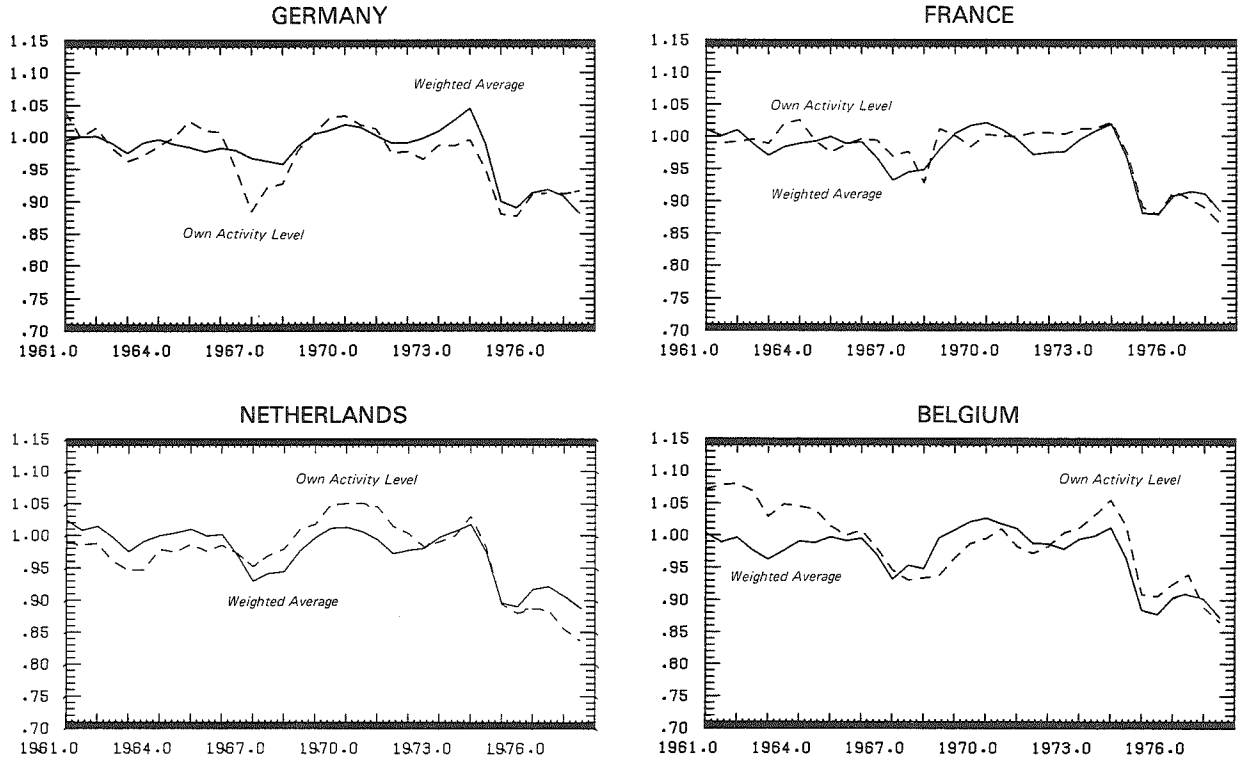
CYCLICAL FLUCTUATIONS IN INDUSTRIAL COUNTRIES, 1961-77*



* Countries' cyclical positions are measured as the ratio of actual to potential output in the manufacturing sector.

CHART 2

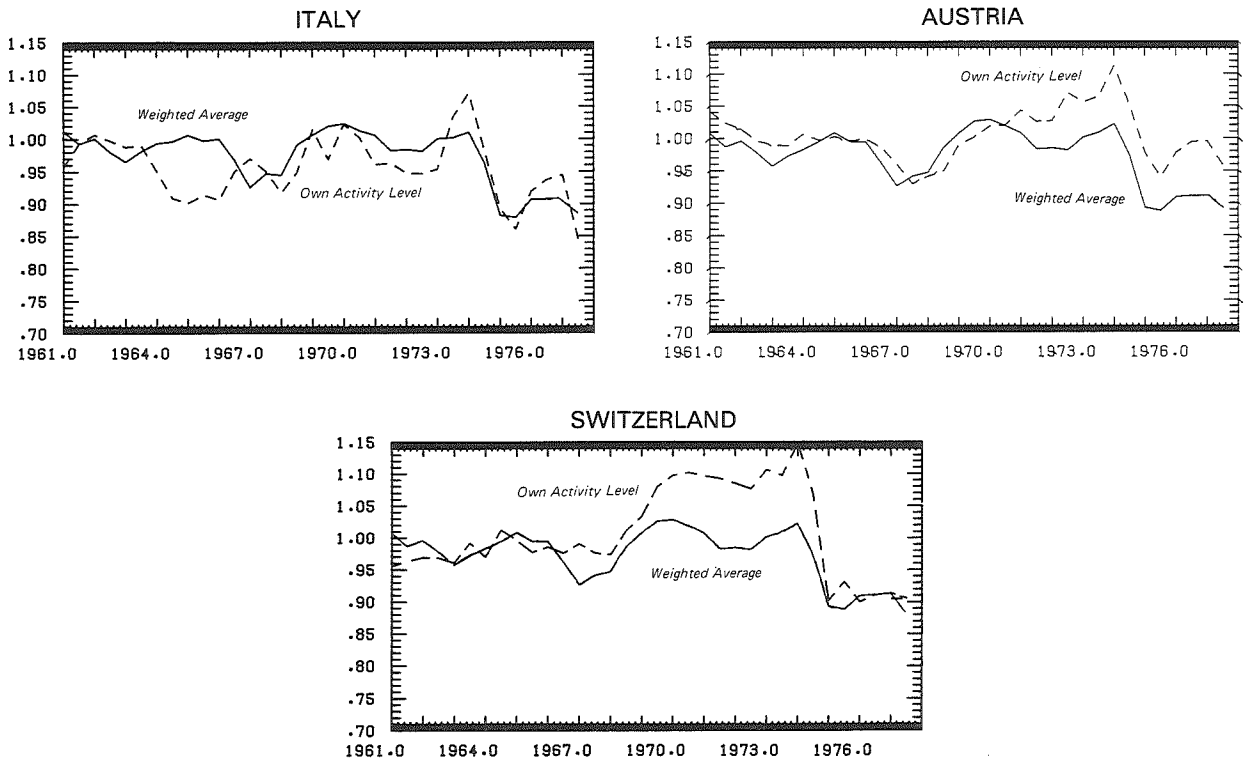
CYCLICAL FLUCTUATIONS IN INDUSTRIAL COUNTRIES, 1961-77*



