7-1-1993

The Effect of Different Monetary Regimes on Cointegration of the Term Structure: Evidence for Germany, the Netherlands, Switzerland, and the United Kingdom

Kevin J. Burns
University of Nebraska at Omaha

The Effect of Different Monetary Regimes on Cointegration of the Term Structure: Evidence for Germany, the Netherlands, Switzerland, and the United Kingdom

A Thesis

Presented to the

Department of Economics

and the

Faculty of the Graduate College

University of Nebraska

In Partial Fulfillment

of the Requirements for the Degree

Master of the Arts

University of Nebraska at Omaha

by

Kevin J. Burns

July 1993

Thesis Acceptance

Acceptance for the faculty of the Graduate College, University of Nebraska, in partial fulfillment of the requirements for the degree of Master of the Arts in Economics, University of Nebraska at Omaha.

Committee

Name	Department
Fuad A. ABDULLAH	Finance & Banking
Mark E. Wohar	Economics
[illegible]	Economics

Mark E. Wohar
Chairman

7-26-93
Date

The Effect of Different Monetary Regimes on Cointegration of the Term Structure: Evidence for Germany, the Netherlands, Switzerland, and the United Kingdom

Abstract

This thesis examines monthly eurodeposit rates for the short-end of term structure as a cointegrated system of the term structure of interest rates, for Germany, the Netherlands, Switzerland, and the United Kindom during the period 1975-1990. The countries monetary regimes are examined in order to find sample periods that reflect changes in policies, in order to determine if the policies affect the cointegration results. The cointegration testing procedure of Johansen and Juselius is employed. The results found support for the expectation theory of the term structure when the countries focus on exchange rate or interest rates, and rejects the expectation theory when the focus is placed upon targeting a monetary aggregate.

Table of Contents

INTRODUCTION

There have been numerous empirical and theoretical studies concentrating on the different theories of the term structure of interest rates. Whether the expectations theory, the segmented market theory, or the preferred habitat theory, they all attempt to explain the empirical observation that yields of different maturities appear to move together through time. For the most part, studies agree that securities that differ only in their terms to maturity have yields which do not deviate from each other for very long. This is consistent with the view that arbitrage limits interest rates for different maturities from deviating from each other for long periods of time.

An equilibrium relationship between interest rates of different maturities has empirically been shown to exist using the recently developed time-series technique of cointegration. For example, Hall, Anderson, and Granger (1992), and Bradley and Lumpkin (1992) show, using the technique of cointegration, that United States Treasury bill rates follow a long-run equilibrium. Siklos and Wohar (1993) use Eurorates to explore the term structure for ten countries, during the period 1975-1990. They find evidence to support the expectations hypothesis for all of the countries except Japan. They also find empirical evidence that shows a significant difference in the ability of the expectations hypothesis to explain the term structure before 1981 relative to the post-1981 samples.

The purpose of this paper is to expand upon Siklos and Wohar (1993), by examining the term structure of Eurodeposit rates as a cointegrated system of the term structure for four countries (Germany, Netherlands, Switzerland, and the United Kingdom). Siklos and Wohar (1993b), did not examine individual countries for possible monetary regime changes which might account for structural changes in a country's term structure. A detailed look at the monetary policies of all four countries is required in order to ascertain the existence of different monetary regimes. Once regime changes are identified the cointegration methodology will be employed to see whether the expectation hypothesis holds during each regime. The sample period begins in 1975 and continues through 1990. The data consists of one month, three month, six month, and twelve month maturities of Eurodeposit rates for Germany, Netherlands, Switzerland, and the United Kingdom. The data was obtained from the Financial Times of London publication.

This paper is organized as follows. Section 2 presents a review of the literature of term structure related to cointegration. Section 3 describes the testing methodology used in later empirical sections. Section 4 discusses the data. Section 5 gives the empirical results of the cointegration procedure for the overall sample periods of all four countries. Section 6 contains the history of monetary policy for the four countries. Section 7 presents the empirical results of the cointegration tests over the subset of monetary regimes of each country. Section 8 presents a summary and conclusion.

