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Interest Rate Based Forecasts
of German Economic Growth

By

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I. Introduction

Interest rates provide a window to future economic growth. Interest represents the rate at which people are willing to trade money today for money tomorrow. This rate is fundamentally linked to expectations of economic growth.

Consider a simple example. Assume that investors want to insure their economic well-being. Most would prefer a reasonably stable level of income rather than very high income in one stage of the business cycle and very low income in another stage. This drives the demand for insurance or hedging.

Suppose the economy is presently in a growth stage and the general consensus is a slowdown or recession for next year. This desire to hedge will lead consumers to purchase a financial instrument that will deliver payoffs in the slowdown. Such an instrument is a one year discount bond. If many people are buying this bond, the price of the one year security will increase and the yield to maturity will decrease. To finance the purchase of the one year bonds, consumers may sell their shorter-term assets. This selling pressure will drive down the price of the short-term instrument, and as a result, raise its yield. In this example, since a recession is expected, we will see long rates decrease and short rates will increase. As a result, the term structure or yield curve (difference between long rates and short rates) will become flat or inverted. The shape of the term structure of interest rates today provides a forecast of future economic growth.

From this simple example, it should be clear that the interest rate based model is very straightforward. It contains only two components. The first component is the term structure or difference between long-term and short-term rates. The second component is a measure of the average propensity to hedge in the economy. With this measure (which is estimated in this paper), one only needs a hand-calculator and a copy of a financial newspaper to obtain interest rate based forecasts of economic growth. The results in this paper suggest that more elaborate (and expensive) forecasts from structural econometric models are unable to deliver forecasts that are more accurate than the term structure model.

II. An Interest Rate Based Forecasting Model

The idea that interest rates should contain information about economic growth reaches back to the American economist Irving Fisher [1907].[1] In his classic, *The Rate of Interest,* Fisher suggested that some people would like to move income from today to tomorrow. Others desire to give up some income in the future to have additional income today. The interest rate equates the demand and supply for this income shifting process.

The desire to shift income is driven by two factors: investors' expectations about their level of consumption next period and their willingness to hedge their income. A person that has a very high risk tolerance (or equivalently low risk aversion) will not have very little desire to hedge their consumption. This type of person does not care if he or she is very rich one period and very poor in the next period. Of course, if everyone had this high level of risk tolerance, then the interest rates will have little or no information about the future path of economic growth.

However, most people are risk averse (low risk tolerance). Insurance is routinely purchased. As a result, the interest rates today should contain information about the future path of economic growth. But there are some complications. Not every investor has the same level of risk aversion. To obtain the forecast of economic growth from the term structure, it is necessary to identify the economy-wide (average) level of risk tolerance.

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[1] Fisher [1907] originally proposed the framework. Formal developments are provided in Merton [1973], Lucas [1978], and Breeden [1979].

Harvey[2] [1988; 1989] implements an interest rate based forecasting model. The model contains a single equation with only one forecasting variable:

$$Growth_{t+1:t+5} = a + b\,(TS)_t + u_{t+5} \qquad (1)$$

where $Growth$ = growth in real (annual) GNP from quarter $t+1$ to quarter $t+5$, TS = term structure or difference between long-term and short-term annualized yields to maturity observed at time t, u = an unanticipated forecasting error which can be used to assess the accuracy of the forecasting model, a and b = estimated (intercept and slope) coefficients.

The coefficients of the model can be easily estimated using linear regression.[3] The t-ratios of the coefficients are more complicated because the variable to be forecasted is overlapping. The technique of Newey and West[4] [1987] is used to get the correct t-ratios.

The coefficients have the following interpretation. The b coefficient represents the average level of risk tolerance in the economy. Equivalently, $1/b$ is the average level of risk aversion in the economy. The coefficient a represents the expected level of economic growth in situations when the long-term rates and short-term rates are equal.

III. Other Financial Forecasts of Growth

Another financial based indicator of economic growth is the stock market. Many researchers have studied the relation between stock returns and economic growth.[5] However, in recent years, the stock

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[2] Harvey [1988] proposes a consumption-based forecasting model. Harvey [1989] applies the idea to U.S. real gross national product.

[3] Harvey [1988] tests a model similar to that above using the growth in real personal consumption expenditures. The model relates expected real yield spreads to real consumption growth. However, if inflation follows a first-order integrated moving average process, the nominal yield spread equals the expected real yield spread. Further, the intercept contains another variable, the expected real short-term rate of interest, which Harvey shows does not contribute to the explanatory power of the model with one to three quarter forecasting horizons. Finally, the yield spread should be between a bond that has five quarters to maturity and a bond that has one quarter to maturity. Since the yield on a bond with five quarters to maturity is not available for the entire sample, a longer-term yield is used.

