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The Information Content
of Interest Rate Spreads
Across Financial Systems

**Frank Browne,
Warren Tease**

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The Information Content of Interest Rate Spreads Across Financial Systems

This paper examines whether information asymmetries and agency costs vary across OECD countries depending on the nature of their financial system. It does this by examining whether the predictive power of the spread between yields on private and government securities (which, it has been argued, reflects such factors) varies across countries. The results indicate that the information content of the spread is highest in those countries with market-based financial systems.

Cette étude a pour objet d'examiner si l'asymétrie d'information et les coûts d'agence varient d'un pays de l'OCDE à l'autre en fonction de la nature du système financier national. Il s'agit de savoir si le pouvoir prédictif de l'écart de rendement entre les titres privés et publics (censé refléter ces facteurs) varie d'un pays à l'autre. A en juger par les résultats obtenus, c'est dans les pays avec un système financier de marché que l'écart de rendement est le plus informatif.

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The Information Content of Interest Rate Spreads Across Financial Systems

by
Frank Browne and Warren Tease (1)

I. Introduction

Recent empirical evidence in the United States has indicated that the spread between the yield on risky (corporate) debt and the yield on government securities provides significant information about the future course of real economic activity. Indeed, in some studies the spread outperformed most others as a leading indicator. This result has stimulated attempts to establish, theoretically and empirically, why the spread seems to be so informative.

To date, a number of alternative explanations have been proposed. One has focused on the interaction between monetary policy and the costs of substituting between bank credit and securities finance. Tighter policy, it is argued, increases the cost or reduces the availability of funds to banks, forcing them to either increase loan rates or reduce lending. This encourages firms to borrow in the commercial paper market; increasing yields there. If tighter money eventually affects output then the spread and output will also be related. Another has concentrated on the idea that different groups of market participants do not have access to the same quality of information. "Insiders", whether managers or managers in conjunction with owners of businesses, have superior information to "outsiders", e.g. financial markets. These insider-outsider conflicts of interest cannot be fully resolved. Therefore, providers of outside finance demand a premium for lending to firms. If bank finance and other sources of finance are imperfect substitutes then these informational deficiencies -- be they due to agency costs or asymmetric information -- have real effects. When they increase banks respond by charging a premium on loans and/or by rationing credit. To the extent that these informational problems exist they probably reinforce the monetary policy-spread-output argument noted above (2).

Given the absence of default risk, asymmetric information problems are not an important feature of government bond markets. Changes in the spread between private and government interest rates of the same maturity could accordingly encapsulate changes in asymmetric information premia.

No clear conclusion about which of these interpretations is correct has been drawn from results based on data for the United States. A common finding is that when monetary policy is controlled for the information content of the spread is reduced. Nevertheless, it retains some predictive power.

This paper examines the role of the spread across a number of countries that have very different financial systems. There are substantial differences in the way financial markets are organised across the major OECD countries.

These have been well documented elsewhere (see, for example, Bisignano, 1990). In bank-based financial systems (Japan and continental European countries) agency costs should be reduced. This is because banks generally have close ties with, and also more specifically hold equity in, non-financial companies (Prowse, 1990). This suggests a greater community of interest between banks and the corporate sector and a corresponding closer sharing of information. This contrasts with market-based financial systems (the United States, the United Kingdom and Canada) where banks tend to have a more arm's-length relationship with the non-financial corporate sector and are generally prohibited by regulation from holding shares in the latter. One would therefore expect information asymmetries and agency costs to be more important features of these systems. Therefore, changes in spreads, to the extent to which they capture variations in asymmetric information, should have lower information content for future output in countries which have bank-based financial systems than in those with market-based systems.

Regardless of the rationale for the spread-activity relationship, most of the emphasis up to now has been on its cyclical nature. However, there may also be a separate longer-term dimension. The process of financial market deregulation and innovation has thrown up an array of new financial instruments which may be progressively lessening agency costs. If, indeed, financial innovation reduces agency costs then the relationship between the spread and corporate investment and output could be loosening with time. There may, however, be offsetting effects; principally a shift away from bank lending (where agency costs are low) to direct financing (where agency costs may be higher). A discussion of these points will be taken up below. Some tests are carried out in the paper to detect any trend change in the relationship.

Section II of the paper briefly reviews the existing literature on the forecasting power of yield spreads. Section III presents a simple model commonly used to assess the information content of the safe-risky spread for future economic activity. Some potential pitfalls in the approach employed are also discussed. Section IV presents the results obtained and Section V is devoted to some concluding comments.

II. Literature Review

The results of the available empirical literature can be summarised as follows. The spread is an extremely good leading indicator. Indeed, it is better than many commonly used leading indicators. However, when monetary policy variables (the Federal Funds rates in the United States) are included in forecasting equations, the predictive power of the spread is reduced but not eliminated.

Stock and Watson (1989) tested the leading indicator value of a wide variety of real and financial variables. They discovered that both the inverted treasury bond yield curve and the matched-maturity short-term commercial paper-treasury bill spread are statistically significant forecasters of declines in economic activity. Friedman and Kutner (1989) also show that this yield spread contains highly significant information about the future evolution of real income regardless of the sample period investigated. They also conclude that this interest differential better represents the information that is relevant for future output changes than either rate separately. For

the interwar period Bernanke (1983) had earlier shown that the Baa corporate bond-treasury bond spread was a leading indicator of output. Mishkin (1990) has stressed the correlation between yields on securities of varying risk quality on the one hand and subsequent economic recessions and episodes of systemic weakness in the financial system on the other hand.