SURVEY OF THE LITERATURE

The structure of interest rates among securities with different maturities, risk, tax treatment, marketability, and special features make up the term structure. The term structure of interest rates is sometimes referred to as the yield curve, where the curve depicts differing rates of interest on securities with different maturities and similar characteristics. The shape of the yield curve has been the subject of much debate, and theories have attempted to explain the term structure and the underlying factors that dictate the shape of the yield curve.

The expectations theory postulates that the yield curve is determined solely by peoples' expectations of future interest rates. The unbiased expectations hypothesis of the term structure assumes that investors view bonds of different maturities as perfect substitutes and that investors are risk neutral. If bonds of different maturites have equal expected returns then they must be perfect substitutes. Hence, for a specific holding period, the geometric average of current short-term and expected future short-term interest rates will equal the long-term interest rate for the same time period.

According to the segmented market theory, the choice of long-term versus short-term maturities is predetermined according to need rather than expectations. This theory does not assume that maturity markets are perfect substitutes. In a segmented market interest rates on different maturities may depend only on supply and demand conditions within that particular segment of the market. Thus, there may be large differences between interest rates with only slightly different maturities. An important assumption of the segmented market theory is that investors and borrowers have determined the best maturities for their loans and investments. They cannot be enticed into other maturities by higher levels of interest rates. The argument for why bonds of different maturities are not substitutes is that investors and borrowers have strong preferences for one maturity. Therefore, investors and borrowers are only concerned with the expected returns for the bonds with the maturity that they prefer.

The alternative liquidity premium and prefered habitat theories of the term structure do not view bonds of different maturities as perfect substitutes, nor are investors assumed to be risk neutral. Both theories determine the term structure using factors other than interest rate expectations. In the alternative liquidity premium hypothesis interest rates on the yield curve are a geometric average of current short-term and expected future short-term interest rates plus a risk or liquidity premium. The preferred habitat theory argues that interest rates on the yield curve are determined by relative supply and demand conditions for bonds across different maturities as well as institutional factors. The theory postulates that investors tend to focus on a specific maturity. However special circumstances may cause them to wander from their natural maturity habitat. This "wandering" will occur when the compensation for choosing a different maturity will give a more favorable yield to maturity for a specific endeavor. The additional return to the investor is known as the liquidity premium. The preferred habitat theory of the term structure accepts the expectations theory, but claims the yield curve is not an accurrate representation of market expectations. This is because the preferred habitat theory recognizes the existence of a liquidity premium built into the yield for bonds on certain maturities. However, the preferred habitat theory says nothing about whether there is any systematic pattern to the Liquidity Premium as it regards bond rates of various maturities.

The liquidity premium theory takes the view that bonds of different maturities are substitutes so that the expected return on one bond does affect the expected return on a bond of different maturity, but it also allows investors to prefer one bond maturity over another. The Liquidity Premium hypothesis holds that investors are more concerned with capital risk than income risk. This concern is because the investors fear that they will have to sell their bonds for cash. Therefore, investors have a natural preference for short-term assets and require relatively high returns on long-term bonds. Some investors may prefer to own short-term rather than long-term securities since shorter maturity represents greater liquidity. Investors will be willing to hold longer term maturities only if they are compensated for the loss of liquidity.

The previous theories on the term structure have been expanded upon to develop equilibrium theories of the term structure. The theory of an equilibrium relationship between interest rates of different maturities has been examined by Vasicek (1977), Brennen and Schwartz (1979), Richard (1978), and Cox, Ingersol and Ross (1985). These studies look at long-run interest rate movements of the term structure to study whether there is one common stochastic trend among interest rates of differing maturities, supporting the expectations theory, or whether individual interest rates are determined by their own forcing variable, supporting the segmented market hypothesis. The question of how many stochastic trends are necessary to describe the movements of interest rates is an important factor in the modeling of the term structure. The number of stochastic trends will also be a determining factor in the pricing of securities. These trends have been examined in the framework of a long-run equilibrium and short-run deviations from this equilibrium. In this context, the time-series technique of cointegration[1] has been used as a method to examine the long-run relationships between default free securities with different interest rates and different maturities and short-run deviations from the long-run equilibrium.