[4] Newey and West's [1987] technique is used to compute the t-statistics. These statistics are also robust to conditional heteroskedasticity in the regression residuals.

[5] Fama [1981] examines the relation between stock returns and growth in GNP and industrial production. Harvey [1988] provides evidence on the relation between stock returns and growth in real personal consumption expenditures.

market has been an unreliable indicator of future growth. One stark example of a false signal was the world stock market crash of October 1987. On the basis of this event, many forecasters predicted a recession for 1988. Such a recession never materialized.

There are many reasons why stock market based forecasts of economic growth may be less reliable than interest rate based forecasts. Both stock and bond prices are forward looking. Consider the fundamental valuation equation for a stock:

$$P_t = \sum_{t=1}^{\infty} \frac{d_{t+1}}{(1+k)^t},$$

where P_t = price of the stock at time t, d_{t+1} = expected dividends on the stock in the future (or equivalently the dividends until the stock is sold plus the capital gain realized on selling the stock), k = discount rate used to bring the future dividends to present value. This rate is often assumed to be constant.

If business conditions are expected to deteriorate, dividends will probably also decrease. The reduction in expected dividends will cause a decrease in the stock price. So a negative return today may reflect expectations of economic growth in the future.

Why has the stock market been an unreliable indicator of economic growth? There are three key distinctions between the interest rate and the stock market models: differing time horizons, fixed versus stochastic cash flows, and different levels of risk.

First, consider the time horizon. The price of the stock is determined by the present value of the dividends for the full life of the firm. While nearby cash flows are heavily weighted, the potential dividends span many business cycles. In contrast, bonds exist in fixed maturities.

The second difference concerns the nature of the cash flows that are being valued. Future dividends are random. It is the expected level of dividends that drives the stock price. The path of dividend payments might reflect many factors – not all of them linked to economic growth. For discount government bonds, the principal value in the future is known today. With fixed rate coupon bonds, the future coupons and the future principal are known.

Finally, consider the difference in the riskiness of the two securities. The discount rate, k, in the valuation equation reflects both the level of risk aversion in the economy and the relative riskiness of the asset. Holding other things constant, if the riskiness of the asset increases, the discount rate will also increase and the price of the stock will decrease. Changes in the riskiness of the stock through time could

cause large swings in the price level that have little to do with expectations of economic growth. For example, less than a 100 basis point increase in the discount rate k could cause a drop in stock prices of the magnitude that we saw in October 1987. Shifts in the risk are less important for the bond market. It is widely accepted that the stocks carry a higher level of risk than government fixed income securities.

These three factors suggest that the stock market may deliver unreliable forecasts of economic growth. Nevertheless, I shall empirically assess the reliability of both interest rate and stock market based forecasts of growth in the German economy.

IV. Traditional Forecasting Methods

There are many organizations, both private and public, that engage in economic forecasting. Corporations demand economic forecasts as an input into their decision-making process for new investment projects. Governments demand economic forecasts in order to help make decisions about future fiscal and monetary policy.

The traditional forecasting models use "structural" methods. The method is called structural because a simplified economic structure is proposed. Although the models are "simple," they typically involve many equations to be estimated and numerous identities that link the equations together. For example, the 1988 version of the Deutsche Bundesbank econometric model contains 87 equations and 157 identities.

These structural models have many disadvantages. They are massive, difficult to implement and expensive. The models rely upon a complex set of assumptions about how the economy works. They require the user to input 'forecasts' of many variables before the model is run. Perhaps most importantly, the final forecasts are often of low quality.

Errors in the structural forecasts can be blamed on data revisions, incorrectly specified input variables, or a mistake in specifying one (or more) of the numerous estimation equations. For example, in its post mortem of its poor economic forecast of 1988 economic growth (forecast made on October 4, 1987), the Bundesbank blamed most of the error (it forecast real growth of 1.9 percent, whereas 3.0 percent was realized) on "incorrect exogenous assumptions, particularly as regards the global economic setting" [DBB, 1989, p. 33]. Interestingly, the forecast was made two weeks before the stock market crash.

Presumably, if the Bundesbank reestimated its forecast at the end of October 1987, the forecast error would have been even more severe. Interestingly, the interest rate forecast was 3.2 percent and was unaffected by the stock market crash.

The most serious difficulty with using structural models occurs if the structure of the economy changes. If such an event occurs, the model must be altered. This is exactly the situation facing Germany. The fundamental changes in the economy resulting from a merger of the two Germanies renders the application of structural forecasting methods questionable. In contrast, no changes are necessary in the application of the interest rate based models.