* Countries' cyclical positions are measured as the ratio of actual to potential output in the manufacturing sector.

CHART 3

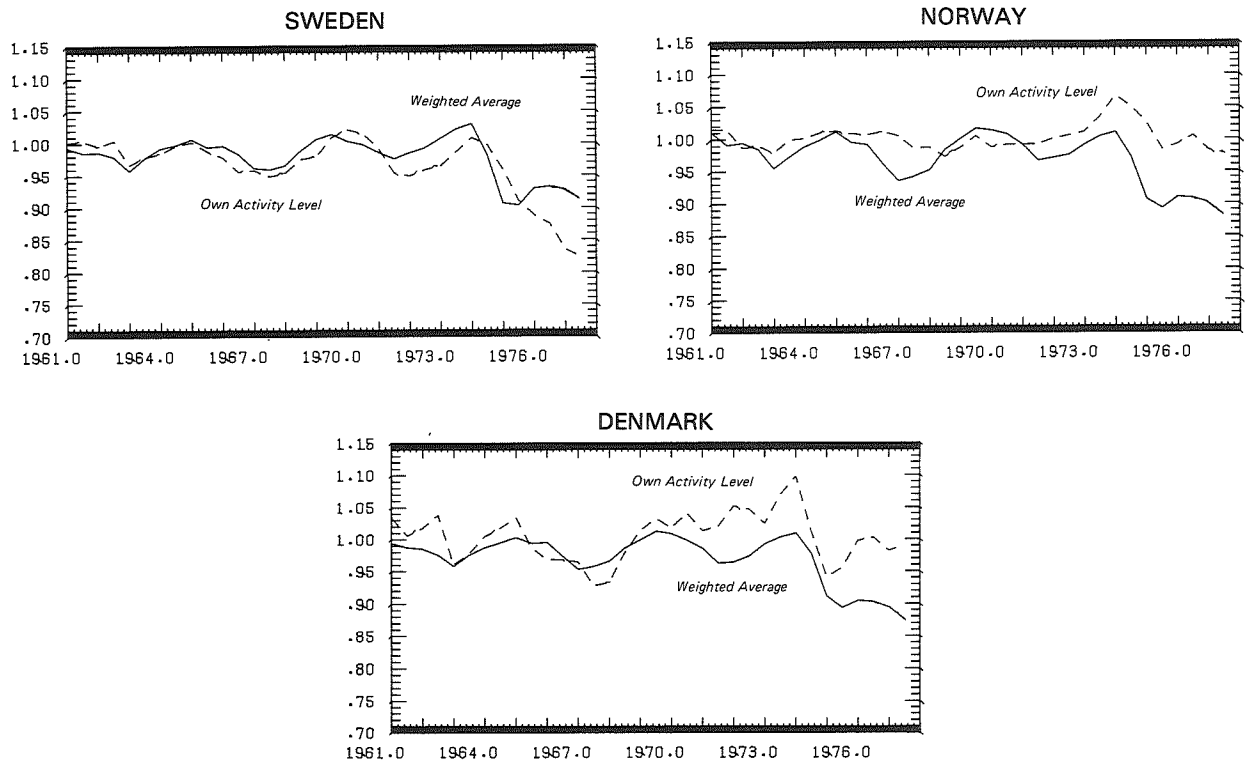
CYCLICAL FLUCTUATIONS IN INDUSTRIAL COUNTRIES, 1961-77*



* Countries' cyclical positions are measured as the ratio of actual to potential output in the manufacturing sector.

CHART 4

CYCLICAL FLUCTUATIONS IN INDUSTRIAL COUNTRIES, 1961-77*



* Countries' cyclical positions are measured as the ratio of actual to potential output in the manufacturing sector.

Table 1

Measures of Synchronization of Cyclical Fluctuations in Industrial Countries and Their Trading Partners

	Correlation Coefficient[1]					
	1961-1965	1966-1970	1968-1972	1973-1977	1975-1977	1961-1977
Austria	.14	.33	.10	.81	.95	.54
Belgium	.15	.79	.39	.79	.85	.70
Canada	.45	.83	.71	.66	.64	.66
Denmark	.76	.41	.50	.72	.88	.61
France	–.07	.41	.37	.89	.87	.44
Germany	.01	.55	.79	.77	.76	.52
Italy	–.06	–.05	.16	.73	.76	.28
Japan	.33	.25	.33	.82	.88	.45
The Netherlands	.02	.86	.76	.82	.74	.70
Norway	.32	.16	–.13	.35	.29	.28
Sweden	.51	.49	.63	.60	.40	.59
Switzerland	–.13	.61	.73	.63	.45	.54
United Kingdom	.50	.16	.32	.73	.63	.59
United States	.00	.56	.20	.59	.61	.46

[1]Correlation between the percentage change in the output gap in manufacturing in a country and a weighted average of percentage changes in output gaps in 13 partner countries. The estimates are based on semiannual data.