These results have led to a number of explanations of the information content of the spread. As noted in the introduction, theories based on asymmetric information suggest that cyclical movements in corporate net worth give rise to cyclical movements in the wedge between the cost of external debt finance (bank loans and corporate bonds) and internal finance (which is an opportunity cost probably best proxied by a government security yield). Gertler, Hubbard and Kashyap (1990) provide a theoretical framework for this asymmetric information story (3). They demonstrate that the risky-safe yield spread is a decreasing function of the firm's internal net worth (4). This can be shown to introduce an accelerator-type effect into firms' investment behaviour. They also demonstrate that the optimum level of investment, which would be feasible with perfect or symmetric information, is not attainable if the initial level of net worth falls short of the optimum level of investment. On the other hand, Friedman and Kuttner (1989) suggest that their finding derives from the fact that the spread reflects default risk premia. This explanation is not clearly supported in an examination of the relationship between spreads and default rates by Davis (1990). Davis found that spreads Granger-cause defaults but that defaults do not Granger-cause changes in the spread. (Results for the United States were unambiguous but those for the United Kingdom were mixed.) Furthermore, Bernanke (1990) has suggested that defaults on prime non-financial corporate paper (i.e. the type typically used in most studies) are extremely rare and could not plausibly explain the size of some of the observed swings in the spread.

Perhaps the most persuasive evidence to date comes from Bernanke and Blinder (1989) and Kashyap, Stein and Wilcox (1991) who show that the information content of the spread is to a large extent "absorbed" when a monetary policy variable is included in the estimation. Therefore, part of its predictive power appears to be due to its response to changes in monetary policy. Nevertheless, the spread retains some predictive power suggesting that its information content is not due solely to the way it responds to monetary policy.

III. Testing the Information Content of the Spread

A. Modelling strategy

The econometric work below follows that of earlier studies and tries, where possible, to use the same type of data used in studies for the United States. This is not always possible and an important problem is the lack of data on short-term commercial paper rates for all but the United States and Canada. To overcome this problem, interbank rates were used as a measure of short-term private interest rates and, additionally, spreads between yields on long-term private and government paper were used. The use of the interbank rate cannot directly test for the monetary policy explanation (since that relies on a shift into commercial paper) but does not prevent an examination of the agency costs argument.

First, simple forecasting equations containing lags of the variable to be predicted (growth rates of output and investment) and lags of the spread are estimated. Thus, the first reported equation (Tables 2 and 3) is:

$$\Delta y_t = \alpha + \sum_{i=1}^4 \beta_i \Delta y_{t-i} + \sum_{i=1}^4 \gamma_i S_{t-i} + \xi_t \quad [1]$$

where y_t is alternatively the log of quarterly real GNP or the log of quarterly real business fixed investment, S is the risky-safe yield spread and ξ_t is a random error term with zero mean and constant variance. Under the null hypothesis of no information content $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$.

The next hypothesis to be tested is that the influence of S on y (if any) is not exclusively due to its response to changes in monetary policy. The equation used to this end is:

$$\Delta y_t = \alpha + \sum_{i=1}^4 \beta_i \Delta y_{t-i} + \sum_{i=1}^4 \gamma_i S_{t-i} + \sum_{i=1}^4 \delta_i r_{t-i} + \xi_t \quad [2]$$

where r is a short-term interest rate which reflects the stance of monetary policy. Once again, the null is $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$. If the spread does reflect monetary policy influences then the probability of accepting the null should be higher in equation [2].

B. Caveats

A factor which must be borne in mind when assessing the forecasting performance of the spread is the depth of the asset markets in question. The market to which the risky rate of interest applies could be affected by agency costs but the size of the market itself may be so small that their effect is lost on aggregate output and investment. By way of corollary, as markets become deeper they should come to represent a broader cross-section of market opinion about the future and their corresponding rates of interest should accordingly acquire superior predictive power. For example, firms in continental Europe make very little use of the corporate bond market. Consequently, a failure of the corporate-government bond yield spread to predict output in these countries may simply reflect the shallowness of these markets rather than the absence of agency cost effects.

The variety of possible influences operating on the spread and investment as encapsulated in the above hypotheses is not exhaustive. Davis (1990) adds call risk to the list. This is the risk that the bond issuer may wish to redeem the asset early relative to the desired maturity of the holder

of the asset. The latter may find this inconvenient and may wish to be compensated for the risk of it happening. Call risk varies with the level of interest rates and thus is likely to be cyclical. It may therefore constitute an additional influence on the spread which is not being accounted for in the above tests. This consideration is, of course, less relevant when short rates are used in the spread.

A potential role for "peso" influences on the spread cannot be dismissed either, particularly where long rates are employed in the spread. If the market attributes a positive probability to some event occurring prior to the maturity date of the safe and risky asset this may also affect the yield differential even when the event fails to occur. Examples of this type of "event risk" affecting the spread might be: the possibility of a tax change having differential impacts on the safe and risky asset; the prospect of a change in bankruptcy laws or other regulatory actions bearing on financial markets; the expectation of some new financial instrument being introduced which, as in the case of junk bonds for example, facilitated leverage buyouts and results in widespread downgradings of existing investment grade corporate bonds. However, peso effects are unlikely to be particularly cyclical and therefore the peso component of the spread is not competing with the agency cost component as a factor related to the cyclical variation in output.