Finally, there is mounting international evidence that the structural models do not work as well in forecasting GNP growth as interest rate based models. Using the root mean squared error evaluation criterion, Harvey [1989] demonstrated that none of the seven leading U.S. econometric services were able to outperform the interest rate based forecast. Some of the structural models include hundreds of equations and thousands of variables. The interest rate model contains only one variable – the difference between long-term and short-term rates.

V. The Evidence

Figure 1 depicts the relation between the interest rate spread (term structure) and real economic growth. The interst rate data are from the International Monetary Fund's *International Financial Statistics (IFS)*. The short-term rate is the money market rate (IFS series 60 B). This is an average of ten daily quotations for day-to-day money. The long-term interest rate is the government bond yield (IFS series 61). This interest rate series includes bonds issued by the Federal government, the railways, the postal system, the Länder governments, municipalities, specific purpose public associations, and other public associations established under special legislation.[6] The real economic growth is calculated from gross national product in 1980 DM.[7]

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[6] The IFS bond yields are calculated as the weighted average of all bonds with an average remaining life to maturity of more than three years (post-January 1977) and remaining life to maturity of more than four years (pre-January 1977). Monthly data are averages of four bank week return dates including the end-of-month yield of the preceding month. Quarterly data are the simple average of the monthly data.

Figure 1 – *Annual GNP Growth and Lagged Yield Spread in the Federal Republic of Germany, 1969–91 (annual observations; percent)*
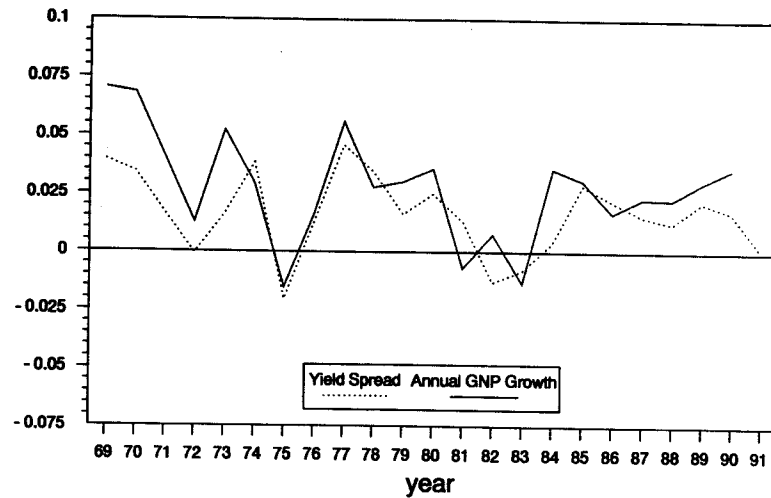

The figure plots annual GNP growth (observed once a year) against the lagged value of the term structure spread. More precisely, the spread in the third quarter of 1987 is plotted against four quarters of economic growth in 1988. In the special situation that the a coefficient is zero and the b coefficient is one, the spread is exactly the forecast of economic growth. In this case, the dotted line would be the forecasted growth and the solid line the realized GNP growth.

The figure shows the extraordinary ability of the spread to predict real GNP growth. The major turning points are picked up by the spread. An examination of the quarterly data reveals that the yield curve flattens and finally inverts in the fourth quarter of 1969 correctly predicting the onset of a recession (business cycle peak 70Q2). A similar situation occurred in the early 1970s. The yield curve dramatically flattened at the end of 1972 and finally inverted in the second quarter of 1973 correctly foreshadowing the pending recession (business cycle peak 73Q3). In the second quarter of 1979, the yield curve became less steep and inverted by the fourth quarter. The yield curve correctly forecasted the oncoming recession (business cycle peak 80Q2). Remarkably there appear to be no false signals.

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[7] An alternative measure of national product is industrial production. However, this measure has the disadvantage of not including personal consumption expenditures. Plots of industrial production growth and the yield spread can be found in OECD [1989, p. 17].