For all but five countries there is an increase in the observed level of covariation between changes in activity levels in 1966-1970 and 1973-1977. For Belgium, the Netherlands, the United States, and Switzerland, there is little change in the level of covariation between periods, while for Canada it declines. When the period is shortened to 1975-1977, a similar pattern of relatively high covariation emerges. Although the brevity of this period limits the significance of these results, they are consistent with the view that the system of greater exchange flexibility — even abstracting to some extent from the direct effects of the oil shock — has contributed little towards insulating countries' activity levels.

V. Factor Analysis Applied to Countries' Cyclical Positions

Factor analysis estimates the extent to which the movement in one country's cyclical position is unique to that country, and the extent to which it is shared among all the countries in the sample. It then concentrates on isolating a small number of statistical constructs, factors, that explain the movement that is shared among the countries. The interpretation of individual factors is necessarily subjective, but is suggested by the movement of the factor over time, and by the countries for which a common factor provides substantial explanatory power. Cyclical movements are measured as changes in the ratio of actual to potential output in manufacturing, and the explanation of cyclical movements in each country is given equal importance.[16]

Factor analysis is performed on the series for the following time periods: 1961-1965, 1966-1970, 1968-1972, 1973-1977. Factors are calculated from the data for the 14 industrial countries, and for the group of ten industrial countries for which more reliable estimates of potential output for the manufacturing sector are available. The cumulative percentage of the total movement in the data explained by the first two factors for these four periods is given in Table 2. The factor weights for the first three factors are shown in Table 3.

It seems reasonable to take as an indicator of the synchronization of cyclical movements among countries the extent to which this movement can be captured by the first one or two factors. Table 2 indicates that the generalized variance explained by the first and second factors is remarkably stable from the early sixties to the early seventies with the movement of these factors explaining, on average, one-half of the generalized variance. It increases very sharply during the period 1973-1977, and the role of the first factor becomes much more dominant. These findings are similar to those discussed earlier.

These results for the sixties contrast somewhat with results found in an earlier study on the covariation of cyclical positions among 12 industrial

[16]In other words, factor analysis is performed on the matrix of correlation coefficients rather than on the variance-covariance matrix; thus the explanatory power of the first factor depends on the percentage of the cyclical movement in country one that it captures, regardless of whether country one shows wide or narrow swings in its cyclical position. If the variance-covariance matrix formed the basis of the analysis, the explanatory power of the first factor would be judged not only on the percentage of the cyclical movement in country one that it captures, but also on the variability of country one's position relative to the variability of the positions in the other countries in the sample.

countries in that the earlier study found some slight increase in the level of covariation between the periods 1958-1963 and 1964-1970;[17] the sharp increase in the level of covariation experienced during the mid-seventies is again observed.

The explanatory power of the common "movement," as represented by the first two factors, remains remarkably high and stable for the Netherlands and Sweden, and to a lesser extent, Belgium and Switzerland, over the observation period; for the United Kingdom and Austria the explanatory power of the two factors tends to decrease over time, but for Austria this outturn reflects largely the very high explanatory power of these factors in the first period. France, Italy, Japan, and Norway are characterized by a substantial degree of country specific movement before the early 1970s.

To the extent that there is an important world cycle, or an indistinguishable alternative in this context, a common exogenous shock, the country weights for the first factor should have the same sign, and be highly significant for all of the countries. Table 3 indicates that this is true only for the period 1973-1977; this first factor is very important for all the industrial countries, and can be identified to a large extent with the direct effects of the oil shock which influenced these countries simultaneously. It is of somewhat lesser importance for the United States, the United Kingdom, and Sweden. The downturn in the Scandinavian countries extended beyond that in most of the industrial countries, whereas the U.S. downturn came to an end much more abruptly. Thus, the second factor indicating a more rapid pickup (or downturn, depending on sign) is also important for the United States (to a lesser extent Japan and Germany) indicating some "pickup," and Sweden and Norway indicating a further "downturn."[18]

The factor weights for 1966-70, and 1968-1972 also indicate synchronized movements in many of the European countries; movements in Italy, France, and Norway do not share in the pattern of movement common to most of the European countries. This "European" movement has little relationship to the cyclical movements in the United States and the United Kingdom. For the period 1966-1970 the second factor reflects a pattern of movement that characterizes developments in the United States, and, to a lesser extent, Canada and the United Kingdom.

The first factor for the period 1961-1965 again represents a "European" cycle that is particularly important for the Nordic countries and the United Kingdom. The second factor also relates to movements in European countries indicating that the common pattern of movement in the Netherlands and Aus-

[17]In this study the explanatory power of the first two factors increased from 75 to 80 percent between these two periods. However, quarterly data on the ratio of actual to trend industrial production were used rather than semiannual data on changes in utilization ratios.

[18]Donald S. Kemp, "Economic Activity in Ten Major Industrial Countries: Late 1973 through Mid-1976," *St. Louis Review,* October 1976, and Charles Pigott, Richard Sweeney, and Thomas D. Willett, "Aggregate Economic Fluctuations and the Synchronization of Economic Activity among Industrial Countries," *Rivista Internationale di Scienze Economiche e Commerciali,* Anno XXV, 1975, N. 5, also found a sharp increase in the degree of covariation for the seventies.

Table 2.

