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INTERNATIONAL INTEREST RATE RELATIONSHIPS: POLICY CHOICES AND CONSTRAINTS

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Introduction

In many industrial countries the domestic impact of interest rate developments abroad has become an increasingly sensitive question. Outside the United States the issue has centred on the possible influence of high or rising interest rates on a still fragile economic recovery. When inflation expectations are unknown interest rate levels are, of course, difficult to interpret, and partly for this reason interest rates have come to play a smaller rôle as explicit objectives of monetary policy. In some – though not all – countries nominal interest rates are nevertheless felt to be uncomfortably high in relation to rates of inflation. Moreover, while there are clearly domestic imbalances which may be contributing to unwelcome interest rate developments, it is evident that in recent years some countries have become more exposed to developments in financial markets abroad. The present paper considers how interest rates in different currencies might be related in different policy environments and examines some of the relationships that have actually been observed.

A glance at Graph 1 reveals that relationships among movements in nominal interest rates in different markets have undergone a

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change in recent years. Since the move to floating exchange rates in early 1973 interest rates in the industrial countries have gone through at least two major cycles, each associated with strong surges of inflation. After 1979 short-term interest rates typically became more volatile on average than in the 1973–78 period, and their development in different markets diverged at least as much as before. Yet since 1979 long-term rates in different countries, though at different levels, seem to have moved more closely in step. The change can be seen not only in the case of rates in the European countries whose currencies are linked in the European Monetary System, but also in that of countries (including Germany and the United States) whose currencies have been floating in relation to one another. This synchronisation is the more noticeable given the increased variability in yields in the United States.

The new pattern of interest rate behaviour is probably mainly a reflection of various changes in the policy environment which took place in the late 1970s, including:

(i) the removal of exchange controls and other restraints on international capital movements in individual countries, by domestic financial deregulation and by the growth of the international financial markets;

(ii) the establishment in early 1979 of the European Monetary System and, in a wider range of countries, an increase in the rôle played by exchange rate stabilisation objectives in the conduct of monetary policy;

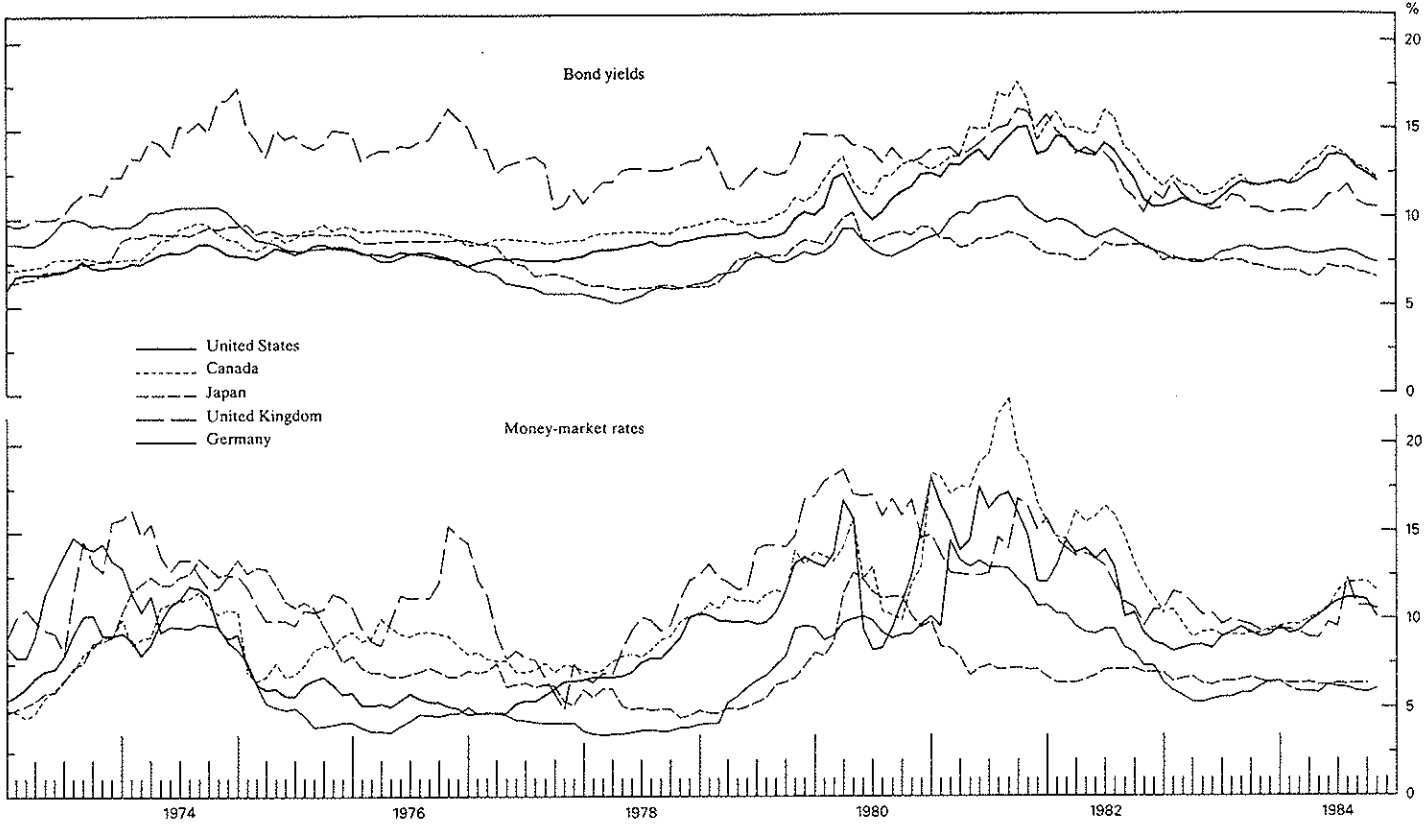
(iii) the synchronised recourse in most of the major industrialised countries to monetary restraint policies in an effort to contain inflation following the second oil price shock; and

(iv) the introduction in October 1979 of new US monetary control procedures and the changes in interest rate behaviour which followed, given the overall policy mix and the way the economy responded.

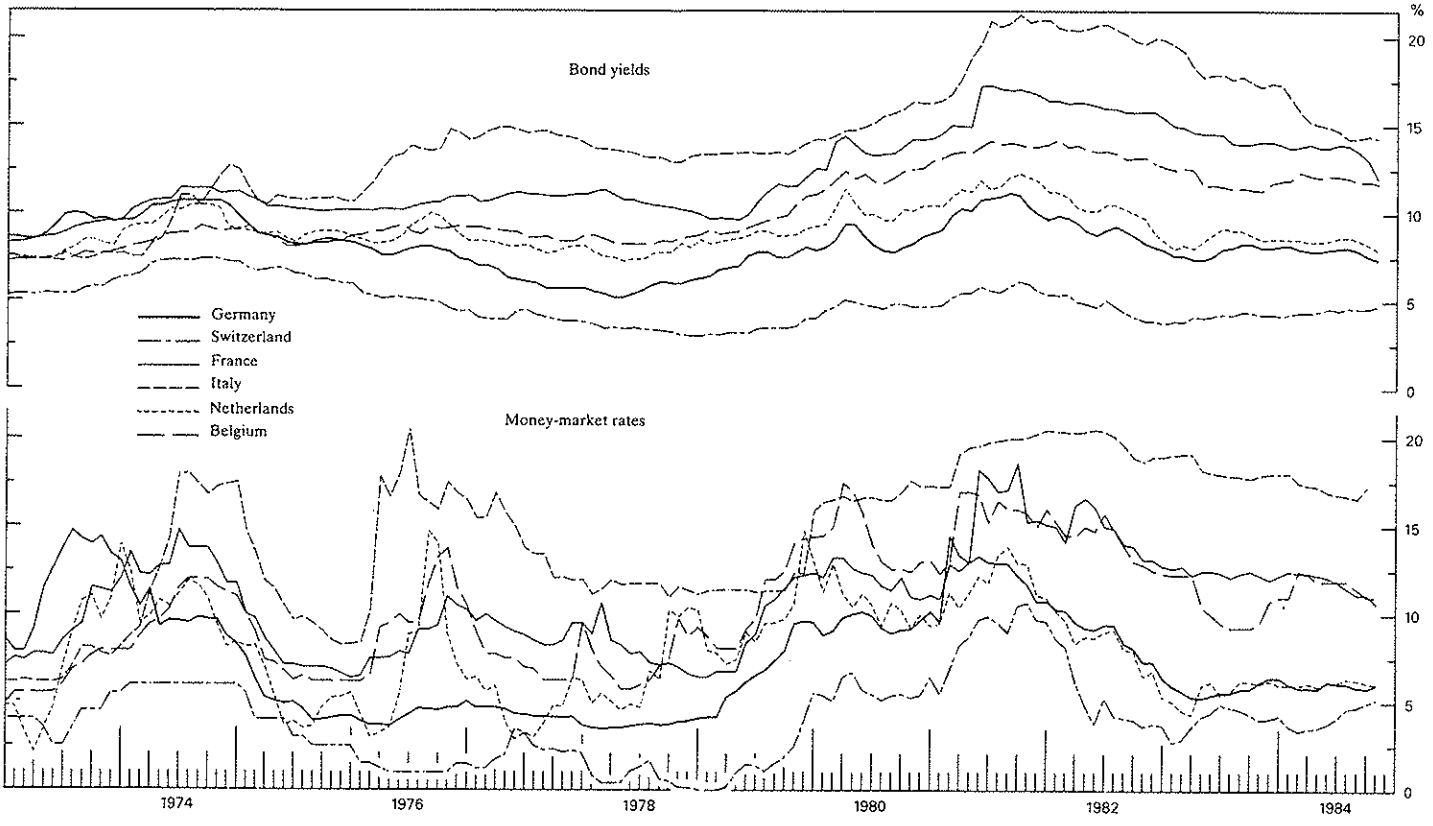
The influence of this last change on interest rate developments elsewhere was not simple and direct but was conditioned by a number of other factors.

Graph 1

International interest rate relationships



Graph 1 (continued)



In the most general terms cross-country interest rate relationships are likely to depend mainly on how closely the financial markets are integrated, on exchange rate expectations and on whether financial assets denominated in different currencies are regarded as close substitutes by borrowers and lenders (after allowing for the impact on returns of expected exchange rate changes). This paper presents some empirical indications of the changing rôle of barriers to international capital movements and discusses the influence of asset substitutability and exchange rate expectations in a more impressionistic way.

It has long been recognised that the ability of countries other than the reserve centre to pursue independent money stock objectives depends ultimately on the freedom of exchange rates to move. At times, however, disturbing exchange rate developments have clearly complicated the execution of policy strategies based on targets for the money stock. There is also ample evidence that in cases where exchange rate objectives have been pursued it has been necessary at times to accept unwelcome movements in short-term interest rates. In the real-world context of money stock objectives and managed floating or of adjustable exchange rate pegs, an investigation of relationships among short-term interest rates and exchange rates should give some indication of the choices countries have actually faced and of the ways in which they have responded to them. It is also of interest to consider how the experience of the EMS has influenced the linkages between interest rates in European countries and the relationship between interest rates in these countries and those in the United States.

Long-term interest rates no doubt depend more on inflation expectations and savings investment relationships, as conditioned by fiscal and other policies. The uncertainty surrounding future developments might lead one to expect a priori that influences from abroad on domestic long-term yields could be relatively limited. Yet if financial markets were becoming more closely integrated internationally and domestic regulatory influences were declining, yields in many countries might increasingly come to incorporate

expectations influenced by developments in major capital markets abroad, even when exchange rates were free to float. Evidence on longer-term interest rate relationships should indicate how important this latter effect has been in practice.

Relationships between yields in different currencies must be conditioned basically by longer-term exchange rate expectations and portfolio preferences. Both of these factors are subject to change over time and it would not be surprising to find yields in different countries at times moving closely together and at others behaving quite independently. Exchange rate expectations may depend not only on anticipated inflation differentials but also on changes in the pattern of exchange rate relationships which market participants think will ultimately take place – as a result, for instance, of a need to correct past deviations from purchasing power parity and/or to restore more balance in external current-account positions. To illustrate how cross-country bond yield relationships might have been conditioned by these factors, this paper considers ways in which real interest rates and real exchange rates may have interacted.

In support of much of the analysis in this paper, simple partial correlation and regression analysis is employed. Qualified use of the results seems adequate for the purpose in hand, which is not to test for stable underlying relationships but simply to present some stylised facts about recent developments. For some countries the results of such simple tests are far from conclusive but the aim is more to provide some simple international comparison than to explain fully developments in any particular country.

The plan of this paper is as follows: Section I briefly reviews the implications for monetary autonomy and for international interest rate relationships of various types of open economy analysis widely used in recent years. Section II recalls some recent changes in the policy environment which are likely to have affected countries' exposure to interest rate developments abroad und uses links between interest rates in national and international markets to indicate the degree of integration which has taken place. Section III

discusses cross-country relationships among short-term interest rates as indicators of the ways in which central banks seem to have responded to developments in the external financial environment in seeking to meet their own intermediate or final objectives. Section IV seeks to cast some light on the international relationships among nominal longer-term interest rates observed in recent years. Section V discusses the rôle of exchange rate expectations in the international transmission of interest rate disturbances and some implications of this. Some tentative policy conclusions are set out in Section VI.

I
Analytical approaches to international financial linkages and interest rate relationships

The question of how changes in interest rates abroad affect interest rates and other variables of policy concern in the home country has not always been addressed directly. A related question, that of how much financial integration and the exchange rate régime affect countries' scope for pursuing independent monetary policies, has not normally been framed mainly in terms of interest rates. Analysis with implications for international interest rate relationships is to be found scattered throughout the voluminous literature focused primarily on other issues such as the rôle of the Euro-currency markets, the determination of exchange rates or the efficiency of the financial markets. Relevant questions have also had to be posed in the process of developing empirical models of open economies. The following brief impressionistic review of some major analytical results reached over time is designed to bring the threads together and to characterise an evolving framework of ideas expressed in policy-making. The assumptions of the most representative models mentioned below and their implications for international interest rate relationships are summarised in Table 1.