Figure 2 — *Annual GNP Growth and Lagged Annual Stock Market Return in the Federal Republic of Germany, 1972–90 (quarterly observations; percent)*
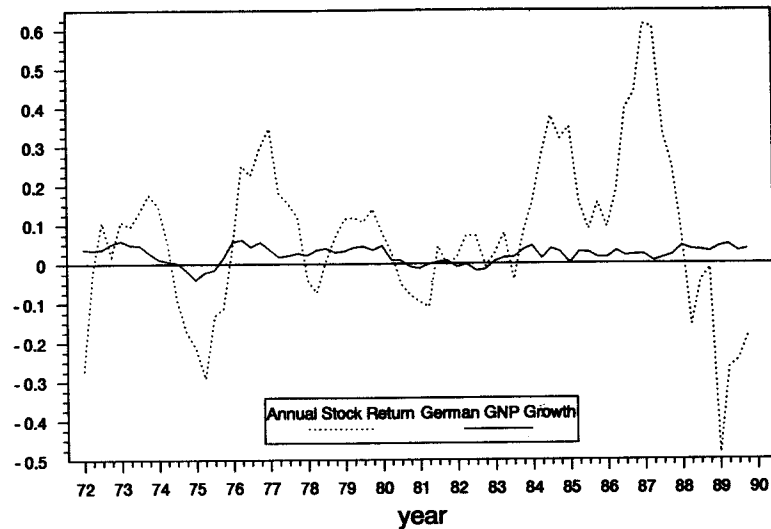
The stock market does not appear to have the ability to track economic growth like the interest rates. Figure 2 plots the annual GNP growth against annual stock returns. The stock market appears to be forecasting recessions in 1971, 1974, 1977, 1979, 1984 and a severe recession in 1988. Only three of these six recession forecasts were realized. The statistical performance of these forecasts are assessed in Table 1.

The results in Table 1 indicate that the interest rate variables have a significant ability to forecast GNP growth. The coefficients are precisely estimated. The risk tolerance coefficient is more than six standard errors from zero. The percentage of variance in GNP that is explained by the model is close to 40 percent. Table 1 also indicates that the German stock market has little or no ability to forecast economic growth in the 1971–89 sample.

Forecasting performance is also measured by the mean absolute error and the root mean squared error of the forecasts. For this method of forecast evaluation, only out-of-sample forecasts are used. For example, a forecast of growth for 1976 is based on the coefficients estimated with data through 1975. Table 2 reports these forecast evaluation statistics.

Table 1 – *The Forecasting Performance for the Federal Republic of Germany of the Interest Rate and Stock Market Return Models, 1971Q1 – 1989Q4*

Variable	a	b	$\bar{R}^2$
Term structure	0.009 [2.387]	0.849 [6.027]	0.363
1 quarter stock return	0.022 [4.774]	0.033 [0.995]	0.008
4 quarter stock return	0.022 [4.069]	0.019 [0.846]	0.020

Note: The model estimated is: $\Delta GNP_{t+1\,:t+5} = a + bX_t + u_{t+5}$. ΔGNP is the annual logarithmic growth in Germany's real gross national product. X is one of: the logarithm of the ratio of one plus the long-term (annual) yield divided by the (annual) call market rate, the one quarter return on the Morgan Stanley Capital International (MSCI) index for Germany in local currency, or the four quarter return on the MSCI index. t-ratios are in brackets. The standard errors are corrected for the implied moving average process and conditional heteroskedasticity with Newey and West's [1987] method. The R-squared is a measure of the proportion of the variance of GNP that is explained by the model. It is adjusted for degrees of freedom. The number of observations is 72.

Table 2 – *Out-of-Sample Forecasting Performance for the Federal Republic of Germany of the Term Structure Model, 1976Q1 – 1989Q4 (percent)*

Variable	Frequency of the forecasts	Mean absolute error	Root mean squared error
Term structure	Quarterly	1.3	1.7
Term structure	Semi-annual	1.3	1.7
Term structure	Annual	1.1	1.5

Note: The model estimated is: $\Delta GNP_{t+1\,:t+5} = a_t + b_t TS_t + u_{t+5}$. ΔGNP is the annual logarithmic growth in Germany's real gross national product. TS is the logarithm of the ratio of one plus the (annual) long-term yield divided by the (annual) call market rate. The coefficients a and b have time subscripts to denote that the regressions are re-estimated at every point in the time series. The forecast horizon is 1976Q1 – 1989Q4.

Three different forecasting frequencies are considered: quarterly, semi-annual and annual. The forecasts for each frequency are annual forecasts, i.e., quarterly is interpreted as four annual forecasts done at each quarter.