Measures of Covariation between Cyclical Positions in Industrial Countries, 1961-1977

	14 Industrial Countries				10 Industrial Countries			
	1961-1965	1966-1970	1968-1972	1973-1977	1961-1965	1966-1970	1968-1972	1973-1977
Percent of generalized variance explained by								
First factor:	32	35	34	68	31	36	38	69
First and second factors:	50	50	52	80	51	52	55	80
Percent of variance explained by the first two factors for								
Austria	91	60	33	78	—	—	—	—
Belgium	56	73	66	87	59	59	59	87
Canada	40	48	07	75	47	63	19	77
Denmark	68	52	26	71	—	—	—	—
France	05	11	42	94	32	14	25	94
Germany	51	71	77	98	59	87	68	98
Italy	21	13	17	67	67	07	14	62
Japan	12	25	77	87	45	23	84	90
The Netherlands	88	75	75	96	54	90	71	95
Norway	45	09	34	93	—	—	—	—
Sweden	76	66	86	80	44	52	88	68
Switzerland	58	78	82	73	—	—	—	—
United Kingdom	75	47	59	40	68	41	62	48
United States	13	71	48	83	31	81	64	80

Table 3

Factor Weights from Semiannual Changes in Output Gaps in Manufacturing

	Factor 1	Factor 2	Factor 3	Commu-nality*	Factor 1	Factor 2	Factor 3	Commu-nality*	Factor 1	Factor 2	Factor 3	Commu-nality*	Factor 1	Factor 2	Factor 3	Commu-nality*
	1961-1965				1966-1970				1968-1972				1973-1977			
14 Countries:																
Austria	-.65	.70	.08	.92	.76	.17	.34	.72	.33	-.47	.03	.33	.86	.21	.36	.91
Belgium	-.57	-.49	-.50	.81	.85	.06	.34	.84	.67	-.46	-.23	.72	.93	.05	-.02	.87
Canada	-.43	.46	-.53	.68	.49	-.49	.29	.56	-.23	-.14	.85	.79	.87	-.02	-.15	.78
Denmark	-.80	-.19	.21	.72	.66	.29	.15	.54	.51	-.01	.33	.37	.84	-.08	.29	.79
France	-.19	-.11	-.53	.32	.29	.16	-.68	.58	.25	.60	.43	.60	.96	-.12	.09	.95
Germany	-.65	.30	.34	.63	.79	-.30	-.38	.86	.87	.13	.37	.90	.95	-.26	-.05	.98
Italy	.44	-.12	-.68	.68	-.09	.35	-.24	.19	.36	.21	.17	.20	.79	.22	.41	.84
Japan	-.33	-.11	-.60	.48	-.47	-.16	-.27	.32	.81	-.34	-.13	.78	.85	-.38	-.01	.87
The Netherlands	-.71	.61	-.20	.92	.82	-.29	-.31	.85	.84	.22	.01	.75	.98	.10	-.01	.96
Norway	-.55	-.39	.02	.45	.30	.04	.67	.54	.00	-.59	-.09	.35	.70	.66	-.04	.93
Sweden	-.76	-.43	.02	.76	.73	.35	-.16	.69	.92	-.14	-.10	.87	.55	.71	-.35	.92
Switzerland	-.22	-.73	.06	.59	.73	.49	-.15	.80	.83	.37	.02	.82	.82	-.21	-.06	.73
United Kingdom	-.86	-.10	.06	.76	.43	-.54	.29	.56	.21	-.74	.06	.59	.64	.03	-.56	.72
United States	.21	.29	-.53	.41	.16	-.83	.05	.71	-.26	-.64	.59	.83	.64	-.65	-.20	.87
Percent of Generalized Variance Explained by Factor																
	32	18	15		35	15	12		34	18	12		68	12	07	
10 Countries:																
Belgium	.67	.38	-.41	.76	.71	.30	.26	.66	-.69	.33	-.31	.68	.92	.15	.08	.88
Canada	.56	.39	.32	.57	.56	-.56	-.40	.79	.31	.31	.79	.81	.88	.05	-.15	.79
France	.31	.47	-.42	.49	.31	.21	-.65	.56	-.16	-.47	.50	.50	.97	-.05	.17	.97
Germany	.58	-.51	.28	.67	.93	.10	-.16	.90	-.81	-.14	.49	.92	.97	-.21	-.01	.98
Italy	-.26	.78	-.05	.68	-.26	.07	-.57	.39	-.33	-.19	.18	.18	.74	.25	.45	.82
Japan	.47	.48	.05	.46	-.38	-.30	-.27	.31	-.87	.31	-.10	.85	.88	-.35	.06	.90
The Netherlands	.74	-.03	.56	.86	.94	.09	-.08	.91	-.80	-.28	.17	.74	.95	.20	.07	.95
Sweden	.65	-.13	-.24	.50	.57	.44	-.05	.52	-.94	.07	-.00	.88	.50	.66	-.23	.74
United Kingdom	.78	-.25	-.23	.73	.54	-.34	.43	.60	-.28	.74	-.06	.62	.69	.08	-.49	.72
United States	-.09	.55	.56	.63	.36	-.83	.02	.82	.26	.75	.43	.82	.69	-.57	-.15	.82
Percent of Generalized Variance Explained by Factor																
	31	20	13		36	16	12		38	17	15		69	10	06	

*This figure indicates the proportion of the variance of the series explained by the factors whose weights are listed.

tria is negatively correlated with the pattern of movement characterizing Swiss activity levels. Movements in French and Italian activity levels are not explained by either of the first two factors.

These factor-analysis results relate only to the observed degree of synchronization in activity levels across countries. They suggest a number of cycles rather than a world cycle characterizing movement in all industrial countries. They suggest similarities in movement between Germany and a number of its European trading partners, and the United States and Canada, although the patterns of similarity in movement have not remained stable. The exceptional outturn is the large first factor for 1973-1977 with important and similar implications for all industrial countries; this factor can clearly be identified with the oil shock. The absence of similar factors for earlier periods suggests either the relatively small role played by such shocks in synchronizing cyclical movements, the ability of countries to offset their influence on real activity, or the limitation of these shocks to small groups of countries.