Table 1

International interest rate relationships in different theoretical models*

Model type and major hypotheses	Interest rate relationships
Fixed exchange rates	
– Perfect capital mobility Static exchange rate expectations	– $i_d = i_f$; $r_d = r_f$
– Imperfect capital mobility Static exchange rate expectations	– $i_d = i_f - \delta$; $r_d = r_f - \delta$
– Perfect capital mobility Expected exchange rate adjustment Non-static exchange rate expectations	– $i_d = i_f + E(\dot{e})$ with $r_d \neq r_f$
Flexible exchange rates	
(i) Mundell-Fleming	
Perfect capital mobility Static exchange rate expectations Fixed price levels	$i_d = i_f$; $r_d = r_f$
(ii) Monetarist model cf. Bilson (1978)	
Perfect capital mobility	$i_d = i_f + E(\dot{e})$
Perfect capital substitutability	$E(\dot{e}) = \dot{\pi}_d - \dot{\pi}_f$
Flexible prices	$r_d = r_f$
PPP holds at all times	$i_d \lesseqgtr i_f$ when $\dot{\pi}_d \lesseqgtr \dot{\pi}_f$
Rational exchange rate expectations	

* For a more complete survey see P. Kouri (1983).

d, f reference to domestic/foreign country

i nominal interest rate

r real interest rate ($r = i - \dot{\pi}$)

δ capital control "tax"

$\dot{\pi}$ expected change in the log of the price level

Table 1 (contd.)

Model type and major hypotheses	Interest rate relationships
Flexible exchange rates	
(iii) Overshooting model cf. Dornbusch (1976, 1983), Frankel (1979)	
Perfect capital mobility	Short-run:
Perfect capital substitutability	$i_d = i_f + E(\dot{e})$
	$E(\dot{e}) = \pi_d - \pi_f + \dot{\theta}$
Sticky prices (wages) and no PPP in the short run	$r_d = r_f + \dot{\theta}$: $i_d = r_f + \dot{\theta} + \pi_d(\dot{\theta})$
	$0 < \Delta i_d < \Delta i_f$ when i_f rises
Rational exchange rate expectations	
Import prices influence domestic price level directly	Long-run equilibrium:
	$i_d = i_f + E(\dot{e})$
	$E(\dot{e}) = \pi_d - \pi_f$; $r_d = r_f$
Flexible exchange rates/managed float	
Portfolio-balance models cf. Dornbusch (1983) Tryon (1983)	
Perfect capital mobility	$i_d = i_f + E(\dot{e}) + \rho$
Imperfect capital substitutability	$\Delta i_d < \Delta i_f$ when i_f rises
No PPP in the short run	(Δi_d) Portfolio model < (Δi_d) Overshooting model
Rational exchange rate expectations	
Various hypotheses for portfolio adjustment mechanisms	
Wealth effects from cumulated stocks of net private capital flows and capital gains	

$E(\dot{e})$ expected change in the log of the exchange rate (domestic currency per unit of foreign currency)

$\dot{\theta}$ changes in the log of the real exchange rate ($\dot{\theta} = \dot{e} + \pi_f - \pi_d$)

ρ risk premium (depending inter alia on domestic and foreign holdings of domestic and foreign bonds and money)

PPP purchasing power parity.

Since most models used for analysing international financial linkages between open economies have evolved from familiar closed economy prototypes their strengths and limitations are well known. As changing circumstances shifted the centre of interest from the degree of market integration to the exchange rate régime and then to uncertainty and risk, asset-based approaches to modelling the financial markets largely supplanted flow-oriented ones and efforts were made to take into account forward-looking (including "rational") expectations and the kind of quick reactions to "news" which seemed to be playing a major rôle in asset markets. The expectation-based models have not always proved particularly helpful in explaining and forecasting actual developments, however, which may suggest either that further refinements are necessary or that some of the underlying hypotheses should be viewed with a degree of scepticism.

(a) Fixed exchange rates and financial integration

Some of the flow-oriented models which were dominant in mainstream economic analysis until the 1960s recognised linkages via trade and current-account balances between financial-market developments in different countries. Direct financial linkages were seldom analysed explicitly, however, and a common presumption was that capital flows could be adequately explained by differentials between interest rates (which were themselves determined solely by domestic factors). This may have been satisfactory in a world of segmented financial markets in which most portfolio adjustments were slow and partial. However, exchange controls and other impediments to international capital flows were being progressively dismantled. On balance the empirical evidence on interest rate relationships and on the ability of central banks to sterilise inflows of funds seems to suggest that by the early 1970s, when the Bretton Woods system began to come under strain, financial markets in many centres had become fairly closely integrated and the substitutability of assets denominated in different currencies had increased considerably (Argy and Hodjera (1973), Aliber (1978)).

It is now widely accepted that under an international monetary system based on credible official exchange rate commitments and in the absence of major barriers (or disincentives) to international capital flows interest-bearing assets in different currencies will ultimately come to be regarded as close substitutes. Abstracting from the possible influence, in particular, of differing tax régimes, levels of nominal interest rates in the different countries will tend to converge and these rates will normally move quite closely in step.[1] Their development may, however, diverge sharply at times when market participants can fairly confidently conclude that changes in currency parities (or in regulations affecting capital movements) are imminent. Under fixed exchange rate arrangements the rôle of national interest rate policies, in most participating countries, may be largely confined to one of forestalling incipient exchange-market disturbances.

(b) Flexible exchange rates and monetary policy independence

Two different types of analysis have been viewed as implying that even under conditions of high international mobility of capital a flexible exchange rate system would give countries scope for monetary policy autonomy.

(i) The Mundell (1963) conclusion, that countries could control domestic output by monetary (i.e. money stock) policy only if the exchange rate was allowed to change, seems to have been particularly influential.[2] It was derived from a traditional model of short-run aggregate demand determination incorporating the (then unconventional) assumption of perfect mobility of capital

[1] In principle, in the absence of parity changes, countries' inflation rates should also tend, in the long run, to converge.

[2] Fiscal policy, by contrast, would have most effect on domestic output (and least effect on output abroad – see below) when the exchange rate remained unchanged (with the central bank accepting changes in its external reserves). The unusual assumption that a non-accommodated fiscal expansion could tend, in putting upward pressure on domestic interest rates, to push up the exchange rate seems of considerable interest in present circumstances.

internationally. In fact, with fixed price levels and static exchange rate expectations, domestic nominal interest rates in this model could never diverge from interest rate levels abroad. Moreover, as changes in the home money stock affected domestic output via changes in the trade balance (in response to exchange rate changes) they had opposite effects on output in other countries – effects which could only be ignored if the country initiating the change was very small.

(ii) Perhaps more important was the recognition, formalised in the monetary approach to the balance of payments (e.g. Johnson (1976)), that the absence of official exchange rate commitments could be a precondition for control of the domestic money stock in countries other than the reserve centre. Even this, however, need not imply that "independent" monetary policies will have no effect on output elsewhere. In fact, in countries with open financial markets a system of floating exchange rates would seem to permit fully independent control of the domestic rate of inflation only in monetarist models of the most abstract kind. In some of these, under very restrictive assumptions,[3] exchange rates could be expected to adjust smoothly in a way which preserved purchasing power parity, so that nominal interest rates would tend to differ by an amount just equivalent to both the expected change in the exchange rate and inflation differentials. Such models, which emphasise only monetary policy, may be most relevant for countries with extremely high rates of inflation.

(c) Economic interdependence in a flexible exchange rate system

However, the evidence leaves little doubt as to the significance of deviations of exchange rates from purchasing power parity. That

[3] Perfect substitutability of interest-bearing assets and of goods, fixed money stock growth rates and stable money demand functions with similar properties in all countries. Under these assumptions international interest rate parity would always be preserved on an uncovered as well as a covered basis. Interest rates would be equalised in real (ex ante) terms. As a result, countries would not be protected against real interest rate shocks from abroad.

such deviations may come about in a context of rigidities in the goods and labour markets – even on the assumption of full substitutability of interest-bearing assets and model-based ("rational") investor expectations – was demonstrated in the well-known Dornbusch (1976) model. Given a non-vertical Phillips curve, the expansionary effect on the domestic economy of a temporary rise in interest rates abroad which causes the home currency to depreciate (and is associated, as in the Mundell-Fleming model, with an assumed improvement in the trade balance) could be felt in a higher rate of inflation as well as in a rise in output.[4] More recently, it has been pointed out that if J-curve effects dominate, at least initially, developments in the trade balance, a rise in interest rates abroad may tend to depress domestic output; and if allowance is made for a direct cost impact of currency depreciation on the domestic price level the home rate of inflation may accelerate the more sharply. It is well known that this kind of effect is strengthened if, because of formal indexation arrangements or for other reasons, wages are rigid not in nominal terms, as was assumed in the older Keynesian models, but in real terms – i.e. if the Phillips curve is vertical (Dornbusch (1983), Kouri (1983)).

Obviously, with exchange rates temporarily diverging from purchasing power parity, nominal interest rate differentials will not merely reflect differences in expected inflation rates. If markets confidently expect that purchasing power parity relationships will ultimately be restored real rates of return can differ temporarily, with the domestic rate protected from higher real rates abroad to the extent that the exchange rate has moved away from purchasing power parity. The situation will be rather different if interest rates

[4] The expansionary effect occurs in the absence of a change in the domestic money stock and despite a rise in domestic interest rates; indeed, the latter actually helps to raise nominal income by causing the velocity of circulation of a given money stock to rise. Subsequent elaboration of models of this kind has recognised, inter alia, the impact on the home country's interest earnings on assets acquired as a result of the trade surplus and that the effects on output are sensitive to the specification of the demand for money.

abroad are expected to continue to rise (as a result, say, of an increase in expected returns on investment or of a continuing budget deficit). In these circumstances continued appreciation of the foreign currency may be expected and the domestic real interest rate will not be protected (Blanchard and Dornbusch (1984)).

If the potential exchange rate effects of rises in interest rates abroad seem likely to exacerbate domestic inflation, the "inflation premium" in domestic interest rates may rise. Moreover, countries may have a strong incentive to prevent the exchange rate of their currencies from depreciating too far or too fast. To the extent that they do this and move towards managing their exchange rates – or seem likely to do so – market expectations may help to keep nominal interest rates much more closely in step than they would be under a régime of freely floating exchange rates.

(d) Imperfect asset substitutability and uncertainty

The possibility that interest-bearing assets may not be perfect substitutes internationally has been taken into account in asset-based portfolio models of open economies.[5] In most portfolio models interest rate relationships remain crucially dependent on long-run exchange rate expectations. However, these expectations may relate simply to the rate needed to balance the current account (Isard (1980)), they will not normally be held with certainty, and the speed with which adjustment to them will take place may also be uncertain. In the presence of risk it is postulated that wealth holders will require larger returns if they are to hold larger quantities of (outside) interest-bearing assets in a given currency.[6] Hence, the return on assets in different currencies may be expected to differ by a risk premium related to the relative supply of interest-bearing

[5] Like the monetary models, these have usually been designed to investigate the determinants of exchange rates, given the money stock and assuming a stable demand for money. The portfolio approach, pioneered by Tobin, was first applied for this purpose by Branson (1968). In recent years the literature has become vast.

[6] The political risks of capital controls may also rise with the stock of outstanding debt (Dooley and Isard (1982)).

assets and money in domestic and foreign currency as well as to domestic and foreign wealth. Interest rate differentials can then be influenced by external current-account balances and sterilised official foreign exchange market intervention (which alter the currency composition of private asset holdings and their distribution between resident and non-resident holders). In this framework the substitution effect on domestic interest rates of a rise in interest rates abroad may be muted and a possible wealth effect of exchange rate changes (affecting the domestic currency value of foreign assets), in increasing the demand for domestic assets, could conceivably (but need not) tend to lower the domestic interest rate.[7]

While the empirical evidence, not surprisingly, is consistent with the view that assets in different currencies are not usually perfect substitutes,[8] yield differentials do not usually seem to have been systematically related to asset supplies in the way that most portfolio models hypothesise (Rogoff (1984)). More generally, if neither monetary nor portfolio models can satisfactorily explain exchange rate movements, they are unlikely to be able fully to explain changes in international interest rate differentials either. The reason may simply be that actual changes occur mainly in response to unexpected disturbances and, in particular, to real shocks, which are not taken explicitly into account in many models of this type. However, it is possible that the models are still not capturing expectations adequately.

Some important influences on exchange rates probably vary from one period to another; recently the strength of the dollar has variously been attributed to the effect of the US budget deficit, to rises in the profitability of investment in the United States and, at times, to the search of international capital for a "safe haven". A

[7] Any tendency for the domestic interest rate to rise in response to rises in the foreign interest rate may also be less than it would otherwise be if the foreign interest rate enters into the home demand for money function (see, for instance, Arango and Madiro (1981)).

[8] In particular, the fact that forward exchange rates appear to be poor and, at times, biased predictors of spot rates may imply the existence of risk premia.

well-known finding of at least one study (Meese and Rogoff (1981)) was that in certain cases a "random walk" model could be as effective as the theoretically based ones in predicting exchange rate changes. This has been interpreted by some writers as implying that in some circumstances international borrowers and investors might as well act on the assumption that, given all the uncertainties, the best forecast for exchange rates – at least in the near future – could be their present level. Despite the uncertainties, however, it may still be reasonable for investors and borrowers to assume that over longish periods exchange rates could normally be expected to drift in a direction indicated by underlying inflation differentials – especially in cases where these are large and likely to prove persistent – and that, allowing for possible changes in equilibrium real exchange rates, past deviations from purchasing power parity may tend over time to be reversed.

(e) Interest rate policy and the term structure of interest rates

Surprisingly, perhaps, considering the amount of attention that has been paid to questions of the term structure in the domestic financial markets, most theoretical models of open economies have provided only for a single interest rate, and most empirical research on interest rate relationships has focused only on short-term rates.

Policy influences on international relationships among short-term interest rates have been studied empirically in "reaction" functions into which conventional intermediate and final objectives often enter simply in the form of a trade-off. However, discrete policy adjustments, changes in the policy mix and the long time frame within which the authorities seek to meet some of their objectives are problems encountered in practice, which means that the relationships established can only be considered as descriptive and not as indicative of stable causal connections. Most other empirical studies of international interest rate relationships have been designed to test special hypotheses developed in a literature which, drawing on finance theory, has dealt with aspects of market efficiency (whether asset prices incorporate new information

quickly), the extent to which real (ex ante) interest rates are equalised internationally, and so on. Here, too, the focus has been mainly on short-term rates.[9]

Because of the policy influences, and because portfolio adjustments can take time, it is often difficult to identify at the short end of the market more basic influences which constitute, in effect, the constraints within which policy operates. It is well recognised on the domestic plane that the inflation constraint appears most clearly in long-term yields into which it enters via expectations. External constraints on monetary policy may be reflected in short-term interest rates, but it is not improbable that they also operate through expectational channels and affect long-term interest rate relationships in that way.