IV. Results

A. Graphical evidence

Before proceeding to the econometric analysis, some inkling of the relationship between the spread and economic activity (12 month growth in real GDP) may be had by inspecting Chart 1. A number of points are worth noting from the charts. The first is that during periods of economic uncertainty -- the recessions of the mid-1970s and early-1980s, and the 1987 fall in stock prices -- spreads widened. The experience in the United States, Canada and the United Kingdom is relatively similar. Second, a strong counter-cyclical correlation is immediately obvious particularly for the more market-based systems of the United States and Canada, although in the case of Canada and to a lesser extent the United States this correlation has weakened in the 1980s. There is also, however, a counter-cyclical correlation for the United Kingdom and Germany and a somewhat weaker one for Japan. For France and Italy it is more difficult to detect visually any specific pattern in the relationship. For those countries for which there is an obviously strong counter-cyclical relationship, the spread seems to lead activity by anything from one to four quarters. Finally, the variation in the spread seems lower in the 1980s for the United States, Canada and the United Kingdom. Also, on average, the spreads appear to be lower. This may reflect the relative stability of the 1980s and the deepening of financial markets. The narrowing of the spread seems unusual given the increase in default rates experienced in the 1980s.

B. Empirical results

The results from estimating equation [1] indicate that the spread between short-term private rates and short-term government rates ($r_p - r_g$) has predictive power in the United States and the United Kingdom (5) (see Tables 2 and 3). In Canada, the short-term spread does not have any predictive power.

However, the long-term spread ($R_p - R_g$) does. In all cases where the spread is significant, the sum of the coefficients was negative, suggesting that increases in the spread are associated with subsequent slowdowns in activity.

The results do not indicate any predictive power in the other countries. For example, the results on the short-term spreads for Germany and France seem to be spurious. Because of a lack of data on short-term government securities in these countries, the spread was calculated by subtracting the yield on long-term government bonds from the short-term private interest rate. This potentially biases the results because such a proxy contains term-structure influences which may provide information on the future course of the economy (Estrella and Hardouvelis, 1989). To control for this, the German and French equations were augmented by a term-structure variable constructed from yields on long-term and short-term private paper (Table 5). Once this influence is controlled for the short-term, spread variable no longer has any predictive power.

When the spread was replaced by the short-term interest rate variable (r) in equation [1] it was found to be significant in the output and investment equations in most cases, the exceptions being Japan (output) and the United Kingdom and Canada (investment). The probability that this variable could be excluded from the output and investment equations also appears to be low relative to the probability of excluding many of the interest rate spread variables.

The tests reported so far are not very stringent. They simply examine whether including lags of the spreads into an equation containing lags of the dependent variable significantly enhance its predictive power. Adding further variables could possibly reduce the information content of the spread. For example, Bernanke (1990) and Bernanke and Blinder (1989) have argued that the spread variable contains information on the stance of monetary policy and that adding a monetary policy variable to the equation reduces the significance of the spread (6). To examine this view, augmented forecasting equations (i.e., specification [2] above) were estimated that include both the spread variable and the short-term interest rate variable (Table 4). The short-term spreads remain significant in the United States, France (note the earlier caveat) and the United Kingdom. However, the probability that they could be excluded from the equation does increase substantially. The short-term spread for Germany is no longer significant. The long-term spreads remain significant in Canada but no longer add any predictive power to the equation for the United States. In the other countries the probability that they can be excluded tends to increase when a short-term interest rate is added. Thus, the inclusion of a short-term interest rate variable into the spreads equations tends to absorb some of the information content of the spread. Nevertheless, it appears that the spread retains significant information value in a number of cases (the United States, Canada and the United Kingdom).

C. Is the spread's information content disappearing?

Both Bernanke (1990) and Kashyap, Stein and Wilcox (1991) find that the information content of the spread deteriorated noticeably in the 1980s compared to earlier periods. They argue that this is a reasonable result if changes in the spread are driven by variations in commercial paper issuance. As the market for commercial paper becomes deeper any given volume of issuance will

have a smaller effect on price. Thus even if monetary policy's leverage over bank credit and commercial paper issuance remains unchanged, its impact on the nominal paper rate will fall. The deepening of the market will therefore tend to reduce the forecasting power of the spread (7).

If agency costs are an important factor behind the spread-activity relationship could variations in these explain the deteriorating information content of the spread for the U.S. economy? On the one hand, banks are institutions specialising in information gathering and processing. Because of this specialisation, investors (depositors) delegate banks to invest their funds and monitor those investments on their behalf (Diamond, 1984). This suggests that intermediated financial systems should, in theory, be better than non-intermediated systems at ameliorating agency problems. The relative decline in commercial banking in funding non-financial corporations in several G7 countries could therefore be accompanied by an increase in agency costs. On the other hand, deregulation and the growth of non-intermediated financial markets has been accompanied by substantial financial innovation. According to some (Ross, 1989, for example), "financial innovation arises as a natural adjunct of the supply and demand of agency constrained participants...." (p. 544). If this interpretation is correct, then financial innovation should reduce agency costs. Those financial systems in which banking has been subject to the greatest competitive pressures and whose overall role in funding the non-financial corporate sector has tended to be eroded are also those which have experienced the most widespread innovation. Hence, it is not clear how agency costs will evolve over time. Increases associated with shifts away from bank lending may be mitigated by the diffusion of new financial instruments.