VI. Application of Reduced-Form Equations to the Explanations of Changes in Countries' Cyclical Positions

The evidence on the transmission process presented above must be viewed as only indirect evidence about the extent to which the transmission process has been affected by the move to flexible rates. As noted above, observed patterns of covariation indicate something about the transmission mechanism — all other things being equal — but other things have not been equal, notably the oil shock affecting all industrial countries, and perhaps even the adoption of fiscal and monetary policies in response to common domestic problems, for example, inflation. An experimental attempt is made here to relate observed changes in countries' activity levels to changes in common shocks, changes in policy stances, and fluctuations in economic activity abroad, and to see whether the impact of the transmission variable has been affected by the move to greater exchange-rate flexibility. The results must be viewed as highly tentative.

An extremely simple reduced-form equation was specified relating changes in a country's cyclical position to changes in activity levels abroad (ΔEI), changes in monetary and fiscal impulses (ΔMI, ΔFI), common external shocks (CS), and dummy variables (Z) reflecting country-specific developments, e.g., strikes. Thus relationships of the following form were specified.[19]

[19]This relationship is a modification of the relationship used by Victor Argy in "The Contribution of Monetary and Fiscal Impulses to Economic Activity," mimeographed, September 1977. He uses a seven equation model of aggregate demand that can be solved to obtain a reduced-form aggregate demand equation. With certain simplifying assumptions, he obtains an estimating relationship of the following form:

$$\dot{Y}_R = \text{fn}(\dot{RB}, \dot{FD}, \dot{FI}, \dot{COMP})$$

where YR is real output; RB represents real balances; FD represents foreign demand; FI represents the fiscal impulse; COMP represents price competitiveness; and the superscript ($\dot{}$) indicates that the variable is expressed in rates of change. No variable was included in the current equation to represent the effects of relative price movements since price effects (in contrast to short-term fluctuations in income) were thought to affect trade flows with a substantial lag. Since the dependent variable used here is the rate of growth of actual manufacturing output above the rate of growth of potential output, each of the explanatory variables was deflated by its "neutral" value.

ΔOutput Gap = fn(ΔMI, ΔFI, ΔEI, CS, Z)

The fiscal impulse, FI, is measured as the difference between the observed budget balance, expenditures minus receipts, and the cyclically neutral budget balance of the central government. It is assumed to be under the control of the central authorities so that changes in the fiscal impulse variable reflect desired changes in fiscal policy. For these calculations the German definition of the neutral balance is used with 1972 as a base year for the calculation of suitable ratios of government expenditure and receipts to GNP.[20] The balance is then deflated by nominal potential GNP. This measure of budget impulse is selected because it is widely used in Fund work, and because it is relatively easy to calculate. This fiscal impulse measure is introduced in level form on the assumption that a sustained expansionary fiscal impulse has a continuing effect on a country's cyclical position. It is also introduced in change form — which is very similar to the Dutch budget impulse measure — reflecting the view that the budget impulse has to increase as a percent of national income from year to year to have an on-going impact on the output gap. The second specification proves superior to the first for all countries other than the United States so that for estimation purposes it is adopted for all countries.

In choosing a measure of monetary stance for inclusion in this relationship it is desirable to select a variable that is under the control of the monetary authorities and clearly indicates the type of monetary policy that the authorities wish to implement. It is difficult to find such variables for the many industrial countries considered here, and the variable selected to represent monetary stance is arrived at by a process of eliminating less desirable alternatives. Further work based on country-specific knowledge of different types of monetary aggregates could substantially improve the representation of monetary stance.

Monetary stance can be represented by real balances, but real balances are not used in the specified relationships because the money supply in many countries was strongly influenced by the transmission process during the historical period. Domestic credit appears to be a more reliable indicator of monetary stance since it is not directly affected by reserve changes, and it is used in calculating the variable representing an exogenous change in monetary stance. The use of this variable is easy to criticize, nonetheless, in that it may have been determined in a number of periods by a reaction function focusing on overall liquidity, and may not be a reliable indicator of monetary policy. Its effectiveness as an indicator is also adversely affected by unanticipated price movements. Monetary policy is represented in the equation by the deviation of the rate of growth of domestic credit from the rate of growth of GNP.[21]

It is very difficult to distinguish between synchronization reflecting com-

[20]The concept and calculation of the cyclically neutral budget balance is explained in Sheetal K. Chand, "Summary Measures of Fiscal Influence," mimeographed, December 27, 1976. The budget figures reflect only the expenditure and receipts of the Federal Government given in *International Financial Statistics*. Data on potential real GNP prior to 1972 were based on the OECD Economic Prospects Division, "The Measurement of Domestic Cyclical Fluctuation," *Occasional Studies*, July 1973; the actual GNP deflator was used to express the real series in nominal terms. More recent figures on the rate of growth of nominal potential GNP are based on Fund Staff estimates. The series on potential GNP are clearly subject to large margins of error.