II
International integration of financial markets

International financial integration, increasingly seen as the defining characteristic of economic openness (given the rigidity of prices in goods markets), is often defined in terms of full equalisation of real interest rates across countries. In a context of flexible exchange rates it cannot be discussed simply in terms of equalisation of nominal interest rates on assets denominated in different currencies – though, as pointed out below, close correlation between *movements* in nominal interest rates may be indicative of a high degree of integration. This section discusses mainly the impact of barriers to integration, leaving questions of

[9] There have been particular reasons for this – for example, the difficulty of measuring long-term inflation expectations.

asset substitutability and the influence of exchange rate expectations to later sections.[10]

Integration in this narrow sense might be expected to have increased significantly since the early 1970s as a result of the growth of the international financial markets and the removal in particular countries of exchange controls and other administrative constraints on capital flows. Moreover, the European Monetary System could potentially become a strong integrating force since the objectives of the system go well beyond that of exchange rate stabilisation.

In the United Kingdom the exchange control system was abolished in 1979 and in Japan regulations restricting external capital movements have been relaxed significantly in stages in the period since 1979–80. Elsewhere recent changes have probably been less far-reaching than is sometimes presumed. Countries which established generally liberal régimes much earlier have removed the constraints on capital inflows which they introduced in the late 1960s and early 1970s in a context of dollar weakness and have expressed determination not to reintroduce such measures. In some cases tax disincentives to specific types of external capital transactions have recently been removed or have come under review. But in a number of countries such easing of exchange controls as has occurred may reflect more the vagaries of developments in external current-account positions.

The international markets have been highly innovative in developing instruments such as currency swaps which strengthen market integration. But for reasons which go beyond a desire to protect domestic money-market conditions in the short run the authorities in some countries have viewed certain of these

[10] The question of barriers can be addressed in terms of the relationships between nominal interest rates on assets denominated in the same currency in domestic and international markets where covered interest parity is known to hold. The question of how far the forward exchange rates correspond to exchange rate expectations can then be seen as one of asset substitutability. The question of how far exchange rate expectations correspond to expected price differentials can also be addressed separately.

developments with caution. In some cases one aim has been to ensure that key domestic monetary aggregates remain clearly defined. In others it has been more to limit the exposure to shocks which large non-resident holdings of short-term instruments denominated in the domestic currency might imply. Fairly generally, a strengthening of the prudential supervision of, inter alia, the assumption of currency risks by financial institutions has been considered advisable. Fiscal régimes often form barriers to market integration and it has sometimes been argued that policies directed at achieving external current-account balance – by constraining net capital flows – might have prevented interest rate levels in different countries from converging in real terms.[11]

It is often argued that with the removal of effective constraints on cross-border transactions interest rates in the domestic market should tend to rise. If the deregulation or the ensuing portfolio stock adjustment were gradual this process could take time. The assumption behind this, that demand for credit was previously excessive – perhaps because credit control relied on effective quantitative restraints – need not apply in all countries. In any case deregulation of cross-border capital flows should ultimately be reflected in a closer relationship between movements in interest rates in the domestic markets and those on comparable instruments in the international markets, which are free of many types of regulatory restraint.[12]

One very simple way of gauging the broad significance of obstacles to market integration, then, is to look at the relationships between changes in interest rates in Euro-currency markets and

[11] This is one interpretation of the apparent close relationship between domestic savings and investment ratios reported by Feldstein and Horioka (1980). For a review of subsequent discussion of this question see Caprio and Howard (1984).

[12] It should be borne in mind, however, that some kinds of regulation simply impose a fairly constant interest cost and that, depending on the kind of disturbance, a similar response of interest rates in different markets may not call for actual capital flows.

those in domestic money markets.[13] In the case of three-month money-market rates simple ordinary least square regressions give striking, though not surprising, results (Table 2).[14] They suggest, firstly, that the presence or absence of comprehensive exchange control systems is a very important influence and, secondly, that obstacles to market integration may have decreased markedly in some cases in recent years. On the basis of these simple tests the largest changes seem to have taken place in the case of the United Kingdom and Japan. The relationships between changes in domestic and Euro-currency rates have also been closer in the second period for Germany. This presumably reflects the removal of disincentives to inflows of funds. Among the countries shown only Italy and France still seem to have obstacles to movements of funds that may effectively inhibit integration of the home and offshore money markets. In the case of France the weak relationship between domestic and Euro-currency interest rates may reflect not only the existence of exchange controls, but also their rôle in protecting domestic interest rates from the full impact of exchange-market expectations. For the other countries shown the relationships appear remarkably close in recent years.

[13] Other influences, such as changing risk premia in international interest rates, appear to be comparatively minor, though they may affect the results shown for the United States in the post-1979 period.

[14] The chain of causation implied in the table seems most appropriate in the case of countries in which domestic short-term interest rates have been strongly influenced by money-market policies geared mainly to domestic objectives. For some countries in which money-market policies have been geared more to exchange rate objectives it may be preferable to think of the external rates as the independent variable and domestic rates as the dependent ones. In such a transformation of the relationships the coefficient of determination and the t-statistics remain unchanged and the coefficients of the independent interest rate term are the reciprocals of the ones reported. Their values – in the post-1979 period – would all lie between 0.4 and 1.0. Coefficients of less than one might then be interpreted as indicating the extent to which domestic rates could be protected from external influences. (The insignificant constant terms help to confirm the absence of a trend but have little effect on the other reported statistics in this table or the following ones.)

Table 2

(a) Regressions of monthly changes in Euro-currency interest rates on changes in representative domestic money-market rates[1]

	Constant[2]	Domestic money-market rate	S.E.	$\bar{R}^2$	D.W.
April 1973 to March 1979					
United States	− .02 (− .60)	1.10 (21.34)	.25	.86	2.62
Canada[3]	.01 (.22)	.91 (5.62)	.18	.64	2.05
Japan[3]	.00 (.18)	.53 (.93)	1.05	− .00	1.76
United Kingdom	− .02 (− .14)	1.05 (7.42)	1.37	− .43	2.81
Germany	.10 (1.08)	.77 (4.98)	.80	.25	2.04
France[3]	.07 (.20)	1.52 (3.01)	1.59	.32	2.48
Italy[3]	− .08 (− .12)	− .75 (− .34)	3.02	− .06	2.57
Netherlands	.02 (.40)	.89 (34.67)	.34	.94	2.21
Belgium	− .01 (− .10)	1.05 (11.96)	.67	.67	2.37
April 1979 to July 1984					
United States	.00 (.02)	1.06 (78.23)	.15	.99	1.99
Canada	.01 (.14)	.89 (25.02)	.33	.91	2.74
Japan	.00 (.01)	1.23 (11.13)	.48	.66	2.56
United Kingdom	.00 (.08)	1.03 (25.92)	.30	.91	2.27
Germany	.00 (.00)	1.01 (18.57)	.34	.85	2.75
France	− .13 (− .27)	2.54 (5.47)	3.78	.31	2.97
Italy	− .06 (− .08)	1.63 (1.31)	5.61	.01	2.88
Netherlands	.01 (.29)	.87 (40.42)	.17	.96	2.12
Belgium	.01 (.22)	.83 (15.60)	.40	.79	2.87

(b) Correlation coefficients between monthly changes in bond yields in domestic and international markets: April 1979 to July 1984

	Dollar yields in		Deutsche Mark yields in		Guilder yields in		French franc yields in	
	United States	Euro-market	Ger-many	Euro-market	Nether-lands	Euro-market	France	Euro-market
$ in United States	1.00	.75	.53	.61	.54	.46	.32	.23
$ Euro-market	.75	1.00	.55	.69	.60	.55	.44	.30
DM Germany	.53	.55	1.00	.84	.68	.70	.38	.39
DM Euro-market	.61	.69	.84	1.00	.67	.69	.42	.43
Fl. Netherlands	.54	.60	.68	.67	1.00	.84	.42	.34
Fl. Euro-market	.46	.55	.70	.69	.84	1.00	.37	.46
Fr.fr. France	.32	.44	.38	.42	.42	.37	1.00	.52
Fr.fr. Euro-market	.23	.30	.39	.43	.34	.46	.52	1.00

S.E., standard error; $\bar{R}^2$, coefficient of determination, adjusted for degrees of freedom; D.W., Durbin-Watson statistics; in brackets, t-statistics. For data sources, see annex.

[1] For the United States and Japan, monthly averages; for other countries, end-month data.

[2] A significant constant is indicative of a trend. [3] September 1977 to March 1979 only.

In evaluating the macro-economic implications of this kind of money-market integration, two points should be borne in mind. Firstly, it need not in itself imply any major constraint on individual countries' monetary autonomy – and, in particular, on countries' ability to influence price and exchange rate expectations. Secondly, even to the extent that domestic money-market rates are not protected by regulations and are adapted to coping with exchange-market disturbances (see below), other domestic rates may be sheltered. In particular, the authorities can usually use their operating techniques and instruments in ways which moderate the response to changes in money-market rates of debtor and creditor rates applied by financial institutions in dealings with non-financial enterprises and households.

In the case of yields in the international market for bonds and notes consistent long series of reliable data are less readily available, while the instruments, the risk categorisation of the issuers and the yield observations are less comparable with those in domestic markets. With the breadth and depth of the international markets increasing over time, the relationship between yields there and yields in domestic markets for the same currency (Table 2b) seems to have become closer in the case of the dollar, the guilder and, in particular, the Deutsche Mark, but it remains quite weak in the case of the French franc.

Except in the case of the French franc, correlations between changes in yields in different currencies since 1979 show that yield relationships in the international market have been closer than those between yields in different domestic markets. Domestic yields in the three European countries have been more closely related to international dollar yields than to dollar bond yields in the United States. This could suggest two causal relationships. On the one hand, as a result of barriers to capital movements (such as the recently abolished withholding tax on interest paid to non-residents on security issues in the US market) foreign influences might have been a significant influence on yields on international dollar issues. On the other hand, long-term interest rate impulses from the United

States may to some extent have been transmitted to Europe via the international markets. The relationships of yields on international French franc bonds to yields in other markets, like their relationships with yields in France, seem to have been quite weak.

III
International short-term interest rate relationships

The objective of this section is not, of course, to examine the ultimate determinants of short-term interest rates. It may even be impossible in principle to give a full answer to the question of how far interest rate levels in particular countries are determined by domestic factors, on the one hand, and external ones, on the other. Not only may observed relationships merely reflect similar, even related, developments in the real economy but influences from abroad will normally be conditioned by domestic monetary policy responses, fiscal policy, the regulatory framework and the exchange rate system. Furthermore, with arbitrage maintaining covered interest parity relationships, interest rates in different markets are determined simultaneously with spot and forward exchange rates. The aim here is simply to consider some aspects of apparent empirical regularities in international short-term interest rate relationships and to point out certain changes which have become evident in recent years.[15]

The extensive changes in the pattern of interest rate behaviour which have taken place in the United States since the late 1970s are well known. Beginning in October 1979, when in a serious effort to counter inflation monetary policy was geared to closer control of the monetary aggregates, bank reserves became the main operating objective. Wide ranges for the Federal funds rate were laid down by the Federal Reserve Open Market Committee to help guide open-market operations and for a time short-term interest rates in the

[15] Footnote on next page.

United States were extremely volatile. After a steep fall in mid-1982 they fluctuated less but remained high in relation to the rate of inflation, which by this time had also declined substantially. By early 1984 they were again rising in a context of a large deficit in the Federal Government's budget, firm monetary policy and strong recovery in the economy. Since 1973 exchange rate objectives have only on rare occasions been prominent in policy deliberations in the United States and since 1979 efforts to influence the exchange rate of the dollar directly have normally been avoided.

Counter-inflationary monetary policies were followed throughout the industrial world as from 1979 and in many countries a central rôle was given to objectives for the monetary aggregates. However, as in most cases the aim was to meet the target in the medium term, targeting did not prove to be inconsistent with efforts to moderate fluctuations in short-term interest rates or to adapting them in ways which could influence exchange-market developments. In many European countries and in Japan budget deficits were very large but steps were being taken to reduce them, and in many

[15] The regressions (and correlations) below were estimated using first differences of monthly data, which reduces the problem of serial correlation in the error terms. Relationships among interest rate levels may be more affected by common responses to exogenous disturbances. Most of the regressions presented are also based on partial relationships. This procedure, of course, is subject to shortcomings, but was chosen in order to illustrate the response of several dependent variables to one causal factor or to analyse the transmission channels. More elaborate techniques designed to isolate innovations in interest rate time series usually seem to give results very similar to those of tests based on first differences (see, for instance, Micossi and Padoa-Schioppa (1984) and Colletaz and Marois (1982)). Furthermore, no attempt has been made here to use causality tests of the kind used by these authors (and in Genberg et al. (1982)) for estimating relationships between short and long-term interest rates and exchange rates. The advantages and disadvantages of the different kinds of test have been the subject of some discussion (see, for example, Schwert (1983) and Kaen and Hachey (1983)). More generally, there may be scope for doubt about the power of post hoc ergo propter hoc analysis applied to variables such as interest rates, which may reflect mainly expectations, in a context of fairly efficient markets in which new information may be quickly incorporated into asset prices.

countries external current-account positions gradually improved. In time, with economic recovery slow to take hold, it became evident that meeting the domestic monetary – and inflation – objectives no longer called for levels of short-term interest rates as high in nominal or real terms as those in the United States. However, the maintenance of relatively low interest rates in these countries implied, given the course of developments in the United States, further upward pressure on the exchange rate vis-à-vis the US dollar. Hence, in varying degrees countries had to take the implications for the dollar exchange rates of their currencies into account.

In general, monetary authorities have carefully explained their objectives and the constraints they perceived can readily be identified. The risk that rises in the domestic prices of raw materials and oil, stemming from depreciation of the domestic currency vis-à-vis the dollar, could feed into wages has clearly been an important consideration in many European countries for much of the post-1979 period. Increasingly, however, in a context of unemployed resources at home and weakness in world commodity markets, a strengthening of the dollar against other currencies seemed more likely to delay a further reduction in domestic inflation rates than to induce a new round of accelerating inflation. It might also have helped to restore the competitiveness of the home economy – though this was clearly not a major consideration in the larger countries. In Japan concern with the dollar exchange rate of the yen may have centred more on the impact on protectionist pressures abroad.

(a) Short-term interest rates and dollar exchange rates

Table 3a suggests a striking parallelism in the period since 1979 between movements in US interest rates and percentage changes in the spot dollar exchange rates of most other currencies (measured as units of the domestic currency per dollar). It also indicates a sharp contrast between this experience and that in the 1973–79 period, when in most cases there was no relationship between the two

Table 3

Relationships between money-market rates and bilateral exchange rates.