As a preliminary to a more systematic search for a time-varying component in the spread's information content, equations were first estimated by least squares with the data sample restricted to the 1980s. The results are mixed (Table 6). Spreads retain predictive power in the United States and Canada. One of the short-term spreads becomes insignificant in the United States whereas the same variable for Canada becomes significant. The short-term spread variables in the United Kingdom, Germany and France no longer add any predictive power to the equations. During the 1980s, the short-term interest rate variables for the United States and Canada seemed to retain their predictive power. For Japan, France and the United Kingdom the probability that these variables could be excluded from the equation increased but still remained relatively low. No clear pattern emerges from these sub-sample results. It seems that the probability of excluding the short-term spreads and the short-term interest rate variables from the output equation increased somewhat in the 1980s (compare Table 2 with Table 6). Nevertheless, they remained significant in the United States and became significant in the case of the spread variable in Canada.

The time-varying information content of the spread was also examined using recursive regressions (8). The patterns over time for the parameter on the one-period lagged spread for those countries for which the spread contains significant information (i.e. the United States, the United Kingdom and Canada) are displayed in Chart 2. Some diminution in the size of the coefficient on the spread is indicated but only for the United States. Again this is in keeping with the results reported by Bernanke (1990) and Kashyap *et. al.* (1991). No noticeable trends are evident for the remaining two countries. The default risk explanation of the information content of the risky-safe interest

rate spread cannot easily account for any deterioration in information content in the 1980s in the United States. If company defaults continued to be a feature of business cycles and if the spread continued to reflect expected defaults then its information content should not have diminished. Indeed, default rates increased significantly in the 1980s suggesting, on this interpretation, some widening of spreads. This has not been the case.

V. Conclusions

What conclusions can be drawn from these tests? The results suggest that the spread between private-sector and government yields (both short-term and long-term) does not appear to have any significant predictive power in Japan, Germany, France or Italy. In contrast, the spread variable seems to enhance the forecasting performance of the simple equations for the United States, Canada and the United Kingdom. Even when monetary policy influences were controlled for, at least one of the spread variables was significant in each of these countries.

Do these results suggest that asymmetric information problems exist and that they vary across countries reflecting the structure of their financial markets? The fact that the spreads are significant in the United States, Canada, and the United Kingdom -- countries with market-based financial systems and extensive securities markets -- is not inconsistent with this view. Presumably, problems of asymmetric information are greater in those countries where the relationship between banks and their borrowers is relatively loose. In times of uncertainty, banks in these systems may raise the rates charged to good borrowers (since with limited information they cannot distinguish between good and bad risks) and ration credit.

Therefore, although the tests employed may not be sufficiently nuanced to distinguish between the different theories of variation in the spread and its relationship to output, the cross-country results do suggest that, even when monetary policy influences are accounted for, variations in agency costs and information asymmetries may be a source of variation in spreads. A conclusion that these phenomena differ across countries -- being highest in countries with arm's-length banking -- is consistent with other recent empirical evidence. Empirical models of corporate capital structure have shown that measures of the size of potential agency costs have a significant and negative effect on leverage for firms in the United States but not in Japan (Prowse, 1990).

The attempt to detect patterns in agency costs over time, as banking systems evolve and financial innovation occurs, was not successful. A deteriorating information content of the spread did emerge from the result for the United States in keeping with the finding reported by others. However this could be due to any one of a multiplicity of influences operating in the U.S. economy and so no particular inference about trended agency costs is warranted.

Notes

1. The authors are grateful to Steve Englander, Jorgen Elmeskov, Andreas Fischer, Robert Ford, Peter Höller, Paul Francis O'Brien and John Roberts for thoughtful comments on an earlier draft of the paper. Efficient statistical assistance was provided by Laure Meuro and secretarial assistance by Andrea Prowse. All remaining errors rest with the authors.
2. Bernanke and Gertler (1989) and Gertler, Hubbard and Kashyap (1990) show that agency costs and informational asymmetries are counter-cyclical. Thus, tight monetary policy, by reducing future output, may contribute to larger agency costs and widen the spread.
3. The main building-blocks of their model are: a representative firm which plans to undertake investment greater in value than its own net worth (where for the purposes of the analysis net worth can be understood as "internal funds"); to do so it is forced to resort to outside debt funding which is uncollateralised to the extent that the value of the investment project exceeds initial net worth of the firm; a limited liability condition which constrains the firm's payout in the event of bad project outcomes; and an asymmetric information problem which for the purpose of the model is assumed to mean that lenders can only observe realised output but not the investment which the firm undertakes.
4. Although the model presented by Gerther, Hubbard and Kashyap is quite instructive it does have some shortcomings. The standard moral hazard problem giving rise to agency costs of debt finance is that the firm will invest in a much riskier project once debt financing has been acquired. However the alternative facing the firm in the Gerther-Hubbard-Kashyap model is the possibility of secretly diverting funds to a safe asset, i.e. a less risky strategy than that desired by investors.
5. Preliminary results in Table 1 show that real GNP and real business fixed investment are non-stationary and were, therefore, used in first-difference form in the subsequent tests. The evidence on the interest differential and interest rate variables was mixed -- in many cases they appear to be stationary or had test statistics bordering on rejecting the hypothesis of non-stationarity. Consequently, they appear in level form in the equations reported below. Tests using first differences of the variables were also conducted. The results were not qualitatively different.
6. For example, Bernanke and Blinder (1989) show that when both the short-term spread and the federal funds rate are included together in

vector autoregressions with a number of real variables the variance of the federal funds rate accounts for substantially more of the variance of the forecast variable.