Table 3 provides a comparison of the term structure forecasting performance with two widely quoted forecasts. The first is that of the Deutsches Institut für Wirtschaftsforschung (DIW). This forecast

Table 3 – *A Comparison of the Forecast Errors of Annual Growth in German Real Gross National Product from the Model Based on the Term Structure, the Deutsches Institut für Wirtschaftsforschung (DIW), and the Consensus Forecast of 5 Major Research Institutes, 1983–89 (percent)*

	Percentage error		
	Term structure	DIW	5 major institutes
Year 1983	2.01	3.07	3.57
1984	−0.92	3.56	1.06
1985	−1.69	−0.33	−0.33
1986	−0.37	0.31	−0.69
1987	−0.09	−0.74	−0.74
1988	−0.19	1.48	0.98
1989	0.80	2.59	1.59
Statistics			
Mean error	−0.06	1.42	0.78
Mean absolute error	0.87	1.73	1.28
Root mean squared error	1.11	2.13	1.63

Note: The model estimated is: $\Delta GNP_{t+1:t+5} = a_t + b_t X_t + u_{t+5}$. ΔGNP is the annual logarithmic growth in German real gross national product from quarter $t+1$ to quarter $t+5$, X is the logarithm of the ratio of one plus the long-term yield divided by one plus the short-term call money rate. The quarterly yields are the arithmetic average of the yields over the quarter. The coefficients a and b have time subscripts to denote that the regressions are re-estimated at every point in the time series.

forms the benchmark for the Bundesbank economic forecast. The second is the consensus forecast of the five major research institutes. The DIW forecasts are made early in the third quarter. The consensus forecasts are published in the last week October or the first week in November. The term structure forecast is available on the last trading day in September.

The results contained in Table 3 show that the term structure model has the lowest forecast errors. From 1983–89, the average absolute error of the term structure forecast is 0.87 percent. This compares to 1.73 percent for the DIW forecast and 1.28 percent for the five research institutes consensus forecast. The other evaluation criterion is the root mean squared error (RMSE). Over the same period, the term structure model had a 1.11 percent RMSE. This compares to 2.13 percent for the DIW forecast and 1.63 percent for the consensus forecast.

The forecasts of the Deutsche Bundesbank are (as a matter of policy) not available to the public. However, there is some information on the quality of its forecasts. First, the Bundesbank revealed that over the 1974–81 period, the mean squared error for its forecasting model was 1.9 percent. This is in the range of the DIW forecasting performance. With the most recent data, the Bundesbank suggested that the DIW and the consensus forecast could be considered a proxy for its forecasts. If this is the case, then the term structure forecasts are much more accurate than the forecasts being used to evaluate important monetary and fiscal policies.

VI. German and U.S. Economic Growth

Harvey [1989] has presented evidence on the relation between the U.S. term structure and U.S. economic growth. It is worth considering the linkages between U.S. and German economic growth. Further, the relation between the term structures is explored. Figure 3 provides a plot of real annual GNP growth in Germany (solid line) and annual growth in the U.S. (dotted line). It is obvious that the economies are closely linked. The statistical correlation between U.S. and German annual real economic growth is 53 percent over the sample.

There are two important deviations in the U.S. and German business cycles. The first occurs between 1968–70. During this period, German real economic growth greatly exceeds the growth in the United States. The second deviation occurs in late 1981 when annual U.S. growth was much higher than German economic growth. Indeed, the U.S. experienced the infamous "double-dip" recessions (80 Q1–80 Q3 and 81 Q3–82 Q4 peak to troughs) while Germany only experienced one recession which begins in the second quarter of 1980. While Germany was experiencing negative growth, the U.S. was enjoying a (short-lived) boom. While Figure 3 shows a high correlation between the business-cycles, it does not suggest that the U.S. economy leads the German economy. The major recessions in 1973–74 and 1980 were likely driven by common global factors which were exacerbated by the sudden increase in oil prices.

Figure 4 depicts the German term structure (solid line) and the U.S. term structure (dotted line). The term structures are positively correlated. Interestingly, we can gain some insights about the departures of the German and U.S. business cycles from the two term structures. In 1968–69, the German yield spread is much higher than