[21]The figures on domestic credit were taken from *International Financial Statistics*.

mon external shocks which affect activity levels in a similar way in all or a number of industrial countries, even in the absence of transmission, and country-specific fluctuations in activity abroad that induce a sympathetic movement in activity at home. The introduction of current and lagged foreign-impulse variables, with the current value representing "common influences" and the lagged value reflecting the transmission impact, was considered but rejected since the data base is semiannual. While some lag in the transmission process may be expected, the arbitrary imposition of a six-month lag does not seem reasonable and the interpretation of the statistical results would be uncertain at best. Instead, explicit allowance is made for the direct effects of the oil shock by the inclusion of a dummy variable that takes the value 1 for 1974:2 and 1975:1. The first factor for the period 1973-77 clearly attests to the importance of this shock. It is extremely important for all countries, and affects all countries in a similar manner. The factors for other periods, however, are not suggestive of common shocks in that their importance varies widely across countries and they are associated positively with upswings in some countries and downswings in others. Because of these inconclusive factor results, and the difficulty of identifying these shocks, no other "common shock" variable is included in the estimated relationship.

EI is the external impulse variable. It is proxied by the weighted average of output gaps in the other industrial countries described earlier. As noted above, this variable is affected by common shocks. With the inclusion of the oil shock variable it is expected that the coefficient on the foreign demand variable will relate to the transmission process rather than to the strength of common shocks.[22]

It was also necessary to introduce a number of dummy variables, Z, reflecting country-specific developments that are unrelated to changes in policy stances or external impulses. These dummies represent, for example, the French strikes of 1968, and the Italian strikes of 1969.

The relationship given above is estimated using ordinary least squares for 12 of the industrial countries over the periods 1963-1977. It is not estimated for Denmark or Norway because of inadequate data. In a number of instances the data suggest that activity levels respond with a lag to changes in domestic and foreign impulses so lagged values or simple weighted averages of current and preceding-period values are also introduced as explanatory variables. The weighting schemes used are described in the footnotes for Table 4.

Clearly, the measurement errors associated with each explanatory variable are likely to increase the standard error of the parameter estimate and reduce the significance of the coefficients. Also, the importance of excluded variables that are correlated with the explanatory variables may bias the estimated coefficients of the explanatory variables. To the extent that they are independent, they will contribute to the low explanatory power of the equation taken as a whole. One might expect a somewhat weak performance of the monetary impulse variable used here since it constitutes only one part of the money supply, and since it may be manipulated to offset changes in foreign assets.

[22]The coefficient could, to some extent, be affected by reverse causation for the larger industrial countries.

Table 4

Reduced-Form Equations Explaining Changes in Manufacturing Output Gaps

	Austria[1]	Belgium[2]	Canada[3]	France[4]	Germany[5]	Italy[6]	Japan[7]	The Netherlands[8]	Sweden[9]	Switzerland[10]	United Kingdom[11]	United States[12]
Constant	–0.00	–0.00	–0.01	–0.00	–0.01	–0.00	–0.00	–0.00	–0.01	0.00	–0.02	–0.00
	(0.7)	(0.8)	(1.8)	(1.3)	(1.7)	(0.6)	(0.2)	(0.1)	(1.9)	(1.0)	(0.5)	(0.3)
Monetary	0.50	0.39	0.50	0.52	1.00	0.75	0.51	2.29	0.31	0.82	0.36	0.81
Impulse	(1.4)	(1.0)	(2.2)	(1.3)	(2.5)	(2.2)	(2.0)	(1.7)	(1.3)	(1.9)	(2.4)	(1.5)
Fiscal	4.89	0.45	10.9	4.40	0.85	2.37	0.16	0.07	0.75	2.35	0.53	4.84
Impulse	(2.5)	(1.8)	(4.4)	(1.5)	(1.0)	(1.7)	(0.1)	(0.3)	(0.1)	(0.5)	(0.4)	(1.7)
Foreign	0.80	0.70	0.29	0.41	0.70	0.09	0.21	0.78	0.78	0.50	0.68	0.09
Impulse	(4.1)	(3.4)	(2.0)	(2.1)	(2.4)	(0.6)	(1.0)	(5.4)	(3.0)	(1.6)	(2.7)	(0.2)
Oil	–0.007	–0.016	–0.010	–0.019	0.012	–0.036	–0.090	–0.021	0.014	–0.091	0.031	–0.052
	(0.3)	(0.9)	(0.9)	(1.1)	(0.5)	(2.6)	(4.0)	(1.6)	(0.5)	(3.3)	(1.4)	(1.6)
Country	0.026			–0.053		–0.055						
Dummy	(3.3)			(4.4)		(4.4)						
SEE	.017	.019	.012	.015	.020	.018	.028	.013	.017	.023	.017	.027
D.W.	2.19	2.04	2.18	1.92	1.74	1.43	1.09	1.41	.99	2.78	2.13	1.58
$\overline{R}$-squared	.63	.65	.74	.74	.54	.55	.51	.76	.31	.67	.44	.45

[1]For Austria the country dummy took the value +1, –2, and +1 for 1972:2, 1973:1 and 1973:2, respectively, reflecting the temporary effects on the level of output caused by a change in the tax system. The fiscal impulse variable consisted of a lagged average over the current and two preceding periods of the change in the cyclical effect of the budget with weights of .1, .3, and .6.

[2]For Belgium the fiscal variable was the current change in the cyclical effect of the budget.

[3]For Canada the monetary and foreign impulses were simple averages over the current and preceding half years. The fiscal impulse variable was the current value of the change in the cyclical effect of the budget.

[4]For France the fiscal and monetary impulse variables were simple weighted averages over the current and preceding period. The fiscal impulse variable was based on the change in the cyclical effect of the budget.

[5]For Germany the monetary impulse was lagged by one period. The fiscal impulse variable was the change in the cyclical effect of the budget.

[6]For Italy the foreign impulse variable was lagged by one period. The fiscal impulse variable was a weighted average of the current and preceding half-year changes in the cyclical effect of the budget with weights of .4 and .6, respectively. The Italian dummy reflects the effects of strikes in 1969-1970.