(a) Monthly changes in exchange rates on changes in US money-market rates

	Constant	US short-term interest rate	S.E.	$\bar{R}^2$	D.W.
April 1973 to March 1979					
Canada	.23 (1.94)	.06 (.30)	1.00	-.01	1.62
Japan	-.31 (-1.11)	.06 (.12)	2.33	-.01	1.35
United Kingdom	.28 (1.14)	.19 (.43)	2.10	-.01	.94
Germany	-.54 (-1.66)	.08 (.13)	2.78	-.01	1.45
Switzerland	-.88 (-2.48)	.53 (.84)	2.99	.00	1.34
France	-.06 (- .21)	.45 (.88)	2.45	.00	1.53
Italy	.57 (2.11)	-.23 (- .48)	2.28	-.01	1.10
Netherlands	-.50 (-1.69)	.52 (.99)	2.51	.00	1.44
Belgium	-.40 (-1.38)	.43 (.84)	2.47	.00	1.36
April 1979 to June 1984					
Canada	.19 (1.72)	.35 (4.48)	.86	.23	1.75
Japan	.28 (.82)	.89 (3.57)	2.74	.16	1.39
United Kingdom	.70 (2.37)	.58 (2.73)	2.36	.09	1.14
Germany	.69 (2.20)	.89 (3.94)	2.50	.19	1.52
Switzerland	.59 (1.75)	1.12 (4.62)	2.68	.24	1.47
France	1.14 (3.47)	.80 (3.36)	2.63	.14	1.51
Italy	1.17 (4.11)	.75 (3.66)	2.27	.16	1.49
Netherlands	.76 (2.47)	.89 (4.02)	2.45	.19	1.42
Belgium	1.08 (3.29)	.82 (3.45)	2.62	.15	1.44

variables.[16] Table 3b shows both positive and negative relationships between changes in interest rates outside the United States and bilateral dollar exchange rates with positive relationships predominating in both periods. Given the way the exchange rates are measured, this means that on average during the period rises (falls) in domestic interest rates have normally accompanied depreciation (appreciation) of the domestic currency.[17]

[16] This may suggest that in the post-1979 period changes in short-term interest rates in the United States involved, more than before, changes in real interest rates (see below).

[17] Since 1979 changes in interest rate differentials have mainly reflected changes in dollar interest rates. Indeed, in many cases bilateral dollar exchange rates seem to be explained at least as well by the former considered in isolation as by the differentials.

Table 3 (continued)
(b) Monthly changes in domestic money-market rates on changes in exchange rates

	Constant	Dollar exchange rate	S.E.	$\bar{R}^2$	D.W.
April 1973 to March 1979					
Canada	.10 (1.25)	− .05 (− .69)	.64	− .01	1.75
Japan	.01 (.21)	.06 (2.34)	.53	.06	1.56
United Kingdom	− .03 (− .27)	.22 (3.70)	1.07	.15	1.79
Germany	− .08 (−1.10)	− .05 (−1.87)	.60	.03	1.25
Switzerland	− .01 (− .26)	.04 (2.40)	.47	.06	1.59
France	− .01 (− .11)	.12 (3.58)	.70	.14	2.23
Italy	− .04 (− .27)	.21 (3.00)	1.33	.10	2.05
Netherlands	.11 (.60)	.09 (1.18)	1.57	.01	1.53
Belgium	.01 (.06)	− .08 (−1.78)	.90	.03	1.50
April 1979 to June 1984					
Canada	− .10 (− .78)	.66 (5.07)	1.00	.29	1.98
Japan	.01 (.16)	.05 (2.08)	.53	.05	1.32
United Kingdom	− .04 (− .32)	.06 (1.22)	.95	.01	2.04
Germany	− .07 (− .71)	.11 (3.42)	.72	.14	2.03
Switzerland	.04 (.38)	.06 (1.89)	.73	.04	1.46
France	.01 (.09)	.05 (1.18)	1.02	.01	2.17
Italy	.12 (1.44)	− .03 (− .86)	.58	.00	1.68
Netherlands	− .08 (− .62)	.09 (1.92)	.99	.04	2.29
Belgium	.05 (.36)	.01 (.29)	.97	− .01	1.69

See footnotes to Table 2.

It is by no means intended to suggest that short-term interest rates have been the only influence on exchange rates or that the relationship between nominal interest rates and exchange rates is simple and direct. However, to the extent that countries were not simply responding to similar problems, a comparison of the coefficients of the interest rate terms in Table 3a and those of the exchange rate terms in Table 3b may be interpreted as indicating how far potential exchange rate pressures stemming from changes in US interest rates were met by adaptation of short-term interest rates elsewhere and how far they were simply reflected in exchange rate movements. Taken together the two sets of results seem consistent with the view that since 1979 developments in short-term interest

rates in the United States have been closely reflected in exchange rates[18] and that interest rate movements in many other countries have tended to be defensive. Clearly, however, in many countries, short-term interest rates largely reflected domestic policy objectives.

It can be argued that official intervention in the foreign exchange market might have helped to protect domestic interest rates from the impact of changes in interest rates abroad and at the same time to moderate any exchange rate impact. In fact, simple regressions of changes in central banks' net foreign assets on changes in interest rates in the United States showed significant relationships only in the case of Canada and the United Kingdom. Clearer evidence of "leaning against the wind" more generally could be detected in the relationship between intervention and changes in the dollar exchange rate of the domestic currency in the case of the United Kingdom, Japan, Germany and Switzerland. This may suggest that official intervention has been designed less to resist interest rate pressures from abroad than to counter exchange-market disturbances of other kinds.

[18] Since the three-month interest rates used in Table 3 are annualised whereas the changes in exchange rates are not, the coefficients in Table 3a are consistent with the impression of some observers that movements in exchange rates have typically been much larger than would have been justified by the associated changes in short-term interest rates had the latter been expected to be purely temporary (i.e. to be reversed after three months). In the case of such purely temporary changes the forward exchange rate would in principle remain unchanged and the three-month interest rate parity condition would imply that a 1 percentage point change in the interest rate differential would be accompanied by a 0.25 per cent. change in the bilateral exchange rate. The estimated coefficients on the US interest rate term in Table 3a (and the ones on the interest rate differential when this term is used instead) are more than three times as large as this. In other words, the factors causing interest rates in the United States to move have generally caused the three-month forward exchange rate to move in the same direction as the spot rate. In fact there has been a tendency for fluctuations in short-term dollar interest rates to be reflected in shifts in the entire term structure of interest rate differentials (and of the implied forward exchange rates).

(b) Short-term interest rates in the European Monetary System

In some respects the European Monetary System introduced, on a regional scale, elements of a fixed exchange rate system into international monetary arrangements (though exchange rate relationships between Germany, Belgium and the Netherlands had long been stabilised under the "snake" arrangements).

Indications of some ways in which short-term interest rates in European countries have been influenced by the functions of the EMS can be seen in Table 4, which uses "divergence indicators" to characterise exchange-market developments within the system.[19]

The correlation coefficients in Table 4a illustrate the well-known tendency for developments in the dollar to affect EMS currencies in different ways. Thus, as might be expected, changes in the bilateral dollar exchange rates of all the currencies concerned show a high positive correlation and changes in the divergence indicators are negatively correlated in systematic ways. Negative coefficients for the relationship between the dollar/Deutsche Mark exchange rate and the divergence indicator for Germany show that the Mark – as the major international investment currency – typically appreciates (depreciates) against the dollar and other European currencies at the same time. The positive relationships which can be seen between the exchange rate and divergence indicator in the case of the French franc, the Italian lira and the Belgian franc show how these currencies typically strengthen (weaken) against the Mark when the Mark weakens (strengthens) against the dollar.

[19] These indicators, which have been calculated since the inception of the EMS, measure deviations in individual currencies from the average value of the basket of EMS currencies. They were designed to permit the calculation of thresholds for movements in individual currencies which could establish a presumption of the need for corrective policy action. In fact, keeping the bilateral exchange rates within the agreed margins is the only binding obligation on participants, and countries may actually have been influenced more by the position of their currency in a band around the central exchange rates, which are fixed in terms of a composite currency unit. Broadly speaking, however, the divergence indicators often convey information of a similar kind.

Table 4
The European Monetary System
(April 1979 to July 1984)

(a) Correlation coefficients between monthly changes in:

	Bilateral dollar exchange rates for					EMS indicators of divergence for				
	DE	FR	IT	NL	BE	DE	FR	IT	NL	BE
and bilateral dollar exchange rates for										
DE	1.00									
FR	.94	1.00								
IT	.94	.95	1.00							
NL	.99	.94	.94	1.00						
BE	.93	.92	.92	.93	1.00					
and EMS indicators of divergence for						and EMS indicators of divergence				
DE	− .12	− .28	− .20	− .07	.05	1.00				
FR	− .02	.05	.05	− .03	.05	− .66	1.00			
IT	.32	.44	.30	.34	.32	− .35	.21	1.00		
NL	.07	− .14	− .07	− .01	.06	.54	− .52	− .46	1.00	
BE	.03	.15	.12	.02	.01	− .56	.32	.19	− .46	1.00

(b) Regressions for monthly changes in money-market rates

	Constant	German money-market rate	Indicator of divergence	rho	S.E.	$\bar{R}^2$	D.W.
Germany . .	.01 (.08)		.00 (− .36)	− .07	.79	− .03	1.99
France	.07 (.78)	.49 (3.97)	− .03 (−6.39)	− .02	.76	.45	1.95
Italy	.09 (1.01)	− .04 (− .41)	− .01 (−1.22)	.16	.58	.02	2.02
Netherlands .	− .02 (− .24)	.58 (4.02)	− .01 (−1.83)	− .22	.91	.22	2.10
Belgium . . .	.06 (.51)	.26 (1.70)	− .01 (−1.35)	.02	.02	.02	1.97

(c) Regressions for monthly changes in central-bank net foreign assets

	Constant	Indicator of divergence	rho	S.E.	$\bar{R}^2$	D.W.
Germany	− .35 (− .63)	.00 (− .25)	.34	3.20	− .03	1.74
France	− .55 (− .47)	− .11 (−2.82)	.25	7.15	.09	1.92
Italy	.03 (.12)	.05 (3.48)	.25	1.23	.15	1.88
Netherlands	.06 (.56)	.01 (2.92)	.10	.76	.10	1.97
Belgium	−2.32 (− .79)	.21 (1.64)	.01	17.08	.01	1.92

DE=Germany, FR=France, IT=Italy, NL=Netherlands, BE=Belgium.

See footnotes to Table 2; rho, correction for first order serial correlation by Cochrane-Orcutt method.

Tables 4b and 4c suggest that in Belgium, the Netherlands and Italy exchange-market disturbances, which affect EMS countries differently, have been clearly reflected in movements in the central banks' net foreign assets and that they have also had an impact on money-market interest rates in these countries. In the case of France (where the movement in official foreign assets is dominated by reserve losses during the period of severe deterioration in the external current account) the response of the money-market rate is much more pronounced. The results for Germany presumably reflect the pivotal rôle of the Deutsche Mark in the system. Over time the functioning of the EMS has, on balance, resulted more in parallel than in divergent movements in short-term interest rates in most of the participant countries (see also below), which can probably be considered to be in line with its objectives. That rates in Italy and Germany are still only weakly related must reflect the relatively wide band for permitted fluctuations in the exchange rate between the lira and other EMS currencies and perhaps also the effect of exchange controls. Central rates within the EMS have had to be changed from time to time, however, and the levels of money-market rates in EMS countries have not come much closer together. This indicates that the process of monetary integration in Europe still has far to go.

(c) The interaction of policy and market expectations

The influence of short-term interest rates in the United States on the exchange markets and the policy response in other countries can be summarised in the direct measures of relationships between short-term interest rates in different countries shown in Table 5.[20]

Relationships between movements in short-term interest rates in the United States, on the one hand, and those in Europe and in

[20] In many countries interest rate policies are geared mainly to day-to-day or one-month interest rates, so that market forces may play a rôle in the determination of the three-month interest rates used here, but in these cases expected policies must be a major influence (see also below).

Table 5

Relationships of monthly changes in domestic money-market rates to changes in foreign money-market rates

	Constant	US short-term interest rate	S.E.	$\bar{R}^2$	D.W.
April 1973 to March 1979					
Canada	.05 (.92)	.68 (6.46)	.50	.36	2.28
Japan	– .02 (– .24)	.20 (1.82)	.54	.03	1.48
United Kingdom	.01 (.07)	.47 (1.98)	1.13	.04	1.71
Germany	– .06 (– .88)	.22 (1.78)	.60	.03	1.38
Switzerland	– .06 (–1.14)	.23 (2.40)	.47	.06	1.53
France	– .03 (– .33)	.34 (2.23)	.73	.05	2.24
Italy	.04 (.26)	.72 (2.58)	1.35	.07	1.79
Netherlands	.02 (.13)	1.11 (3.64)	1.46	.15	1.67
Belgium	.02 (.19)	.35 (1.87)	.90	.03	1.69
April 1979 to June 1984					
Canada	.00 (.02)	.63 (8.61)	.80	.54	2.17
Japan	.02 (.30)	.11 (2.26)	.53	.06	1.11
United Kingdom	.00 (.01)	.06 (.75)	.95	– .01	2.08
Germany	.01 (.10)	.12 (1.76)	.77	.03	2.12
Switzerland	.07 (.74)	.17 (2.61)	.71	.08	1.42
France	.07 (.56)	.18 (1.97)	1.00	.04	2.20
Italy	.09 (1.19)	– .01 (– .18)	.58	– .02	1.69
Netherlands	– .01 (– .11)	.09 (.98)	1.02	.00	2.33
Belgium	.06 (.48)	.20 (2.34)	.93	.07	1.71

	Constant	US short-term rate	German short-term rate	S.E.	$\bar{R}^2$	D.W.
April 1973 to March 1979						
United Kingdom	.02 (.15)	.43 (1.79)	.16 (.69)	1.14	.03	1.68
Switzerland	– .07 (–1.31)	.24 (2.52)	– .08 (– .92)	.44	.06	1.58
France	– .03 (– .29)	.33 (2.10)	.05 (.33)	.74	.04	2.24
Italy	.04 (.27)	.72 (2.49)	.02 (.08)	1.36	.06	1.79
Netherlands	.04 (.24)	1.04 (3.34)	.31 (1.08)	1.46	.15	1.71
Belgium	.03 (.24)	.33 (1.72)	.08 (.45)	.90	.02	1.68
April 1979 to June 1984						
United Kingdom	.00 (.02)	.07 (– .46)	– .07 (– .44)	.96	– .02	2.09
Switzerland	.04 (.51)	.13 (2.03)	.33 (2.95)	.68	.19	1.73
France	.07 (.55)	.13 (1.46)	.39 (2.46)	.96	.12	2.23
Italy	.09 (1.18)	– .01 (– .16)	– .01 (– .06)	.58	– .03	1.68
Netherlands	– .02 (– .17)	.02 (.28)	.55 (3.53)	.93	.16	2.50
Belgium	.05 (.47)	.17 (2.01)	.20 (1.28)	.92	.08	1.89

See footnotes to Table 2.

Japan, on the other, have not changed significantly and in some cases they have become weaker. Only the links between short-term rates in Canada and the United States have evidently become closer.