Figure 3 – *GNP Growth in the Federal Republic of Germany and in the United States (percent)*
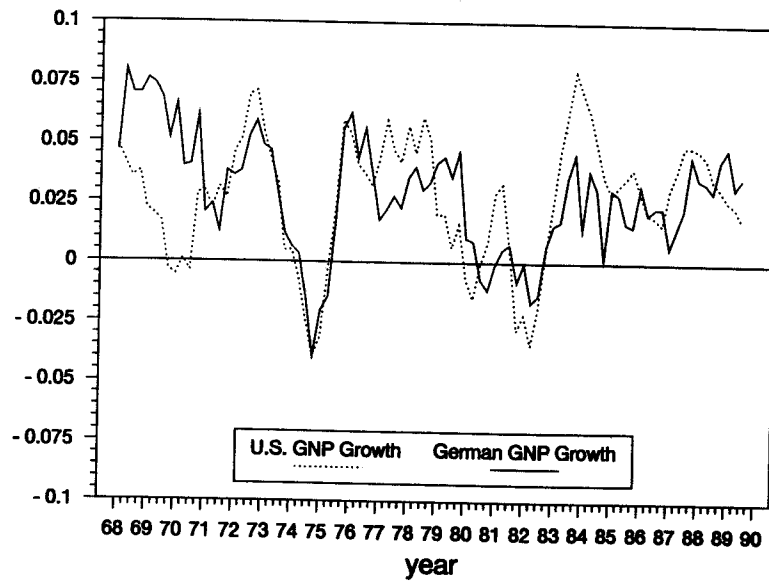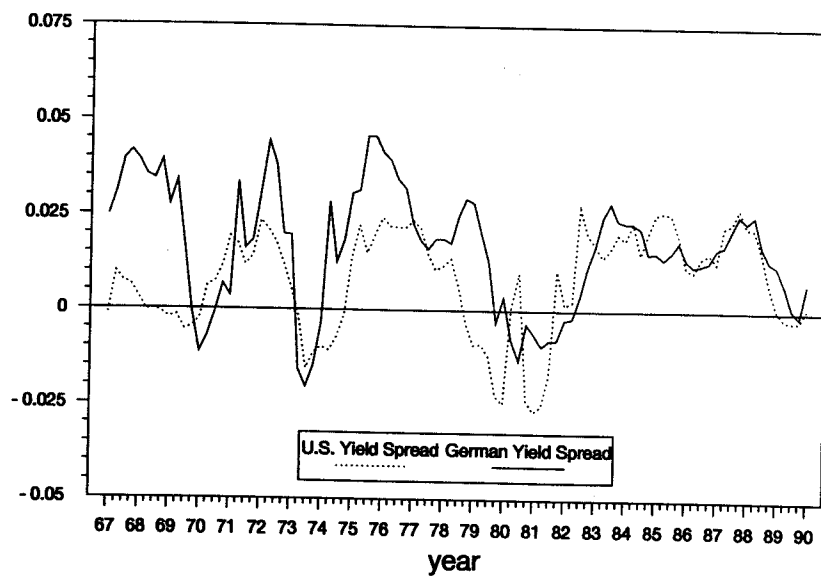

year

Figure 4 – *Yield Spread in the Federal Republic of Germany and in the United States (percent)*

year

the U.S. yield spread. This is mainly due to the lower short-term rates in Germany. In the second half of 1966, German authorities eased monetary policy. By May 1967, the Lombard rate had dropped to 3.5 percent (from 6.25 percent at the beginning of the year). Coordinated with other monetary actions,[8] this produced low rates and a large spread between the long- and short-term interest rates.

The difference between the German and U.S. yield spreads were consistent with the difference between economic growth in the two countries. Germany experienced strong growth during this period (large yield spread) while U.S. growth was much smaller (small yield spread).

The substantial difference between long-term and short-term rates began to disappear in 1969 coinciding with a change in German monetary policy. There were six increases in the Lombard rate in 1969.[9] By the fourth quarter of 1969, the yield curve had inverted foreshadowing the pending economic downturn.

The second deviation in the U.S. and German yield spreads occurs in 1979–82. The U.S. yield curve inverts in the fourth quarter of 1978 correctly predicting the recession that begins in the first quarter of 1980. The German yield curve begins to flatten in the second quarter of 1979 as a result of increased short-term rates. The German money market rates almost tripled from the fourth quarter of 1978 to the fourth quarter of 1979. The yield curve inverts in 1979 Q4. The German yield curve inversion follows the U.S. inversion. Consistent with the yield curve movements, the German recession follows the U.S. recession.

Another difference in this period between the U.S. and German yield curves is the duration of the inversion. The German yield curve inversion lasts from the fourth quarter of 1979 to the second quarter of 1982. In contrast, the U.S. yield curve is positively sloped in the

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[8] Other monetary actions included: the reduction of the minimum reserve requirements, widening of the Bundesbank intervention limits in the foreign exchange market (to discourage money exports by banks), large open market purchases of government bonds by the Bundesbank for its own account, and the decision by the Bundesbank to treat as money market paper the Kassenobligationen of the Federal authorities of the Länder, Railway and Postal Administration [See OECD, 1968].

[9] The more restrictive monetary policy actually began in November 1968 by imposing a reserve ratio of 100 percent against increases (after November 15) in banks' foreign deposit liabilities. The Lombard rate increased by: 4 to 5 percent in April, 5 to 6 percent in June, 6 to 7 percent in September and to 9 percent in December. In addition, the deutsche mark was revalued by 9.3 percent on October 27, 1969 [See OECD, 1970].

second and third quarters of 1980. Again, the differences in the yield curves correspond to differences in the business cycles.