7. Within the monetary policy explanation of the spread's predictive ability, an alternative story to the deepening of the commercial paper market for the deteriorating information content (in particular, for long-term securities) is an improved Fisher effect in the 1980s. Monetary policy actions can have two opposite effects on interest rates. One is to lower nominal rates by injecting more liquidity into the system (i.e. the liquidity effect). The other is to raise nominal interest rates by raising inflationary expectations (i.e. the standard Fisher effect). Financial market liberalisation seems to have strengthened the Fisher effect in the 1980s in some countries including the United States (see Browne and Fischer, 1991). The consequence is a reduced leverage of monetary policy over medium- to long-term nominal rates.
8. Permitting the coefficient on all four lags of the spread to vary with time would be quite cumbersome; equations with single lags were therefore estimated.

Note on Data Definitions

(Series begin on date indicated: all series end in 1990Q4,
except 1990Q2 for Italy)

United States	r_m :	Federal Funds rate (1960Q1)
	r_g :	three-month or six-month yield on Treasury bills (1960Q1)
	r_p :	three-month or six-month yield on prime commercial paper (1960Q1)
	R_g :	yield on 10-year government bonds (1960Q1)
	R_b :	prime rate on long-term bank lending (1967Q1)
Japan	r_m :	call-money rate (1966Q4)
	r_g :	proxied by 3-month Gensaki rate (1977Q2)
	r_p :	proxied by rate on short-term bank loans (1977Q2)
	R_g :	yield on long-term Central Government bonds (1966Q4)
	R_p :	yield on industrial bonds (1966Q4)
	R_b :	prime rate on long-term bank lending (1960Q1)
Germany	r_m :	rate on day-to-day money market loans (1973Q1)
	r_g :	proxied by yield on public-sector bonds (1973Q1)
	r_p :	3-month FIBOR (1973Q1)
	R_g :	yield on long-term public-sector bonds (1973Q1)
	R_b :	bank lending rate (1965Q1)
France	r_m :	rate on day-to-day money market loans (1960Q1)
	r_g :	proxied by yield on public-sector bonds (1970Q1)
	r_p :	3-month PIBOR (1970Q1)
	R_g :	yields on Central Government bonds (1960Q1)
	R_b :	prime rate on bank lending (1960Q1)
Italy	r_g :	rate on 3-month Treasury bills (1975Q1)
	r_p :	proxied by interbank deposit rate (1975Q1)
	R_g :	yield on Treasury bonds (1960Q1)
	R_p :	yield on private sector bonds (1960Q1)
	R_b :	overdraft rate charged by commercial banks (1965Q1)
United Kingdom	r_m :	call-money rate (1960Q1)
	r_g :	rate on 3-month Treasury bills (1975Q1)
	r_p :	3-month interbank rate (1975Q1)
	R_g :	yield on 10-year or 20-year government bonds (1960Q1)
	R_b :	overdraft rate (1960Q1)
Canada	r_m :	rate on day-to-day loans in the money market (1960Q1)
	r_g :	rate on 3-month Treasury bills (1960Q1)
	r_p :	rate on 3-month prime corporate paper (1960Q1)
	R_g :	yield on 10-year Federal government bonds (1960Q1)
	R_b :	prime rate on bank lending (1960Q1)

Table 1. Augmented Dickey-Fuller statistics

Variable	United States (1)	Japan (2)	Germany (3)	France (3)	United Kingdom (4)	Italy	Canada
GNP	1.77	2.55	1.18	3.94**	0.99	2.53	2.64
BFI	1.53	0.81	0.35	1.27	0.79	0.94	1.13
(rp-rg)	4.49** 2.83	2.77	3.19*	4.23**	2.65	3.29*	2.68
(Rp-Rg)		3.63* 2.89*	3.15*	2.45	3.24* 2.06	2.14	2.96*
(Rb-Rg)	2.99* 2.45	2.62	2.88*	2.67	2.96*	3.03*	2.56
t	2.41	4.26**	3.24*	2.39	1.85	0.18	1.60

1. The bold numbers below the (rp-rg) and (Rb-Rg) rows are respectively ADF statistics on the difference between the yields on six-month commercial paper and Treasury bills and the difference between the rate charged on long-term bank loans and the yield on long-term government bonds respectively.

2. The bold number below the (Rp-Rg) row is an ADF statistic on the difference between grade AA and grade BB industrial bonds.

3. Because of lack of data on short-term government bonds, rg is replaced by Rg for France and Germany.

4. The bold number below the (Rp-Rg) row is the ADF statistic for the difference between the yield on 25 year corporate paper and 20 year government bonds.

*(**) denotes that the hypothesis of non-stationarity can be rejected at the ten (one) per cent level.

Data Description (for each interest rate series see Appendix)

GNP: log of real GNP, quarterly.

BFI: log of real business fixed investment, quarterly.

(rp-rg): difference between rates on short-term private (rp) and government (rg) securities.

(Rp-Rg): difference between yields on long-term private (Rp) and government (Rg) securities.

(Rb-Rg): difference between rates charged on bank loans (Rb) and yields on long-term government securities.

t: short-term nominal interest rates that reflects monetary policy.

Critical values: 10% 2.84
1% 3.77

Table 2. The information content of the spread for output
(Full sample)

	United States (1)	Japan (2)	Germany (3)	France (3)	United Kingdom (4)	Italy	Canada
Variable							
(rp-Rg)	0.0007** 0.0000**	0.8819	0.0352*	0.0003**	0.0132*		0.6847
(Rp-Rg)		0.4980 0.3695	0.4952	0.3980	0.7378 0.6064	0.7771	0.0565*
(Rb-Rg)	0.0000** 0.9570	0.6038	0.3785	0.1171	0.1135	0.1522	0.0000**
r	0.0000**	0.1290	0.0024**	0.0001**	0.0265*	0.0124*	0.0000*

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1, 2, 3, 4: See Table 1.