[7]For Japan the monetary and foreign impulse variables were lagged one period; the fiscal variable was the change in the cyclical effect of the budget for the current period.

[8]For the Netherlands the monetary impulse variable was lagged one period. The fiscal impulse variable was a simple average over the current and two preceding periods of the change in the cyclical effect of the budget.

[9]For Sweden the monetary and fiscal impulse variables were lagged one period; the fiscal variable was the change in the cyclical effect of the budget.

[10]For Switzerland the monetary impulse variable was lagged one period; the fiscal impulse variable was a simple average over the current and preceding half year of the change in the cyclical effect of the budget.

[11]For the United Kingdom current values were used for both monetary and fiscal impulse variables. The fiscal variable was represented by the change in the cyclical effect of the budget.

[12]For the United States the monetary impulse variable was lagged by one period. The fiscal variable was the current change in the cyclical effect of the budget.

For 5 of the 12 countries the monetary impulse variable is significant at a 99 percent confidence level; at an 80 percent confidence level the coefficient is insignificant only for Belgium. The fiscal impulse variable is highly significant for only 2 of the 12 countries and significant at an 80 percent confidence level for only six countries. This may reflect, in part, the particularly large scope for error in the measurement of the cyclically neutral budget. The foreign impulse variable is introduced with a lag for Canada, Japan, and Italy. It plays a relatively small role in explaining movements in activity in Italy, Japan, and the United States. All of the relationships given in Table 4 must be viewed as subject to large margins of error, and further work is clearly called for.

The implications of these relationships for the transmission process are explored in several ways. Shift dummies are included for the period after 1972 to test for the stability of the coefficients on the foreign-impulse variable after the move to greater exchange-rate flexibility.[23] For 3 of the 12 countries the coefficient on foreign activity increases significantly with the move to managed flexibility. These countries are Belgium, France, and Austria. In as far as this coefficient relates to the transmission process, and not to the strength of common shocks, it suggests a strengthening of this process after 1972.

A second approach is used to explore the development of the transmission process since 1972. It is hypothesized that the foreign-impulse variable does not fully represent the impact of fluctuations in activity abroad and that much of the unexplained movement in the series is attributable to the transmission process. The inclusion of the foreign-demand variable is necessary, nonetheless, to obtain unbiased coefficients for the other exogenous variables. Thus the estimated coefficients for fiscal and monetary impulses and the common shock are used to adjust observed changes in activity levels for the ten larger industrial countries for changes that can be attributed to deviations in fiscal and monetary policy stances from "neutrality," and for the common oil shock.[24]/[25] The "adjusted" series on changes in economic activity are then analyzed by means of factor analysis to see whether the pattern of covariation has changed significantly. The results are given in Table 5.

The adjusted series show a somewhat higher degree of covariation than the unadjusted series for the period prior to 1972, as indicated by the explanatory power of the first and second factors in Table 5, and a lower degree of covariation thereafter. This suggests that the domestic policy stances during the earlier period contributed to a reduction in the observed synchronization of cyclical movements. The degree of synchronization of the adjusted series for the period 1973-1977 fell relative to the unadjusted series.

[23]A shift dummy on the monetary impulse variable after 1972 proved uniformly insignificant.

[24]The impulse measures were defined as deviations from neutrality, that is, deviations of fiscal stance from the cyclically neutral budget using 1972 as a base period and deviations of the rate of growth of real domestic credit from the rate of growth of potential GNP. Thus, the correction was based on setting the "impulse measures" to zero. Although estimated relationships were available for Austria and Switzerland, adjusted series were not calculated for these countries since it was desirable to compare the factor analysis results before and after adjustment for the same group of countries.

[25]Argy, "Monetary and Fiscal Impulses," made similar adjustments for purposes of testing whether monetary and fiscal policy had been stabilizing.

Table 5

Measures of Covariation between Cyclical Positions in Industrial Countries Adjusted for Differences in Policy Stances and the Initial Impact of the Oil Shock, 1966-1977

	1966-1970	1968-1972	1973-1977
Percent of generalized variance explained by			
First factor:	36	40	52
First and second factors:	57	64	67
Percent of variance explained by the first two factors for			
Belgium	89	63	71
Canada	3	49	82
France	75	79	65
Germany	62	70	79
Italy	66	59	71
Japan	40	67	69
The Netherlands	62	74	78
Sweden	68	83	78
United Kingdom	42	19	44
United States	63	77	32

When compared over time, the degree of synchronization of the adjusted series tends to rise gradually. These results are consistent with the view that there has been a strengthening of the transmission process over the last five years. They are also consistent with the view that common exogenous shocks other than the oil shock have become increasingly important, although the first factor obtained from the adjusted data does not support this interpretation.[26]

VII. Summary and Conclusion

Various techniques have been used to analyze the observed degree of synchronization of cyclical fluctuations among industrial countries, and to determine whether the move to greater exchange-rate flexibility has resulted in a weakening of the transmission of real impulses among countries. The observed degree of synchronization increased between the late 1960s and the period of managed floating. When the period immediately following the oil shock was excluded from the managed-rate period, the observed degree of covariation between changes in activity levels remained high.

The pattern of covariation provides only indirect evidence on the

[26]The conclusions suggested here contrast somewhat with those drawn in Pigott, Sweeney, and Willett, "Aggregate Economic Fluctuations," which attributes a large amount of the recently observed covariation to external shocks.

strength of the transmission process since activity levels reflect, among other things, the impacts of policy stances and common exogenous disturbances. An attempt was made to directly estimate the impact of country specific fluctuations in foreign activity levels to see whether this impact had changed with the move to greater flexibility. Further observed activity levels were adjusted for changes in policy stances and even for the direct impact of the oil shock. The adjusted series were analyzed for information on the transmission process. Although all of these results must be viewed with caution because of the scope for error in the calculations and their interpretation, they indicate that the increase in the observed degree of covariation among countries since 1972 cannot be attributed exclusively to a convergence of policy stances or the oil shock. They suggest a continuing or heightened importance of the transmission process under a system of greater exchange-rate flexibility, and underscore the need for coordinated demand management policies in returning to more normal activity levels.