Closer relationships have developed between short-term interest rates in Switzerland, the Netherlands, Belgium and France, on the one hand, and those in Germany, on the other. In some of these countries interest rate instruments have often been used in a co-ordinated way. However, money-market rates in the United Kingdom have clearly followed a quite different course from rates in other European countries.

As shown above, the independent movements in money-market rates in Europe and Japan have implied acceptance of large changes in bilateral spot dollar exchange rates (as well as in forward exchange rates). The extent to which other interest rates in these countries can develop independently of interest rates in the United States, now widely termed the problem of "decoupling", depends crucially on interest rate and exchange rate expectations. These are influenced by domestic as well as external circumstances and can change markedly over time. Hence it is virtually impossible to predict the likely impact on exchange rates and longer-term interest rates of any given change in short-term interest rate differentials.

Some light can be thrown on the interaction of monetary policy and market expectations by examining the short-term portion of the yield curve. Indications of expected near-term movements in interest rates can be derived by calculating the implicit forward interest rates needed to equalise returns on, say, a six-month and two consecutive three-month placements over a six-month holding period on the assumption that risk premia can be ignored. In Table 6 relationships between implicit three and six-month forward rates calculated in this way for several currencies in the well arbitraged offshore money markets are compared with the relationships among the corresponding three-month rates for the current period.

Clearly, the relationships between the implied forward rates in dollars and those in most other currencies were much closer in the post-1979 period than those between the current three-month rates,

which simply mirror the decoupling evident in Table 5. In the case of the Deutsche Mark, for instance, the coefficients on the corresponding dollar rates rise from 0.17 for the current three-month rates to 0.36 for the three-month forward rates and 0.46 for the six-month forward rates. Similar results can be seen for other currencies, with the notable exception of the yen.

These results may, of course, indicate that the market perceived limits on the extent to which countries' economic performance could differ over time. They may also reflect market awareness that in the past policy in countries other than the United States had at times been adapted to limiting interest rate differentials with a view to moderating exchange rate fluctuations. Such a view might have persisted even in cases in which the authorities have in recent years

Table 6

Regressions of changes in current and forward interest rates on changes in corresponding rates in the United States

	Current 3-month rate			3-month forward rate			6-month forward rate		
	US rate	$\bar{R}^2$	D.W.	US rate	$\bar{R}^2$	D.W.	US rate	$\bar{R}^2$	D.W.
April 1973 to March 1979									
GB	.72 (2.81)	.09	2.32	.58 (2.58)	.07	2.98	.55 (2.17)	.05	2.42
DE	.28 (2.13)	.05	1.67	.31 (3.31)	.12	2.13	.35 (3.75)	.16	1.61
CH	.56 (4.22)	.19	2.12	.46 (4.70)	.23	2.10	.46 (4.26)	.19	1.99
NL	.55 (2.69)	.08	1.59	.51 (4.56)	.22	1.95	.48 (3.86)	.16	2.35
April 1979 to June 1984									
CA	.50 (7.40)	.46	1.98	.72 (13.24)	.73	2.64	.80 (13.21)	.73	2.37
JP	.31 (3.88)	.18	2.17	.28 (4.28)	.21	2.65	.29 (4.52)	.23	1.94
GB	.14 (1.70)	.03	2.32	.38 (4.22)	.21	2.58	.46 (5.98)	.35	2.23
DE	.17 (2.52)	.08	2.19	.36 (7.23)	.44	1.80	.46 (7.42)	.46	2.11
CH	.24 (2.81)	.10	2.17	.37 (4.37)	.22	2.28	.40 (4.05)	.19	2.42
FR	.01 (.05)	– .02	2.51	.20 (1.50)	.02	2.25	.40 (3.68)	.16	1.79
NL	.09 (1.26)	.01	1.32	.31 (4.91)	.27	2.09	.42 (5.89)	.35	2.18

US=United States, CA=Canada, JP=Japan, GB=United Kingdom, DE=Germany, CH=Switzerland, FR=France, NL=The Netherlands, BE=Belgium.

See footnotes to Table 2; calculations of forward rates as explained in the text (six-month forward rates equalise returns on a twelve-month and two consecutive six-month placements). The regressions were run with constants, which proved insignificant in all cases.

proclaimed their intention of gearing policy more to domestic objectives. At all events the relationships may be indicative of limits on the broader impact of action to decouple short-term interest rates.

IV
Expectations and long-term interest rate relationships

Given the larger elements of risk and uncertainty in long-term interest rate relationships and the possibility that these could vary from country to country, it may seem surprising that international linkages among long-term yields are in many cases closer than those among short-term rates. It was to be expected, of course, that links between both short and long-term interest rates in countries whose currencies are linked through a (credible) exchange rate agreement would have become tighter. However, closer relationships seem also to have developed between long-term interest rates in countries whose currencies have been fluctuating widely against one another and whose short-term interest rates have displayed quite divergent developments. In this section the relationships between long-term interest rates in the United States and Germany and those in other countries are taken to be indicative of some of the different kinds of influence which may have been operating in a context of different exchange rate régimes.

A conventional term structure equation relating long to short-term interest rates in the same country can be readily adapted to incorporate the impact of nominal foreign yields. In many econometric models this is standard practice. In the framework of the expectations theory of the term structure, long-term rates in each country are seen to reflect expected short-term interest rates and a (fixed or variable) term premium. To the extent that future short rate developments in different countries are likely to be related, the foreign yield can be seen as incorporating many of the

unobservable expectational elements in domestic long rates. However, if markets are integrated internationally and long-term interest arbitrage conditions can be assumed to hold (i.e. that over the relevant time horizon the expectations operating in different markets are consistent) domestic long-term bonds will be priced in a way which allows differentials vis-à-vis foreign yields to reflect expected exchange rate changes (and, perhaps, a risk premium). The problem here, obviously, is that it is virtually impossible to measure longer-run exchange rate expectations directly in any credible way, given the lack of any generally accepted, stable and empirically satisfactory model.

The issue of price expectations cannot be avoided entirely since some of the most interesting aspects of the interest rate transmission mechanism have to be analysed in terms of real rates. However, given the difficulty of measuring long-term inflation expectations[21] and bearing in mind that tax and other institutional arrangements may influence the extent to which they become incorporated into interest rates, it would seem advisable to begin by considering nominal interest rate relationships and to introduce the potential influence of inflation expectations at a later stage.

It should be borne in mind, of course, that as a result of inflation and high interest rates the meaning of long-term interest rates has changed over time. Maturities have been reduced in response to uncertainty and high interest rates have lowered effective duration in relation to maturity. However, long-term yields must still give useful indications about the rates relevant to savings and investment decisions, even if variable interest rates have become increasingly common in long-term loan contracts.

[21] In practice the results of most efforts to model inflation expectations in individual markets – whether survey, time series or model-based, and however ingenious – have remained highly controversial, and to apply any of them to estimating expected long-term inflation differentials may seem to call for some stretch of the imagination.

(a) Nominal long-term interest rate relationships

Direct relationships between changes in bond yields in various countries and domestic short rates, US or German long rates and the lagged domestic bond yield are shown in Table 7.[22] Particularly interesting is the relatively good fit in the equations incorporating US yields for the countries with developed, fairly open financial markets, including Germany, Switzerland, the United Kingdom and Canada. The overall relationship seems strong in the case of France and, in the equation with German yields, in that of the Netherlands. Relatively weak results for Italy and Belgium may in part be attributable to the comparative narrowness of the bond markets in these countries and to the dominant influence of public-debt management practices.[23]

Considering first the relationships among domestic rates, it would appear that the tendency noticed in the United States since October 1979 for long rates to respond more closely than before to movements in short rates is less evident in other countries. Between the two periods the coefficients of the domestic interest rate term show rises for Japan and France but declines or little change for the other countries. For the United Kingdom, it is interesting to note the relatively large size and significance of the coefficients for both periods. On the other hand, as might have been expected, the coefficients seem relatively low in the smaller, more open economies. The coefficients of partial determination (which provide an estimate of the portion of the total explained variance which can be attributed to individual explanatory variables) confirms that the importance of the domestic money-market rate has changed little or has declined in all countries except France and the United Kingdom.

Turning to the cross-border influences, it can be seen that between the two periods the coefficients of the US yield term have

[22] Since the regressions are based on first differences of monthly data, their overall explanatory power can be regarded as quite high in most cases, especially in the post-1979 period.

[23] Some tendency of bond yields in Italy to remain unchanged for long periods and then to move in large steps can be noticed in Graph 1.

Table 7

Domestic and foreign influences on monthly changes in bond yields

	Constant	Foreign bond yield I	Domestic short rate II	Lagged domestic bond yield[1]	S.E.	$\bar{R}^2$	D.W. /h	Partial R^2 – variable I	II
Relationships with yields in the United States									
April 1973 to March 1979									
US	.02 (1.24)		.10 (4.50)	.29 (2.91)	.11	.28	– .16		
CA	– .00 (– .13)	.81 (5.59)	.13 (4.50)		.15	.49	2.14	.29	.20
JP	– .00 (– .05)	.23 (1.17)	.18 (3.91)		.21	.18	1.72	.02	.17
GB	– .02 (– .21)	1.03 (1.63)	.34 (4.94)		.67	.28	2.33	.04	.25
DE	– .01 (– .67)	.32 (1.82)	.13 (3.75)	.43 (4.33)	.17	.45	.46	.06	.16
CH	– .02 (– .98)	.20 (1.47)	.20 (5.39)	.23 (2.39)	.13	.39	.02	.05	.29
FR	.01 (.75)	.02 (.17)	.13 (5.92)	.30 (3.21)	.14	.40	–1.49	.00	.31
IT	.05 (1.37)	– .05 (– .15)	.15 (5.21)	.23 (2.34)	.32	.38	.51	– .00	.29
NL	– .02 (– .66)	.98 (4.73)	.10 (5.75)		.22	.45	2.13	.19	.27
BE	.01 (.62)	.24 (1.53)	.08 (3.55)		.16	.17	2.12	.03	.15
April 1979 to June 1984									
US[2]	.05 (.85)		.22 (6.40)		.37	.38	1.98		
CA[2]	.00 (.08)	.90 (6.72)	.10 (1.75)		.52	.56	1.98	.47	.08
JP	– .02 (– .64)	.33 (4.31)	.24 (3.34)		.30	.34	2.22	.21	.14
GB	– .01 (– .29)	.26 (2.47)	.35 (6.37)		.40	.46	2.20	.09	.36
DE	– .01 (– .32)	.28 (5.05)	.13 (3.49)	.38 (4.49)	.21	.57	–1.79	.24	.15
CH[2]	.00 (.30)	.17 (4.54)	.13 (4.80)		.15	.55	1.99	.25	.29
FR	.02 (.52)	.20 (2.50)	.26 (6.87)	.20 (2.24)	.30	.50	–1.14	.08	.40
IT	– .01 (– .13)	.00 (.02)	.17 (2.13)	.47 (4.06)	.34	.30	–1.15	.00	.09
NL	– .02 (– .65)	.41 (5.13)	.04 (1.01)	.23 (2.31)	.29	.39	–1.69	.32	.03
BE	.04 (1.18)	.12 (1.83)	.11 (3.28)		.24	.22	2.04	.07	.16
Relationships with yields in Germany									
April 1973 to March 1979									
DE	– .00 (– .19)		.13 (3.55)	.49 (5.25)	.18	.43	.99		
GB	.02 (.23)	.27 (.77)	.35 (4.98)		.68	.26	2.38	.01	.26
CH	– .01 (– .45)	.19 (2.79)	.21 (6.27)	.19 (2.04)	.13	.44	.66	.08	.31
FR	.02 (.93)	.09 (1.21)	.13 (5.71)	.30 (3.26)	.14	.41	–1.31	.02	.31
IT	.06 (1.56)	.29 (1.79)	.14 (5.04)	.24 (2.52)	.32	.40	1.06	.04	.28
NL	.02 (.75)	.43 (3.52)	.09 (4.71)		.23	.38	2.11	.15	.24
BE	.02 (.97)	.01 (.12)	.08 (3.56)		.17	.14	2.15	.00	.16
April 1979 to June 1984									
DE	.01 (.27)		.18 (4.46)	.39 (3.92)	.25	.39	.07		
GB	– .00 (– .10)	.35 (2.15)	.38 (6.97)		.41	.45	2.33	.04	.40
CH	.01 (.60)	.25 (3.70)	.13 (4.35)		.15	.47	2.06	.21	.27
FR	.03 (.80)	.25 (1.63)	.25 (5.45)	.12 (1.12)	.31	.47	– .84	.08	.38
IT	– .01 (– .12)	.21 (1.44)	.17 (2.06)	.43 (3.63)	.35	.33	– .86	.04	.09
NL	– .01 (– .38)	.81 (7.62)	.03 (.86)		.26	.51	1.78	.48	.02
BE	.04 (1.33)	.25 (2.50)	.09 (2.81)		.23	.26	2.00	.12	.14

US=United States, CA=Canada, JP=Japan, GB=United Kingdom, DE=Germany, CH=Switzerland, FR=France, IT=Italy, NL=The Netherlands, BE=Belgium.

S.E., standard error; $\bar{R}^2$, coefficient of determination, adjusted for degrees of freedom; D.W./h, Durbin-Watson or Durbin h-statistics; in brackets, t-statistics; partial R^2-coefficients for I, foreign yield, and II, domestic money-market rate. [1] Lagged one period. [2] Equation corrected for first order serial correlation.

risen in the case of Canada, Japan and France. For Germany and Switzerland they show little change, while for the United Kingdom and the Netherlands, where they were very high in the first period, there has been a decline. The coefficients appear in a different light, however, when seen in a context of the much larger range through which dollar rates have moved since 1979 and of the relatively moderate fluctuations in interest rates in this period in the low-inflation group of European economies. What is particularly striking is that the links between long-term interest rates in the United States and bond yields in other countries (as seen in the t-values) have clearly become much more significant since 1979 in all cases except that of Italy. In most cases, the ability of the equations to account for the variance of bond yields rises significantly between the two periods and the partial R^2 statistic shows that fairly generally it is the linkage with US yields which accounts for this. It is here that the change in the rôle of international factors can be seen most clearly.[24] In the case of the Netherlands and Canada, where the relationship of domestic bond yields to foreign yields has long been close, it appears to have become much more important than the link with domestic money-market rates.

Within Europe cross-border influences on domestic bond yields have evidently become much stronger since 1979. In the case of the Netherlands and, to a lesser extent, Switzerland, where the bond-market relationships with Germany were quite close in the early 1970s, they have remained so or have become much closer. In the case of France and Belgium links between domestic bond yields and those in Germany, which used to be fairly weak, have strengthened since the establishment of the European Monetary System. In the

[24] Chow test statistics generally show little change in the overall relationship. Even in the case of equations with only US yields and domestic money-market rates (i.e. without the constant or the lagged term) they identify significant changes only in the case of France (at the 5 per cent. level of significance) and the Netherlands (at the 1 per cent. level). Similar equations with German yields show significant changes only in the case of the same two countries.

case of lira and sterling yields the links with DM yields have remained fairly weak. (For both countries this corresponds to an absence of close international rate relationships at the short end of the maturity spectrum.)