The test statistics are generated from an autoregressive-distributed lag model of the form:

$$\Delta Y_t = \alpha + \sum_{i=1}^4 \beta_i \Delta Y_{t-i} + \sum_{j=1}^4 \delta_j s_{t-j} + \xi_t$$

where: Y_t = log of real GNP in period t

s_t = the interest-differential or interest rate variable (r) in period t.

The statistics in the table report the probability that the restriction $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ cannot be rejected; in that case s_t does not add any information content.

*(**) denotes that the restriction can be rejected at the ten (one) per cent level.

Table 3. The information content of the spread for investment
(Full sample)

Variable	United States (1)	Japan (2)	Germany (3)	France (3)	United Kingdom (4)	Italy	Canada
(rp-rg)	0.0001** 0.0116*	0.4435	0.0200*	0.0469**	0.0964*		0.3709
(Rp-Rg)		0.8123 0.1377	0.4624	0.7001	0.3200 0.5329	0.5427	0.1042
(Rb-Rg)	0.0060** 0.7401	0.5017	0.7096	0.5592	0.1493	0.3595	0.4182
r	0.0315*	0.0034*	0.0441*	0.0237*	0.1917	0.0831*	0.3748

1, 2, 3, 4: See Table 1.

For a description of the test statistics see Table 2.

*(**) denotes that the restriction can be rejected at the ten (one) per cent level.

Table 4. Information content: Augmented equations

Variable	United States	Japan	Germany (3)	France (3)	United Kingdom	Italy	Canada
(rp·rg)	0.0429*	0.7073	0.8739	0.0109*	0.0813*	..	0.5299
(Rp·Rg)		0.5353	0.9595	0.8752	0.2608	0.7894	0.0120*
(Rb·Rg)	0.6468	0.8082	0.1351	0.4018	0.1188	0.4903	0.0217*

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3. See Table 1.

The test statistics are generated from a model of the form:

$$\Delta Y_t = \alpha + \sum_{i=1}^4 \beta_i \Delta Y_{t-i} + \sum_{j=1}^4 \gamma_j s_{t-j} + \sum_{k=1}^4 \delta_k r_{t-k} + \xi_t, \text{ i.e. equation [2] in the text,}$$

where: Y_t = log of real GNP in period t ;

s_t = the interest-differential variable in period t ;

r_t = short-term interest rate in period t .

The test statistics reports the probability that the restriction $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ cannot be rejected.

** denotes that the restrictions can be rejected at the ten (one) per cent level.

Table 5. The influence of the term structure

	Germany	France
Output	0.8612	0.1975
Investment	0.7122	0.3335

The test statistics are derived from an equation of the form:

$$\Delta Y_t = \alpha + \sum_{i=1}^4 \beta_i \Delta Y_{t-i} + \sum_{j=1}^4 \delta_j (r_p - R_g)_{t-j} + \sum_{k=1}^4 \Phi_k (r_p - R_p)_{t-k} + \xi_t$$

The test statistic reports the probability that the restriction $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ cannot be rejected.

Table 6. Information content of spread for output

Sample: 1980:1 to 1990:4

Variable	United States (1)	Japan (2)	Germany (3)	France (3)	United Kingdom (4)	Italy	Canada
(rp-rg)	0.2529 0.0036**	0.2229	0.7382	0.5310	0.9806	0.4520	0.0830*
(Rp-Rg)		0.2919 0.2685	0.4772	0.1641	0.0307* 0.1322	0.1103	0.1601
(Rb-Rg)	0.0008** 0.4441	0.5481	0.3363	0.4902	0.4493	0.8205	0.0166*
F	0.0025**	0.1340	0.5429	0.1125	0.1596	0.4667	0.0247*

1, 2, 3, 4: See Table 1.

For a description of the test statistics see Table 2.

*(**) denotes that the restriction can be rejected at the ten (one) per cent level.