During the 1979–82 period, the U.S. experienced a "double-dip" business cycle. The U.S. economy peaked in the first quarter of 1980 and bottomed out in the third quarter of 1980. The recession duration was only three quarters. The economy also peaked in the third quarter of 1981 and bottomed in the fourth quarter of 1982 (duration 5 quarters). The double-dip in the U.S. yield curve correctly forecasted these two recessions. In Germany, however, there was no "double-dip" in the yield curve. The duration of the inversion signaled one longer recession – rather than two short recessions. The German yield curve became positively sloped in the third quarter of 1982 correctly forecasting the end of the recession in the first quarter of 1983.

The analysis indicates that the German yield curve has the ability to forecast German economic growth. In addition, the differences between the German yield curve and the U.S. yield curve correctly forecast the differences in real economic growth in the two countries.

VII. Post-Script 1991

The statistical analysis of the German yield curve and real economic growth was carried out on data through the fourth quarter of 1989. Since 1989, there have been extraordinary political and economic events that provide a challenge to any forecasting model.

In the U.S., the yield curve inverted in the second quarter of 1989 correctly signaling a slowdown in economic growth in 1990. The official peak of the U.S. business cycle was 1990 Q3, so the yield curve gave a five quarter advance signal – which is exactly what it should predict. The duration of the inversion was three quarters. However, the U.S. inversion was minor (albeit persistent) compared to the last three inversions. As a result, the model predicted a minor downturn. Finally, the reversion to the positively sloped yield curve at the beginning of 1990 forecasted an end to the downturn by mid-1991. Recent data support this interpretation of the current U.S. business cycle episode.

In contrast to the situation in the U.S., the German yield curve was positively sloped in both the second and third quarters of 1989. In the fourth quarter, there is a minor inversion (−0.1 percent). However, this fourth quarter inversion is ambiguous. If the yield curve is measured using Treasury bill yields rather than money market yields for the short-term rate, there is no inversion.

Given the historical analysis of the yield curves and business cycles, the behavior of the German yield curve with respect to the U.S. yield curve suggested that (1) there was no recession forecast for Germany in 1990 and (2) if there was a slowdown, it would follow rather than coincide with the U.S. slowdown. The recent data provide some support for this out-of sample forecast.

Consistent with the model's prediction, no recession was realized in 1990. In fact, German real growth was unaffected by the worldwide economic slowdown in 1990. The economy [10] grew at a robust rate of 4.5 percent in 1990. Indeed, the real growth exceeded the expectations of the five major institutes, DIW and the yield curve model. The German union was associated with an unexpected surge in private consumption expenditures.

However, some caution needs to be exercised in interpreting the economic data. National income statistics refer to the western part of Germany. While there was robust growth in the western part of Germany in 1990, there was contraction in the eastern part. Since the data from the east is sparce, it is difficult to precisely evaluate the realized all-German growth in 1990.

Given the union of the two Germanies, the yield curve model can now be used to forecast all-German growth. The yield curve model forecasts slow but positive growth. One important question is whether the union delayed or preempted negative German economic growth. The Bundesbank has pursued a restrictive monetary policy with the expectation that this will control inflationary pressures resulting from the union. At the beginning of 1990, the Lombard rate stood at 5.5 percent and, at the end of the year, it posted four consecutive increases to 8.0 percent. So far in 1991, the rate has been increased three times to 9.25 percent. At the same time, inflation has risen to its highest rate since December 1982.

The German short-term rates have substantially deviated from U.S. short-term rates. By the second quarter of 1991, U.S. Treasury bill rates were trading at less than 6.0 percent yield to maturity. U.S. short-term rates have consistently moved downward from the third quarter of 1990. However, at the same time, inflationary pressure was not an important issue for the U.S. Federal Reserve Bank.

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[10] Interpretation of the growth data is complicated. The national product data only refers to the western part of Germany. Data on the eastern part is not yet available. All data for the post-script were obtained from the Wiesbaden-based Federal Statistics Office on September 6, 1991.

The different behavior of the U.S. and German short-term interest rates has led to a positively sloped yield curve in the U.S. and flat yield curve or slightly inverted yield curve in Germany. The yield spread differences point to differences in the business cycles in the short term. While 1990 German economic growth appeared to be immune to the flattening of the yield curve in 1989, it is unlikely that Germany will be spared slow growth in 1991. Indeed, the five major institutes forecast 1991 western growth to be only 1.5 percent and the DIW forecasts western growth to be 2.0 percent. Based on the third quarter 1990 yield curve, my model suggests all-German real growth of 1.7 percent for 1991.