The presence of a significant lagged dependent variable term in relationships of this kind is sometimes interpreted as suggesting that the markets are not fully efficient in the sense of adjusting instantaneously to all the available information. It may be indicative of a degree of price fixing or of smoothing operations by the authorities or private market makers (it may also be capturing the influence of omitted variables). In a number of countries, and notably in Switzerland, the importance of the lagged yield term has evidently declined over time. In the post-1979 period it remained significant in Germany and the Netherlands but the implied adjustment lags seem to have fallen significantly.

In Table I in the annex the US yield is replaced by (a) a variable designed to exclude the impact on changes in US yields of changes in US money-market rates together with (b) changes in the US short-term interest rate. The first variable – the residual of regressions of changes in long-term interest rates in the United States on current and lagged changes in US short-term interest rates (together with a constant) – may be thought of as isolating the unpredicted element ("surprises") in the long rate. The variable can be seen to be quite significant in the post-1979 period in all of the countries listed except the United Kingdom, Japan and Italy – and substantially more so than in the pre-1979 period. However, it also appears that movements in US short-term interest rates may have been directly reflected in yields in a number of other countries.

In the same table (annex) the level of the long-term yield differential, lagged one month, is also included in the equations. The introduction of this term has little effect on the coefficients of the other terms or on the overall explanatory power of the relationship. However, its own coefficient can be used, along with the constant term, to estimate a long-term underlying yield differential for the period – the level to which the differential would tend to gravitate in

the absence of changes in the other variables.[25] In Table 8 the underlying differentials calculated in this way for both periods are compared with the average inflation differentials (based on changes over four quarters in price indices for consumer expenditure).

(b) Interpreting nominal yield relationships

Close international relationships among movements in nominal yields must be indicative of a high degree of financial-market integration. Care must be taken in using the reported results as

Table 8

"Underlying" yield differentials[1] and average inflation differentials

	CA	JP	GB	DE	CH	FR	IT	NL	BE
					vis-à-vis the United States				
"Underlying" yield differentials									
1973–79 (a)	1.6	–0.4	5.0	–5.0	–1.8	15.0	6.2	0.5	0.4
1979–84 (b)	1.5	–7.0	–1.1	–4.1	–8.5	2.1	4.9	–3.8	1.0
Average inflation differentials[2]									
1973–79 (a)	1.9	3.5	7.8	–2.1	–2.4	2.9	9.3	0.9	1.7
1979–84 (b)	2.3	–3.4	3.6	–2.4	–2.3	4.1	10.0	–2.0	0.2
					vis-à-vis Germany				
"Underlying" yield differentials									
1973–79 (a)			5.7	–	–3.0	3.4	11.6	1.4	1.7
1979–84 (b)			4.0	–	–2.5	6.3	8.9	1.1	4.1
Average inflation differentials[2]									
1973–79 (a)			9.9	–	–0.3	5.0	11.8	2.9	3.7
1979–84 (b)			6.0	–	–0.9	6.5	12.5	0.3	2.4

See footnotes to Table 7.

[1] Estimated constant divided by estimated coefficient of yield differential, lagged one period with sign reversed. [2] Domestic minus foreign. Based on changes over four quarters in consumer expenditure price indices (for Italy, consumer prices).

(a) April 1973 to March 1979; (b) April 1979 to July 1984.

[25] Setting the other terms in the equation – all of which are expressed in terms of changes – at their "equilibrium" values of zero simply yields the relationship: $0=\hat{a}+\hat{b}D$, where $\hat{a}$ is the constant, D the differential and $\hat{b}$ the estimated coefficient of the yield differential term. The long-run yield differential can therefore be calculated as $-\hat{a}/\hat{b}$.

measures of stable causal links, however, especially since the relationships can change over time. In particular, in interpreting the coefficients of the US or German yields in the equations, account has to be taken of (i) the potential influence of omitted variables and (ii) common disturbances, which may have fundamentally affected yields in different countries in a similar way.[26]

(i) Current accounts, government budget balances and the money stock are among the variables most commonly listed among the potential determinants of exchange rate and interest rate expectations. Table 9 shows the effect of adding to the regression for the 1979–84 period countries' own trade balances and the central government's financing shortfall.[27] These can be viewed as proxies for the evolving current-account and government debt positions. It was only to be expected that for most countries the underlying position would be more relevant than month-to-month changes. However, the trade balances appear significant (with the expected sign) in Canada, Germany, Switzerland and Italy, as do the government borrowing requirements for Canada, the United Kingdom, Germany, the Netherlands and Belgium. The absence of significant results for some countries with comparatively large budget and external imbalances is, of course, striking and must partly reflect the nature of official operations in the bond market.

[26] The coefficients might not be completely reliable for countries in which movements in domestic short rates are closely correlated with movements in US yields. However, since 1979 relationships between money-market rates in the United States and other countries except Canada have not generally been strong (see Table 6).

[27] Recorded flows entered as exports minus imports and revenue minus expenditure, respectively (without adjustments for cyclical factors or the currency composition of the financing). The recorded flows enter these equations as first differences of the cumulative flows which many portfolio-balance models identify as the relevant influence on interest rate levels. For some countries other variables such as government borrowing at long term or the public-sector financing requirement were tested without satisfactory results. No attempt was made to test the impact of the money stock (or base money).

Table 9

Influences on monthly changes in bond yields including trade balances and budget deficits

(April 1979 to July 1984)

	Constant	US yield	Domestic money-market rate	Trade balance	Government budget balance	Lagged domestic bond yield[1]	rho	S.E.	$\bar{R}^2$	D.W./h
Canada	.03 (.24)	.86 (6.30)	.09 (1.50)	– .29 (–2.18)	– .13 (–1.68)		– .24	.51	.58	2.12
Japan	– .03 (– .58)	.33 (4.28)	.24 (3.41)	– .01 (– .44)	.00 (.19)		– .14	.30	.35	1.90
United Kingdom	– .06 (–1.09)	.25 (2.54)	.37 (6.20)	– .06 (– .38)	– .08 (–1.88)		– .16	.40	.49	2.06
Germany	.11 (1.68)	.27 (4.02)	.11 (2.92)	– .06 (–2.39)	– .03 (–1.89)		.22	.23	.41	1.83
Switzerland	– .05 (–1.42)	.18 (4.59)	.12 (4.65)	– .14 (–1.73)			– .14	.15	.56	2.01
France	– .03 (– .30)	.20 (2.41)	.26 (6.41)	– .01 (– .45)	.00 (.67)	.21 (2.14)		.32	.49	–1.45
Italy	.03 (.23)	– .00 (– .04)	.14 (1.79)	– .07 (–1.17)	.02 (1.34)	.40 (3.30)		.34	.31	– .90
Netherlands	– .04 (– .95)	.44 (5.20)	.03 (.77)	– .02 (– .41)	– .04 (–1.80)	.23 (2.23)		.29	.40	–1.56
Belgium	.09 (1.49)	.14 (2.13)	.10 (2.84)	.00 (.01)	– .01 (–1.46)		– .16	.24	.23	2.06
				Beta coefficients[2]						
Canada		.59	.16	– .19	– .19					
Japan		.38	.44	– .03	.03					
United Kingdom		.13	.58	– .02	– .11					
Germany		.34	.28	– .28	– .16					
Switzerland		.32	.39	– .18						
France		.22	.73	– .05	.09	.21				
Italy		– .00	.39	– .09	.15	.40				
Netherlands		.46	.13	– .03	– .21	.23				
Belgium		.22	.40	.00	– .16					

See footnotes to Table 7.

[1] Lagged one period. [2] Beta coefficients, defined as the coefficient of the variable multiplied by the ratio between the standard deviation of the variable and that of the dependent variable, indicate the importance of each variable in the overall regression.

(ii) To some extent, the close cross-country relationships between movements in nominal yields may reflect simultaneous responses to real disturbances of various kinds, not all of which originated in the United States. The oil shocks affected many economies in similar ways and longer-standing structural imbalances have been evident in many countries.

Bearing in mind these reservations, some inferences about the order of magnitude of international influences on interest rates can be made from the above results. The coefficients of the US yield term in the equations in Table 7, adapted – where relevant – to include lagged adjustment effects, have values ranging from 0.1 to 0.5 for most European countries and Japan. Applied to the rise of about 4 percentage points on balance in US yields between early 1979 and mid-1984, they suggest that US yields could have contributed at most ½ to 2 percentage points to the measured change in yields over this period in these countries and to keeping them correspondingly higher than they might otherwise have been.

It is not surprising to find close relationships between yields in Germany and those in other European countries, given the increasingly synchronised developments in short-term interest rates in the markets concerned. It should be pointed out that, in contrast to yields in the United States, yields in Germany are now scarcely higher than they were in early 1979. It seems unlikely that linkages among European markets have, per se, placed much upward pressure on yields in individual countries.

Although no very definite conclusions about the impact of external trade and budget imbalances seem warranted, the introduction of such variables generally improves the explanatory power of the equations for countries with sensitive market-oriented yield-setting mechanisms, without lowering the coefficient (or significance) of the foreign yield term. In a number of cases, the Beta coefficients for the variables concerned suggest that they have a significant impact on changes in interest rates.[28] The question of

[28] In the case of Germany they substantially raise the explanatory power of equations without lagged yield terms.

whether they capture international portfolio-balance effects in a meaningful way or simply reflect the impact of imbalances in the economy is left open here.

Comparison of the various influences on long-term interest rates (see also Table I in the annex) suggests some interesting differences between countries' situations. Domestic money-market rates are still the major influence on yields in France, Italy, Belgium and the United Kingdom, which to a degree is to be expected in the case of countries whose markets are protected by exchange or other controls or whose currencies are floating independently. That expectational links with yields abroad seem to be particularly strong in the case of Canada and the Netherlands (considered vis-à-vis Germany) testifies to the close integration of the capital markets in these countries with the financial markets in neighbouring countries. In the case of many other countries – most notably that of Japan and Germany – the major influence from abroad seems to come directly from foreign short-term rates. This tendency for long yields to respond to movements in short rates abroad at times when domestic short rates seem to move independently may seem somewhat puzzling. But, as suggested above, it could be indicative of the market's belief that the authorities might adapt their policies to resisting depreciation of the currency or, alternatively, of concern that currency depreciation would tend to culminate in rises in the domestic rate of inflation and in nominal interest rates.

The magnitude of the estimated underlying yield differentials clearly varies from one estimation period to another under the influence, in particular, of changes in monetary policy. While the (statistically significant) underlying yield differentials between European countries are close to the corresponding average inflation differentials, significant underlying yield differentials vis-à-vis the dollar are difficult to distil econometrically. The differentials obtained differ markedly in most cases from the average differences between recorded inflation rates in the United States and other countries. Within the EMS periodic central exchange rate adjustments have typically served to counterbalance past

divergences in inflation rates, and the markets no doubt take this into account. In the case of currencies which have been floating independently inflation differentials must have been more difficult to predict, but it is possible that, in addition, real ex ante interest rate differentials have also been less stable.

V
Exchange rate expectations, the international interest rate transmission process and its implications

One of the most striking characteristics of international yield relationships is the extent to which they have at times diverged from contemporaneous inflation differentials. This can be seen in Graph 2, which uses changes over four quarters in price indices for consumer expenditure in the comparison.[29] It strongly suggests that expected long-term inflation differentials do not always respond mainly to contemporaneously reported price data or that real rate differentials vary widely over time. Since the early 1970s international inflation differentials have typically been much more volatile than yield differentials, but in certain periods, or on average over long periods of time, the yield and inflation differentials have been quite closely related.

In many cases the relationship seems to have changed over time. In the 1973–79 period the surge in recorded inflation rates in most countries relative to inflation rates in the United States (and Germany, where, for a time, the inflation rate was much lower than that in the United States) was not reflected in yield differentials, perhaps because it was initially unexpected and then thought likely to be transient. After 1979 inflation rates in Canada, France and Italy at times rose sharply again in relation to the inflation rate in the

[29] Consumer expenditure deflators may be free of some of the distortions in the consumer price index known to have been caused at times, particularly in the United States, by the way in which mortgage interest rates enter into the housing component.

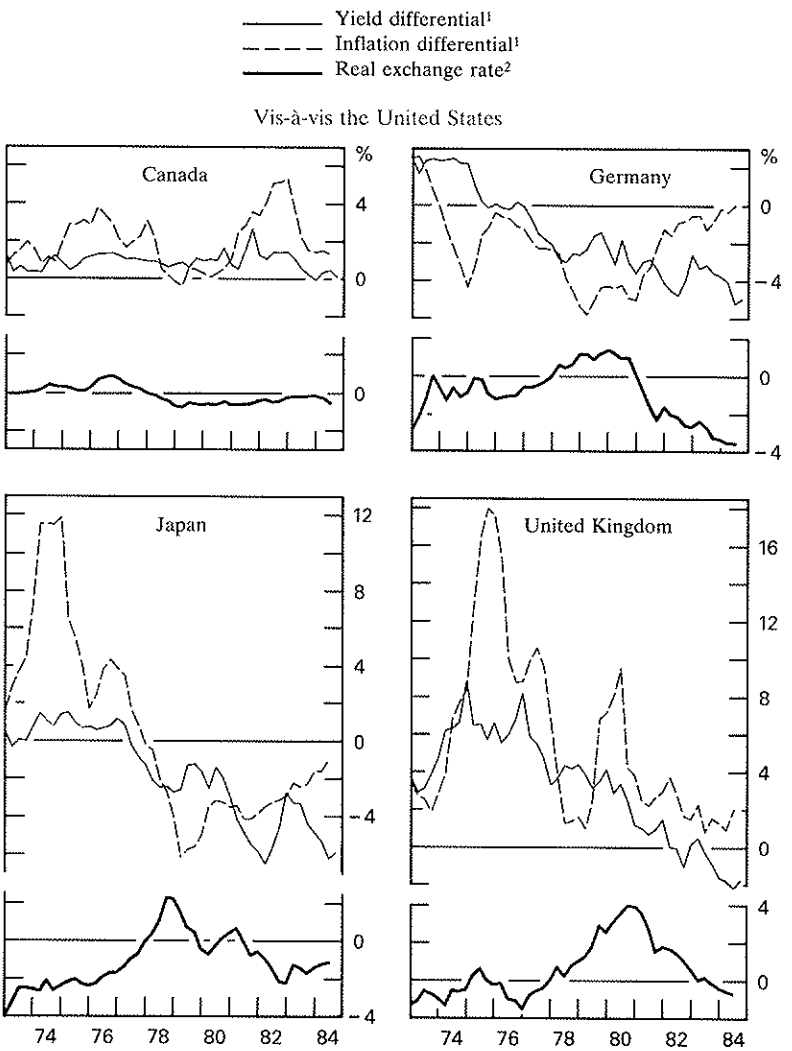
United States to an extent which was not fully reflected in yield differentials. In the case of Japan, Germany and Switzerland, however, yield differentials vis-à-vis the dollar became more volatile, fluctuating as much as or more than inflation differentials. The graphs show the inflation indicator moving well below the yield indicator in 1978–79 and, after a sharp change in direction, rising well above it in 1980–81 as inflation slowed down in the United States. In the following period both curves show fluctuations, but between 1981 and mid-1984 a marked widening, on balance, of the gap between them is revealed in each case. Gaps of this kind may be indicative of higher real interest rates in the United States than in other countries.