Chart 1. The Spread and GDP Growth

———— Spread (right scale)
 - - - - - 12 month growth in real GDP

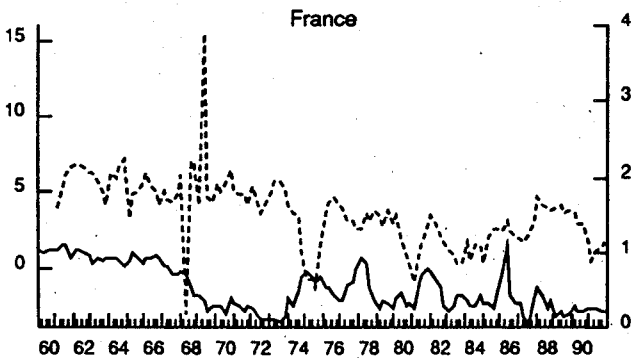
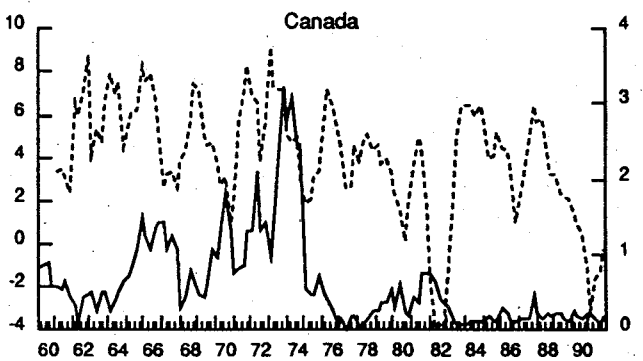
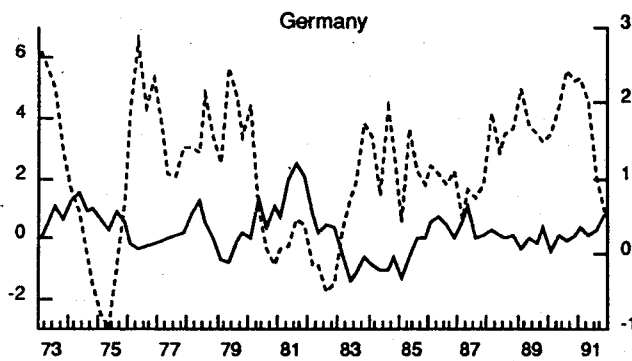
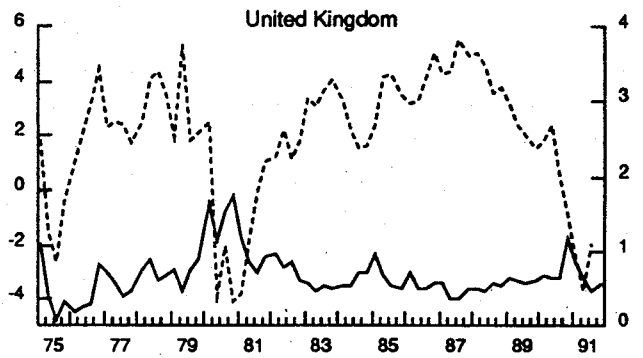
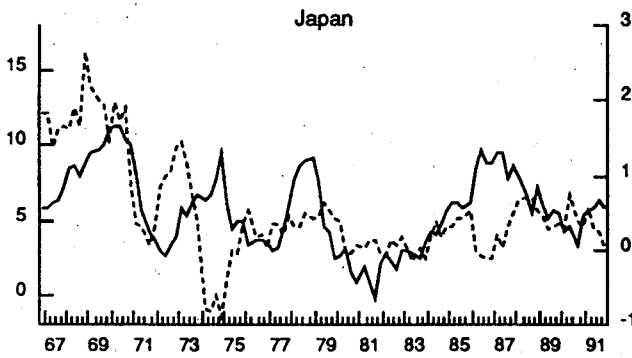
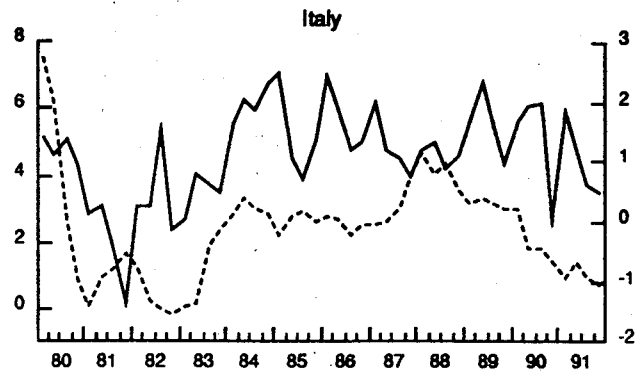
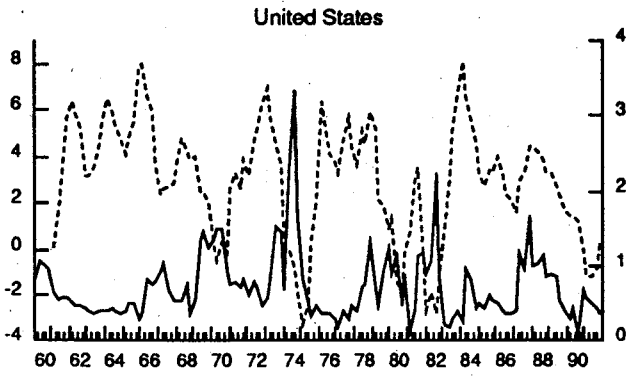
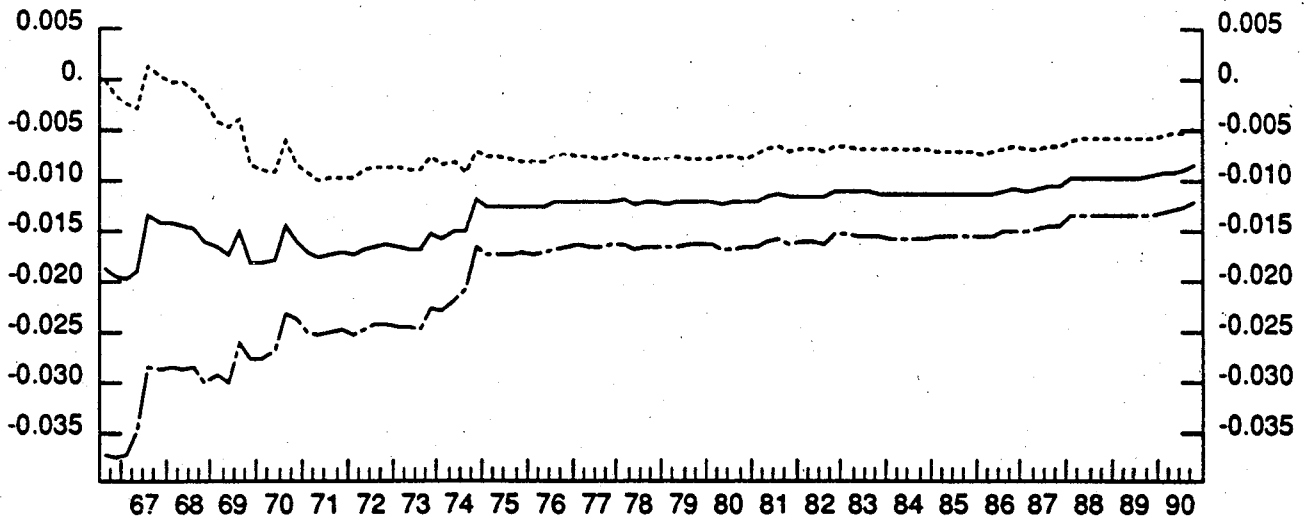
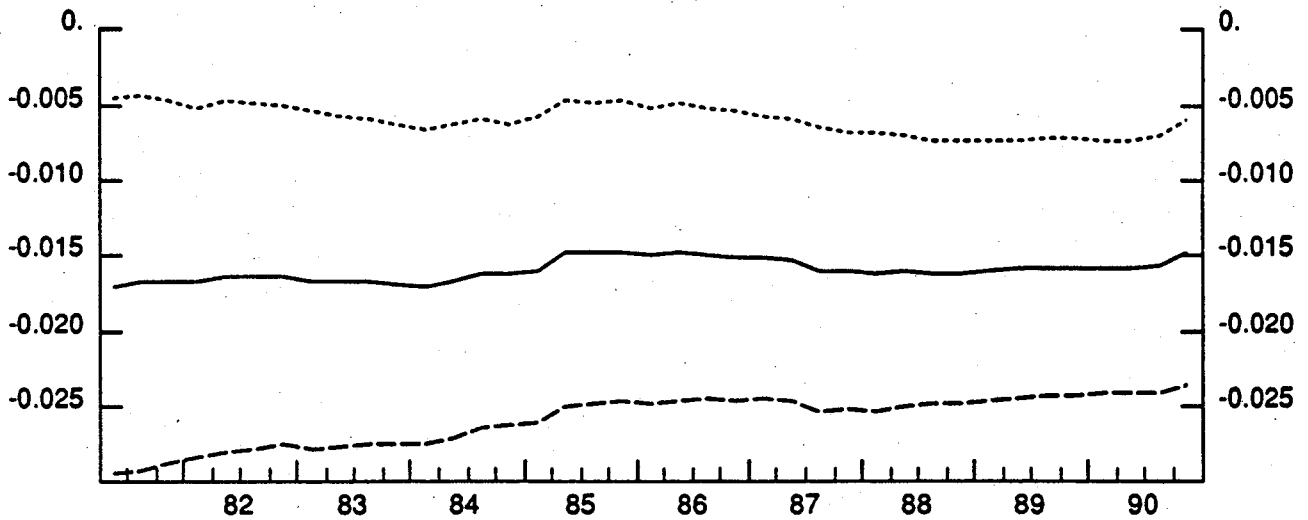