Preliminary data support the forecast of slower economic growth. The western economy grew at a strong 2.5 percent rate in the first quarter and a preliminary −0.5 percent rate in the second quarter. In annualized terms, the western German economy has grown at a 4.0 percent rate in the first half of 1991. However, it is widely expected that eastern Germany will experience negative growth (up to −25 percent) in 1991. The recent data are consistent with projections that I made in the fall of 1990.

VIII. Conclusions

Today, there is considerable uncertainty about the path of German economic growth. The primary factor causing uncertainty is the impact of the German union. In particular, Germany must deal with increased public borrowing which is now 8 percent of GNP, increased interest rates, prospects of new taxes, and increased inflationary pressures. Traditional structural models are of limited use in this extraordinary situation. However, the yield curve model is well suited for the task.

Uncertainty about future economic growth has many negative consequences. Perhaps the most serious consequence concerns the business investment process. If the path of economic growth is uncertain, it is more likely that businesses will delay investment projects. This could exacerbate the slow growth situation that is currently being experienced in 1991.

An accurate forecasting model may help reduce any uncertainty. Accuracy is measured in many different ways. Traditionally, accuracy is measured by the difference between forecasted values and actual values. This paper demonstrates that the interest rate based model has

substantially lower forecast errors than the forecasts of the Deutsches Institut für Wirtschaftsforschung. The interest rate based model also outperforms the consensus forecasts of five major research institutes. Accuracy is also measured by the ability to pick up the turning points in the business cycle. The term structure model has correctly signaled all the economic turning points in the last 20 years. The term structure model also has the ability to pick up more subtle (non-recessionary) turning points.

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Zusammenfassung: Vorausschätzungen des deutschen Wirtschaftswachstums auf der Grundlage von Zinssätzen. – In den Zinssätzen sind Erwartungen hinsichtlich des Wirtschaftswachstums enthalten. Darauf greift das hier vorgestellte Modell zurück, das die Vorausschätzungen des BSP aus der Struktur der deutschen Zinssätze herleitet. Die Prognosen, die auf den Zinssätzen basieren, sind genauer als die weithin

zitierten Prognosen des Deutschen Instituts für Wirtschaftsforschung. Das Zinssatz-Modell liefert auch geringere Schätzfehler als die Gemeinschaftsdiagnose der fünf großen Forschungsinstitute. Das Modell verwendet nur eine Variable, nämlich die Differenz zwischen den langfristigen und den kurzfristigen Zinssätzen. Dieses Prognose-verfahren könnte gegenwärtig besonders zweckmäßig sein, weil die jüngsten großen Veränderungen in der deutschen Volkswirtschaft im Zusammenhang mit der Wieder-vereinigung die Verwendung traditioneller Strukturmodelle zweifelhaft erscheinen las-sen.

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Résumé: Prévision de la croissance économique allemande basée sur les taux d'intérêt. – Les taux d'intérêt contiennent des expectations de la croissance économique. Dans cette étude, l'auteur propose un modèle simple qui extrait la prévision du produit national brut de la structure des taux d'intérêt en Allemagne. Les prévisions basées sur les taux d'intérêt sont plus exactes que les prévisions de l'Institut für Wirtschaftsfor-schung qui sont citées partout. En outre, le modèle du taux d'intérêt montre moins d'erreurs de prévision que la prévision commune de cinq instituts de recherche économi-que en RFA. Le modèle financier n'a qu'une variable – la différence entre les taux d'intérêt à long et à court terme. Ce type de prévision peut être de grande valeur surtout en présence parce que les changements récents dans l'économie allemande après l'unifi-cation mettent l'application des modèles traditionnels et structurels en doute.

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Resumen: Predicciones del crecimiento económico alemán sobre la base de tasas de interés. – Las tasas de interés contienen expectativas sobre el crecimiento económico. En este trabajo se propone un modelo simple que extrae predicciones para el PBN de la estructura de tasas de interés en Alemania. Las predicciones basadas en las tasas de interés son más exactas que las bien conocidas predicciones del Deutsches Institut für Wirtschaftsforschung. El modelo de tasas de interés también provee errores de predic-ción menores que la predicción común de los cinco institutos de investigación más importantes. El modelo financiero sólo utiliza una variable: la diferencia entre las tasas de interés de largo y de corto plazo. Este tipo de predicción podría ser particularmente valioso dado que los cambios mayores que ha sufrido la economía alemana cuestionan la aplicación de los modelos estructurales tradicionales.