It is, of course, true that current inflation rates may not accurately reflect long-term inflation expectations, which are subject to inflation experience over longer periods. Many independent measures suggest that in the United States, in particular, the experience of unprecedented rates of price increase in the late 1970s caused inflation expectations to ratchet upwards and recent inflationary performance has been attributed in part to a strongly rising dollar. Inflationary shocks must also have tended to break down money illusion elsewhere, though in some cases confidence in the determination of the authorities to restore price stability in the medium term remained strong.[30] However, even indicators which allow for more stable or model-based long-term inflation expectations generally imply that real bond yields in the United States have become more volatile and have risen on balance since 1979. The indications available for other countries seem consistent with the view that real interest rates have been less volatile and have typically risen less than real interest rates in the United States (e.g. Cumby and Mishkin (1984)).

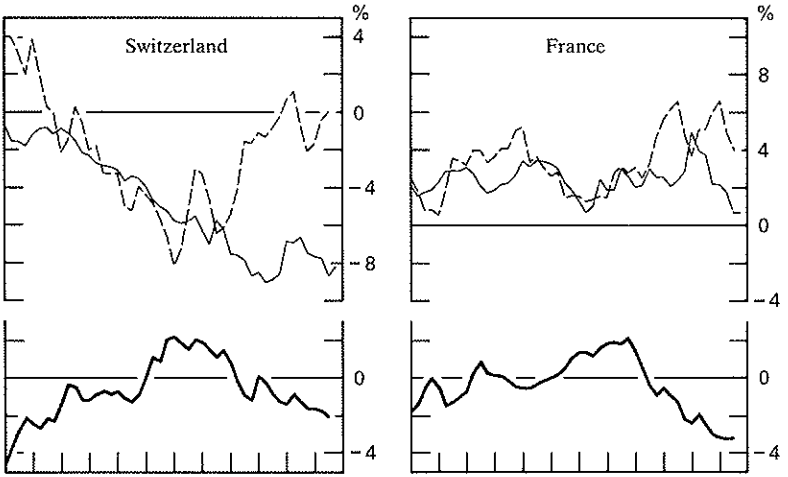
[30] Since 1979 bond yields in the United States have on average shown stronger (though much less than full) immediate responses to changes in rates of consumer price inflation than in the pre-1979 period, but this need not imply that reactions to rises and falls were symmetrical. Similar, though less marked, changes seem to have taken place in some other countries.

Graph 2

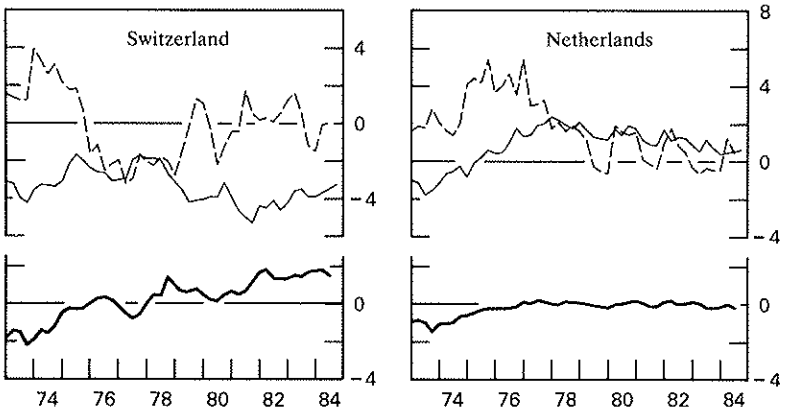
Long-term interest rate differentials, inflation differentials and the real exchange rate



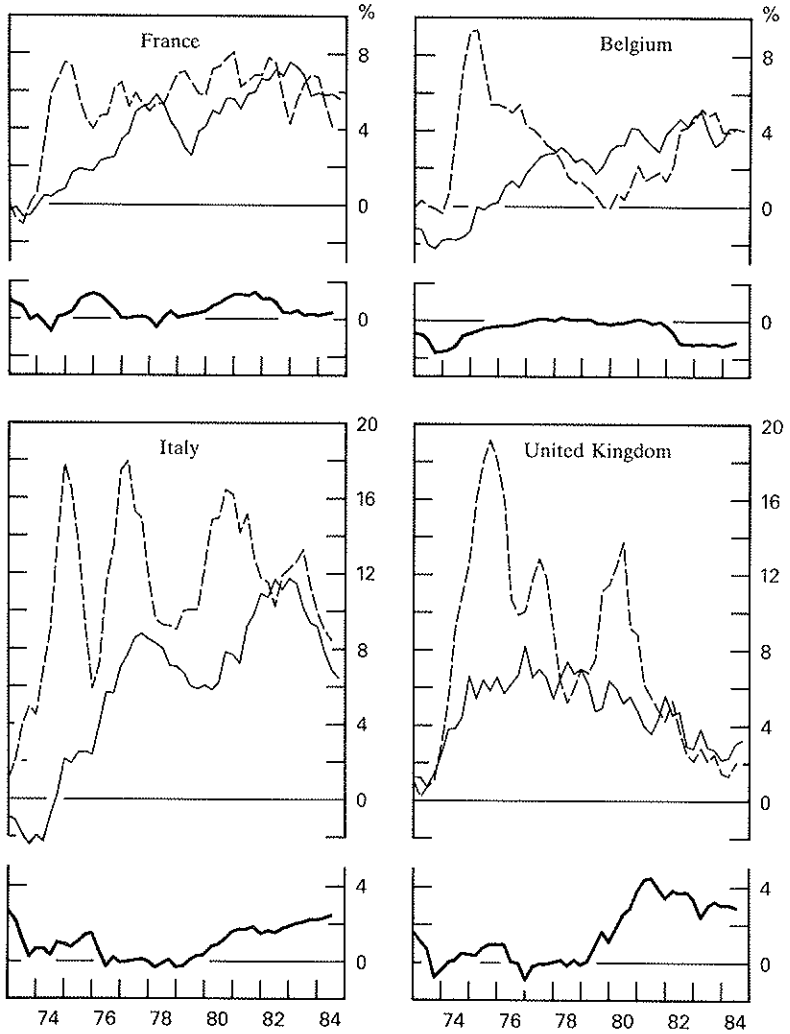
Graph 2 (continued)



Vis-à-vis Germany



Graph 2 (continued)



[1] Domestic minus foreign.
[2] Fourth quarter 1977 = 0 (as explained in the text on page 54).

Explanations for the rise in real interest rates in the United States differ in the weight they attach to changes in the Federal budget deficit, in monetary policy, in financial deregulation and in the profitability of investment. As a result, views about the extent to which real rates incorporate risk premia of various kinds and about how long they are likely to remain high also differ. In any event, while capital inflows from abroad have probably kept real interest rates in the United States lower than they might otherwise have been, they have tended to raise real rates abroad.[31] However, the real interest rate linkages must have been conditioned by exchange rate developments.

According to one view of flexible exchange rates, interest rate rises in a single country, insofar as they reflect changes in expectations about the domestic rate of inflation, would tend to be associated with a weakening of the spot exchange rate and would not normally be mirrored in yields elsewhere. Real interest rate rises, on the other hand, would tend to be associated more with a strengthening of the country's currency and could, at the same time, tend to be transmitted to other countries.

A comparison based on the numbers of months in which the direction of the movement in other countries' bond yields was the same as that of US yields shows a distinct rise (as a proportion of all cases) in the post-1979 period. For instance, US and German yields both rose or fell in 51 per cent. of the months included in the 1973–79 period and in 62 per cent. of the months in the post-1979 period. Between the two periods there was also a distinct increase in the share of cases in which a rise in US yields was associated with a strengthening of the bilateral dollar exchange rate (from 57 to 67 per cent. of cases involving the Deutsche Mark). More particularly, changes in real yields predominated in the 1980–81 period when

[31] Rough indications of international relationships among real interest rates (using averages of backward and forward-looking measures of changes in consumer prices) appear in Table II of the annex. These show that many of the relationships became much stronger in the post-1979 period. In this period some of the strongest relationships among the changes, in particular, are ones involving the dollar.

monetary policy in the United States had to struggle against entrenched inflationary expectations and in 1983–84 when market sentiment was dominated by changing assessments of the profitability of investment in the United States and by the outlook for the evolution of the Federal budget deficit.

Expectations of exchange rate changes going beyond expected changes in relative prices (i.e. changes associated with overshooting) have been identified as one factor which could permit real interest rates in different countries to diverge. Portfolio-balance effects are another. In practice, exchange rate overshooting is usually identified by large movements in real exchange rates which may not be justified by fundamentals, though judgements about the latter may differ widely. The lower curve in each panel of Graph 2 is, in effect, an index of real bilateral exchange rates. It shows movements in the nominal exchange rates adjusted for relative price movements as measured by the consumer expenditure deflators. The fourth-quarter 1977 base is somewhat arbitrary, but at that time inflation rates were relatively low (between the two oil shocks), while international yield and inflation rate differentials were small and less divergent than at most other times during the past decade. In any case not too much importance need be attached to the level of the curves and these bilateral exchange rates should not, of course, be interpreted as indicators of trade competitiveness.

In the graphs changes in real exchange rates in relation to the base period are scaled by averaging them over ten years so as to facilitate comparison with the inflation and yield differentials. The curves may therefore be interpreted as indicators of the rough allowance for exchange rate overshooting that market participants might make in forward-looking long-term international yield comparisons, on the assumption that the base period real exchange rate relationships were likely to be re-established in the long run.[32]

[32] For example, the 30 per cent. real depreciation of the Deutsche Mark against the dollar between the fourth quarter of 1977 and the second quarter of 1984 translates into an allowance for expected real appreciation at a compound annual rate of about 3.5 per cent. (the rate needed to bring the index of the real exchange rate back to 100).

In interpreting the movements allowance must, of course, be made for any changes that have taken place since 1977 in the equilibrium exchange rate of the dollar vis-à-vis certain other currencies. It is likely that such changes have taken place but most improbable that these could explain all of the movement in the real exchange rate of the dollar over this period.

The most striking feature of a comparison of the three curves is the extent to which "real" yield differentials vis-à-vis the United States have been associated with changes in real bilateral exchange rates, particularly in the post-1979 period when real dollar exchange rates moved over a wide range but rose strongly on balance. In the previous period a weak dollar vis-à-vis many other currencies in real terms was associated with relatively low real interest rates in the United States, whereas subsequently a strong dollar accompanied relatively high real interest rates there.

These relationships, which are particularly noticeable in the case of Japan, Germany and Switzerland and only slightly less so in that of France and Italy, are of the kind which would be predicted from the overshooting hypothesis. (They might be partly explained, it is true, by larger risk premia, with other factors accounting for the progressive rise in the dollar over time.) In some cases real yield differentials may have narrowed in 1982. After early 1983, however, with the dollar rising further, differentials between yields in the United States and those in Japan, Germany, Switzerland and the Netherlands widened substantially at a time when the current inflation rate advantage of these countries in relation to the United States was apparently being further eroded. By mid-1984 in the case of these countries and of France the gap between the two types of differential was large relative to that recorded at any time at least since the mid-1970s. It is possible that the market is discounting a risk of some rise in the inflation rate in the United States. In any case there seems to be a presumption that real yields in the United States, though now quite high, are not expected to remain so high on a permanent basis, and that this has tended to limit their transmission to other countries.

The cases in which the pattern of interest and exchange rate relationships seems to have been different are also interesting. In that of Canada, the real US dollar exchange rate and nominal yield differentials vis-à-vis the United States remained comparatively stable throughout the 1973–84 period. The same can be said of real exchange rate and yield relationships in the post-1976 period between Belgium and the Netherlands, on the one hand, and Germany, on the other. Whereas in the case of Belgium the nominal yield differential has risen over time, in that of the Netherlands it has declined steadily. Where experience has seemed to justify expectations of stable exchange rates, nominal yields seem to have become closely related – more so, apparently, than measured inflation rates.

Past experience of strong real appreciation of the Swiss franc may help to explain why real yields in Switzerland have in recent years been persistently low in relation to those in Germany. Here too, however, nominal yield comparisons may have played a rôle. For France and Italy changes in real DM exchange rates have also been kept relatively small by periodic exchange rate adjustments, which have apparently served to correct for relatively high inflation rates previously. Nominal yields may have been influenced mainly by domestic factors. That the persistently low – and often apparently negative – real yields seen in the 1970s in these two countries are no longer in evidence may, however, owe something to an increase in the rôle of external influences.

In the case of the sterling/dollar and sterling/Deutsche Mark exchange rates the relationships are different again and appear consistent with the widely held view that, in certain periods, the real exchange rate of sterling underwent large oil-related changes. However, the absence of significant real yield differentials between Germany and the United Kingdom as from early 1982 and the relatively stable real bilateral exchange rate are striking.

That interest rates in many countries have been insulated to some extent from rises in real interest rates in the United States suggests that flexible exchange rates might give countries some

protection from certain kinds of external shock. But there are questions about how long this experience can continue before portfolio effects come into play and how far the experience can be generalised. Moreover, as indicated above, the insulation has been achieved only with the help of large swings in real exchange rates.

The costs of such swings are well understood. They include the impact of distorted price signals on investment and the international allocation of resources, the danger that unsustainable current-account positions will foster protectionist pressures, the risk that the correction which ultimately proves necessary will have unfavourable effects on output and employment and the possibility that disorderly movements in exchange rates could call for exchange-market intervention to an extent which comes into conflict with the objectives of monetary policy. As mentioned above, stable or declining dollar commodity prices and the availability of domestic unemployed resources, which have helped to dampen the domestic inflationary effects of currency depreciation and enabled countries to achieve some terms-of-trade gains, have helped to make dollar appreciation less unacceptable than it might otherwise have been, but the long-run effects remain to be seen. Moreover, currency movements probably protect countries only against temporary changes in real interest rates abroad or, in the context of more lasting rises, for a temporary period only. Ultimately in closely integrated financial markets the influence of the exchange rate régime on real interest rate relationships may be much more limited and any more lasting element in changes in real rates – due to changes in returns on investment – seems likely to spread from one country to another.