Chart 2. Coefficient on spread

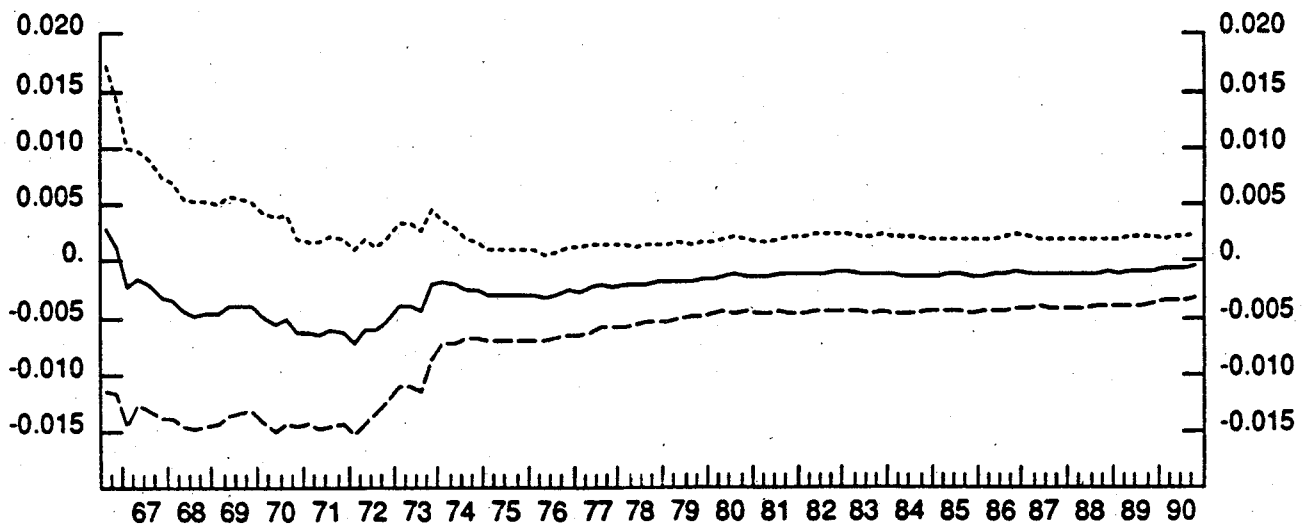
United States



United Kingdom



Canada



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