Discussion

Robert E. Baldwin*

It is a pleasure to have the opportunity to comment upon the very interesting and ambitious paper by Duncan Ripley. In her careful study of changes in the degree of synchronization of cyclical movements in real economic activity between 1952-1974 she pointed out most of the possible sensitive parts of the analysis so I can do little more than reemphasize some of these.

The first issue that arises is what difference one would expect a system of flexible versus fixed exchange rates to make in the degree to which real changes in economic activity are transmitted abroad. There are, of course, an almost bewildering set of models to analyze, each with differences in assumptions concerning such factors as the responsiveness of the trade account to real income and relative price changes; the responsiveness of capital flows to changes in interest rates and exchange rates; the flexibility of prices and wages; the nature of expectations about future changes in prices and exchange rates; the nature of various adjustment lags; and the time period under consideration. It might be useful to expand somewhat the second section of the paper by presenting a taxonomy of the different possibilities that emerge from a spectrum of models, such as those surveyed by Rudy Dornbusch in his paper. In her own survey, Ripley does, however, touch on most of the reasonable possibilities. Out of this, the conclusion seems to emerge that the transmission of real economic activity from one country to another under flexible rates runs the range of possibilities from being quite similar to that under fixed rates to being weaker than under this latter system and even to being stronger and more magnified. Thus, the traditional notion that, in the intermediate run, flexible rates tend to weaken the propagation of real disturbances is not something we can be very confident about, given the apparently long lags in the responsiveness of the trade account to relative price changes coupled with the high responsiveness of foreign direct investment to exchange-rate changes.

The system that we have had and that Duncan is investigating is, of course, not a pure flexible-rate versus pure fixed-rate system but a managed float system versus one with a fixed rate that has been subject to occasional adjustments. This tends to blur the distinctions one might expect on theoretical grounds.

We should not forget that it is not the type of exchange-rate system we have that by itself determines the nature of real adjustments but also the

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nature of politically feasible real adjustments that determine the nature of the exchange-rate system. It is not an accident that governments intervene in exchange-rate markets now nor an accident that we did not stick entirely with fixed rates in the so-called fixed-rate period. For example, one now sees the same political pressures in export surplus nations against allowing the extent of appreciation indicated by free market forces that we did in the fixed exchange-rate period. In other words, only a fairly small range of adjustments is politically tolerable in any time period so that the operation of a fixed versus flexible system becomes rather similar as far as their real transmission effects are concerned.

With regard to political pressures exerted on exchange-rate policies, it has always seemed rather puzzling that export interests rather than import-competing industries seem more important both in depreciations and appreciations of countries' currencies in response to periods of trade deficits and trade surpluses. On the other hand, in the field of trade policy, the import-competing industries dominate export industries when it comes to exerting political pressures. It is not clear to me just why this is so.

A second issue concerns how to relate the cyclical activity of one country to that of others. In this regard Duncan relates the ratio of a country's actual-to-potential output to a weighted average of this ratio for its trading partners. As weights for constructing an average of trading partner activity, she uses the effect on the exports of the country under consideration of a 1 percent change in economic activity in each trading partner. In other words, the weights relate to how changes in activity abroad affect the country being considered. I wonder about the relationship in the other direction, namely, the effect of the country under consideration on the other countries. I would think that some sort of average of the trade effects of changes in economic activity in both directions would be more appropriate as weights than just the effect in one direction. The effect of changes in economic activity in one country on economic activity in another is also transmitted through other mechanisms besides income effects in trade, i.e., substitution effects related to relative price changes and effects due to changes in capital flows. By using only the income effects of trade as weights one might be missing some of the transmission effects. A country-by-country comparison would seem to avoid some of these problems.

As she has reported, the results of her initial correlation and factor analyses are that the transmission of economic activity among countries seems just as high — indeed even higher — after flexible rates were introduced as during the fixed-rate period. But, as she notes, one cannot conclude from this that the transmission mechanism is as strong under flexible as fixed rates. Some factor in the later period may simply have been common to all countries and thus made them all move together without having anything to do with the transmission mechanism. Similarly, various domestic policies may have happened to be synchronized and thus to produce a more uniform movement.

To examine this possibility, Duncan runs regressions for each country that make the change in a nation's output gap a function of changes in mone-

tary policy, changes in fiscal policy, changes in external impulses, the oil shock, and a number of dummy variables. Her external variable is still significant in most cases, but, as she again says, one cannot be sure that this does not just represent some common cause affecting all countries' output. The direction of causality between a country's output gap and the gap in other countries also is not clear.

Duncan then takes the coefficients on the monetary and fiscal variables as well as on the oil shock to adjust the observed changes in activities. Hoping to have corrected for factors that did not stay constant over the period, she again performs her factor analysis and finds the degree of synchronization does not decline in the flexible-rate period but actually rises. This time there is a more uniform upward trend throughout the period, however. This is consistent with a point she makes earlier, namely, the gradual increase in the openness of economies during the period.

In conclusion I found the paper most interesting and stimulating. The problem she is dealing with is a formidable one on both theoretical and econometric grounds and she has shown considerable imagination and ingenuity in handling it. I think we can conclude that the data do not support the old notion that the degree of synchronization of real activity under flexible rates is less than under fixed rates.