VI
Conclusions

This paper has sought to cast some light on relationships among interest rates in industrial countries. A brief review of the analytical literature indicated that the linkages might be expected to depend

mainly on (i) the freedom of international capital movements; (ii) the exchange rate régime and the factors underlying exchange rate expectations; (iii) the substitutability of assets denominated in different currencies; and (iv) the causes of changes in interest rates abroad. Some empirical regularities in international relationships among short and long-term interest rates were then examined. These suggest the following broad conclusions.

Firstly, the strength of the linkages between nominal interest rates in different countries depends on the degree of international integration of financial markets. They seem to have become stronger in cases where there was little or no recourse to controls over international capital movements or where exchange controls were abandoned.

Secondly, in a context of large variations in interest rates in the United States since 1979, as well as a substantial rise in US interest rates in real terms, other countries attempted in certain periods to "decouple" short-term interest rates in their own markets from money-market rates in the United States. To a degree they were able to do so – by accepting large movements in the dollar exchange rates of their currencies, though to some extent exchange-market intervention or exchange controls helped to take some of the strain.

Thirdly, longer-term interest rate developments have increasingly come to reflect market expectations and they indicate growing interdependence of the major financial centres. Bond yields in many countries continued to be influenced significantly by bond yields in the United States. In some cases bond yields at times remained high even when domestic money-market rates were moving down or rose when domestic short-term rates remained stable. High real yields in the world's largest financial market emerge as a potentially strong influence on yields elsewhere. Nonetheless, indications were found that currency movements might to some extent have shielded long-term rates outside the United States.

What implications can be drawn from these conclusions? Since the nature of the linkages between yields in different countries

seems to depend heavily on exchange-market expectations, which may be based on many things, the influence of policy-makers in individual countries can at times be limited. However, the outlook for relative rates of inflation and current-account positions must be a major influence in the long run and these can without question be affected by monetary and other economic policies. Vulnerability to real interest rate pressures from abroad depends not only on whether domestic and foreign assets are close substitutes and on whether exchange rates move in a protective way but also on the expected repercussions of real exchange rate changes in the domestic economy.

It has been pointed out that these repercussions are not confined to the financial markets but will also be felt in the external current account, economic activity and employment. Here, too, the degree of protection will depend on the effectiveness of domestic policies in keeping inflation under control. Wage-fixing procedures which allow past rises in the prices of imports to have a large and prompt impact on wages are bound to be particularly unhelpful. Experience suggests that insulation can be fairly effective even in the case of real interest rate pressures which last for a considerable length of time. To the extent that changes in real interest rates abroad prove lasting, however, and that capital flows to more profitable areas in the world economy raise real rates elsewhere, remedies would have to be sought mainly in structural changes designed to improve the prospective profitability of investment at home.

Recourse to new exchange and capital controls or to taxes on external transactions has been suggested as one possible course of action. While unilateral measures of this kind may seem to offer at least temporary relief, this type of action has often proved to be ineffective and increasing interdependence could make it even more so. It could at the same time lead to a severe disruption of international financial and economic relationships.

A different kind of proposal is for a return to some kind of fixed but adjustable exchange rate system to which monetary policy in most countries might to a considerable extent be geared. To a

degree, this is what some countries have already done, on a regional scale, in the context of the European Monetary System. The experience of the EMS countries shows, of course, that the smooth functioning of such an arrangement calls for appropriate domestic policies. Any attempt to stabilise rates more generally would seem to call for more confidence than has yet been established in the ability of all major countries not only to preserve a high degree of price stability, but also to avoid major imbalances in other spheres.

A more gradualist approach would rely on persistence with stable monetary policies combined with efforts to reduce international policy divergences of other kinds. These efforts are the more likely to be effective to the extent that countries are prepared to define their own interests in a realistic, but long-term way.

Annex: data sources

Domestic short-term interest rates: Representative rates for three-month instruments except in the case of France (one-month), Italy (day-to-day), Belgium (four months) and (prior to February 1977 only) Japan (call money). For the United States, commercial paper; for Canada, finance company paper; for Japan, bonds trading under repurchase agreements (Gensaki rate); for Belgium, certificates of the Security Fund; for Switzerland, Euro-currency rate; for other countries, domestic interbank rates. For the United States, Japan and Switzerland, monthly averages; for other countries, month-end data. Source – central banks.

Domestic long-term interest rates: Representative yields. For the United States, AAA corporate bonds; for Canada, industrial bonds; for Germany and France, public-sector bonds; for Italy, bonds of special industrial credit institutions. Central government bonds for Japan, United Kingdom (twenty years), Switzerland, the Netherlands (latest three issues) and Belgium. For the United States, Germany and the Netherlands, monthly averages; for other countries, month-end. Source – central banks.

International short-term interest rates: Euro-currency rates at maturities corresponding to the domestic rates (for Belgium, financial franc). Source – BIS.

International long-term interest rates: For Germany, yields on DM bonds of foreign issuers (source – Bundesbank). For the United States, long-term private-sector bonds; for France, three to seven-year bonds; for the Netherlands, guilder notes at over three years. Source – OECD.

Exchange rates: Domestic currency units per dollar or per Deutsche Mark. Monthly averages. Source – BIS.

Divergence indicators: Monthly averages. Source – BIS (based on ECU exchange rates published by EEC).

Central-bank net foreign assets: Valuation-adjusted domestic-currency data relating to changes in central-bank money (Germany), the monetary base (Italy) and bank liquidity (France) or from central-bank balance sheets (the Netherlands and Belgium).

Trade balances: For the United Kingdom, balance-of-payments basis. For other countries, exports (f.o.b.) minus imports (c.i.f.), trade basis. Seasonally adjusted. Data supplied by central banks.

Central-government cash deficit: Public-finance basis. For Canada, budget balance; for Japan, balance on general account; for the United Kingdom, borrowing requirement (sign reversed); for Germany, Federal Government cash surplus; for Italy, net of funding operations; for the Netherlands, financial balance; for Belgium, net Treasury financing requirement. Data supplied by central banks.

Consumer price and consumer expenditure deflators: Based on data from national sources supplied by central banks.

Annex Table I

Influences on monthly changes in bond yields

	Constant	I. Foreign yield "surprises"[1]	II. Foreign short-term rate	III. Domestic short-term rate	Lagged yield differential[2]	Lagged domestic yield[3]	rho	S.E.	$\bar{R}^2$	D.W./h	Partial R^2: coefficients I	II	III
Relationships with yields in the United States													
April 1973 to March 1979													
Canada	.12 (1.46)	.70 (4.19)	.16 (3.77)	.08 (2.33)	− .06 (−1.27)			.15	.51	2.08	.12	.25	.12
Japan	− .01 (− .26)	.17 (.68)	− .01 (− .01)	.18 3.78)	− .02 (− .92)			.22	.14	1.75	.00	.00	.18
United Kingdom	.51 (1.46)	1.48 (1.48)	− .04 (− .30)	.33 (4.57)	− .10 (− .10)			.67	.30	2.16	.04	.00	.25
Germany	− .01 (− .59)	.38 (1.85)	.01 (.29)	.12 (2.68)	− .01 (− .62)	.45 (4.22)		.18	.38	− .43	.03	.01	.14
Switzerland	.00 (.17)	.29 (1.96)	.04 (1.30)	.21 (5.63)	.01 (.68)	.20 (2.13)		.13	.45	− .84	.05	.04	.31
France	.01 (.18)	.09 (.56)	.00 (.05)	.13 (5.62)	.00 (.05)	.35 (3.66)	− .11	.14	.43	−1.14	.00	.00	.31
Italy	.13 (1.71)	− .14 (− .36)	− .04 (− .52)	.15 (4.79)	− .02 (−1.16)	.23 (2.28)		.33	.37	.75	.00	−.01	.30
Netherlands	.01 (.33)	.79 (2.88)	.11 (2.11)	.09 (4.65)	− .01 (− .32)			.24	.38	2.21	.06	.09	.25
Belgium	.03 (1.38)	.10 (.51)	.04 (1.11)	.07 (3.13)	− .06 (−1.48)			.17	.16	2.11	.00	.02	.14
April 1979 to June 1984													
Canada	.26 (2.15)	1.17 (6.72)	.04 (.62)	.24 (2.97)	− .14 (−1.87)		− .21	.51	.55	2.22	.26	.03	.17
Japan	− .03 (− .27)	.09 (.85)	.14 (5.38)	.17 (2.50)	− .01 (− .23)			.28	.41	2.25	.01	.32	.10
United Kingdom	.00 (.04)	.12 (.77)	.08 (2.17)	.36 (6.52)	− .01 (− .21)			.41	.44	2.17	.01	.05	.40
Germany	− .10 (−1.16)	.20 (2.90)	.10 (5.75)	.16 (4.54)	− .03 (−1.27)	.43 (5.72)	− .16	.20	.67	− .62	.06	.22	.19
Switzerland	.08 (.58)	.19 (3.46)	.03 (2.04)	.14 (5.09)	.01 (.48)		− .16	.16	.50	2.04	.11	.07	.29
France	.26 (2.79)	.21 (1.97)	.06 (2.20)	.23 (6.19)	− .12 (−2.65)	.18 (2.04)		.29	.44	− .57	.02	.07	.35
Italy	.23 (1.63)	.01 (.11)	− .02 (− .79)	.13 (1.70)	− .05 (−1.74)	.48 (4.23)		.33	.32	− .83	.00	.00	.07
Netherlands	− .05 (− .52)	.36 (3.16)	.10 (3.59)	.06 (1.38)	− .02 (− .57)	.26 (2.39)		.30	.34	−1.05	.12	.16	.04
Belgium	.04 (1.20)	.17 (2.51)	.03 (1.90)	.11 (3.32)	− .03 (− .77)			.24	.23	1.93	.05	.04	.17
Relationships with yields in Germany													
April 1973 to March 1979													
United Kingdom	.74 (2.75)	− .02 (− .04)	.04 (.25)	.31 (4.43)	− .13 (−2.84)			.66	.32	2.29	.00	.00	.23
Switzerland	− .07 (−1.10)	.23 (2.71)	− .01 (− .33)	.21 (5.43)	− .02 (− .84)	.13 (1.37)		13	.46	− .65	.10	.00	.31
France	.06 (2.05)	.10 (1.15)	.02 (.72)	12 (5.26)	− .02 (−1.93)	.24 (2.49)		14	43	− .91	.02	.01	.29
Italy	.12 (1.81)	.31 (1.50)	10 (1.35)	.13 (4.57)	− .01 (−1.10)	.20 (1.98)	.17	.32	36	1 03	.03	.02	.26
Netherlands	.03 (.90)	.58 (4.15)	01 (.10)	.09 (4.94)	− .02 (−1.07)			.23	.42	2.31	.17	.00	.25
Belgium	.03 (1.25)	.04 (.39)	− .04 (− .96)	.08 (3.35)	− .02 (−1.46)			.17	.17	2.20	.01	.01	.16
April 1979 to June 1984													
United Kingdom	.23 (1.40)	.27 (1.38)	.21 (3.35)	.38 (7.36)	− .06 (−1.31)			.38	51	2.09	.02	.08	.42
Switzerland	− .07 (− .42)	.24 (2.69)	.04 (1.46)	.14 (4.45)	− .02 (− .47)			.16	.42	2.13	.10	.05	.29
France	.48 (2.64)	.33 (2.09)	− .01 (− .23)	.23 (5.42)	− .08 (−2.52)	.16 (1.73)	− .13	.30	.53	− 91	.05	.00	.35
Italy	.31 (1.54)	14 (.79)	.02 (.39)	.14 (1 77)	− .04 (−1.60)	.42 (3.70)		.33	.33	− 52	.01	.00	.07
Netherlands	.13 (1.38)	.89 (6.09)	.15 (2.95)	.02 (.55)	− .12 (−1.47)			.28	43	1.91	.33	.10	.01
Belgium	.43 (3.24)	.24 (2.05)	06 (1.56)	.08 (2.53)	− .11 (−2.99)			.22	.32	2.10	.05	.05	.13

See footnotes to Table 7.

The partial R^2 coefficients shown are for the first, second and third independent variables.

[1] Residual from regression of foreign yield on foreign short-term interest rate, current and lagged (one to four periods).

[2] Domestic minus foreign yield (levels), lagged one period.

[3] Lagged one period.

Annex Table II

Correlation coefficients between levels of real bond yields in*

	CA	JP	GB	DE	CH	FR	IT	NL	BE	US
April 1973 to March 1979										
and										
CA	1.00	.64	.23	.33	.76	.64	.30	.27	.50	.81
JP	.64	1.00	.24	.00	.76	.81	.77	.60	.71	.62
GB	.23	.24	1.00	−.11	.16	.39	.39	.69	.68	.05
DE	.33	.00	−.11	1.00	.38	−.08	−.49	−.24	−.37	.26
CH	.76	.76	.16	.38	1.00	.69	.44	.30	.42	.83
FR	.64	.81	.39	−.08	.69	1.00	.78	.49	.75	.78
IT	.30	.77	.39	−.49	.44	.78	1.00	.63	.81	.40
NL	.27	.60	.69	−.24	.30	.49	.63	1.00	.82	.05
BE	.50	.71	.68	−.37	.42	.75	.81	.82	1.00	.36
US	.81	.62	.05	.26	.83	.78	.40	.05	.36	1.00
April 1979 to July 1984										
CA	1.00	.74	.80	.83	.46	.88	.86	.82	.27	.88
JP	.74	1.00	.87	.71	.06	.81	.91	.86	.43	.90
GB	.80	.87	1.00	.82	.23	.93	.88	.82	.42	.97
DE	.83	.71	.82	1.00	.47	.80	.78	.79	.49	.85
CH	.46	.06	.23	.47	1.00	.25	.20	.15	.22	.26
FR	.88	.81	.93	.80	.25	1.00	.86	.87	.29	.95
IT	.86	.91	.88	.78	.20	.86	1.00	.85	.29	.93
NL	.82	.86	.82	.79	.15	.87	.85	1.00	.22	.86
BE	.27	.43	.42	.49	.22	.29	.29	.22	1.00	.41
US	.88	.90	.97	.85	.26	.95	.93	.86	.41	1.00

US=United States, CA=Canada, JP=Japan, GB=United Kingdom, DE=Germany, CH=Switzerland, FR=France, IT=Italy, NL=The Netherlands, BE=Belgium.

* Nominal interest rates minus a centred twelve-month moving average of changes over twelve months in consumer price indices.

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