Previous research which found cointegration between the yield on a short-term bond and the yield on a long-term bond, include Campbell and Shiller (1987), Engle and Granger (1987), Stock and Watson (1988), and Choi and Wohar (1991). These studies all found one common stochastic trend among these two interest rates using data on United States treasury securities. Campbell and Shiller (1987) and Engle and Granger (1987) utilized the data of a one month Treasury bill rate and a yield to maturity for a twenty year bond. Choi and Wohar (1991) utilized the Treasury bill rates for a three-month Treasury bill rate and a six-month Treasury bill rate. Stock and Watson (1988) looked at the federal funds rate, the ninety day Treasury bill rate, and the one year Treasury bill rate.

Research on whether the entire term structure of United States Treasury bills could be modeled as a cointegrated system include Hall, Anderson, and Granger (1992), Bradley

---

[1]Two variables are cointegrated if individually they are integrated of order one [I(1)], but a linear combination of them yields a stationary series integrated of order zero [I(0)]. I(1) variables are nonstationary series that must be differenced in order to achieve stationarity--a variable that is I(0). If the variables are cointegrated then the linear combination of them will be stationary. Movements in cointegrated variables can deviate from each other in the short-run, but the long-run relationship is restored over time.

and Lumpkin (1992), and Zhang (1993). Hall, Anderson and Granger (1992) use data from January 1970 to December 1988 that covers eleven United States Treasury bill rates ranging from one month to eleven month maturities. Their results support cointegration among these eleven different interest rates, finding ten cointegrating vectors for the eleven different yields. It should be noted that they found the term or liquidity premium of Treasury bills followed a stationary process, and that a single nonstationary common stochastic trend underlies the time series behavior of each yield to maturity. They conclude that this common trend cannot be identified, and could consist of a linear combination of several nonstationary I(1) variables.

Bradley and Lumpkin (1992) use data from June 1969 to December 1989. Their research differs from previous work in the range of the maturities of the Treasury bills. Their work uses seven Treasury bill maturities ranging from three month Treasury bills to thirty year Treasury bills. Their conclusions are supportive of the existence of an equilibrium among Treasury rates with differing maturities. This finding suggests that although there may be deviations among the different rates, there exists an equilibrium to which the rates will return. Bradley and Lumpkin (1992) used a two-step procedure that was developed by Engle and Granger (1987). This procedure is not invariant to normalization[2] and does not allow one to test for the number of common stochastic trends.

Zhang (1993) followed Bradley and Lumpkin (1992) and examined the number

[2]Normalization means results are not necessarily invariant to the choice of the dependent variable.

of common stochastic trends among Treasury bills and longer maturity Treasury notes and bonds. Zhang (1993) employed monthly data from February 1964 to December 1986 using twelve Treasury bills ranging from one month maturities to twelve month maturities, and seven Treasury bonds ranging from two year maturity to thirty year maturity. Zhang (1993) used the Johansen (1988,1991) and Johansen and Juselius (1990) method to examine this set of nineteen yields. Zhang (1993) divided the nineteen yields into two sets, twelve Treasury bill yields and seven Treasury bond yields. Within the twelve Treasury bill yields Zhang (1993) found one common stochastic trend, which is consistent with the conclusions of Hall, Anderson and Granger (1992), and Siklos and Wohar (1993b). The set of seven Treasury bond yields resulted in Zhang (1993) finding two common trends. The final evaluation of Zhang's (1993) work violated the expectaions hypothesis of the term structure, because he found three common stochastic trends when covering the entire term structure. The expectations hypothesis predicts that *n* different maturity interest rates share one common stochastic trend, and thus contain three cointegrating vectors.

Mougoué (1992) examines the term structure of daily interest rates on Eurocurrency deposits with maturities of one month, two months, three months, and six months. The deposits were denominated in six currencies, the Canadian dollar, German mark, Japanese yen, Swiss franc, United Kingdom pound, and the United States dollar. The sample period ranged from November 12, 1980 to November 29, 1990. In examining the four-dimension system of interest rates, he finds that for each of the six countries, these series of four interest rates, contain three stochastic trends (one cointegrating vector). Mougoué incorrectly infers from this result that he finds support for the expectations hypothesis. He states, "The theory of the term structure of interest rates suggests that there is at most one linear independent cointegrating vector underlying the four interest rates within each country." (Mougoué 1992, p.292). Hall, Anderson, and Granger (1992) clearly show that if movements in interest rates within the term structure are to be consistent with the expectations hypothesis, then in the long-run these rates should contain one common trend which drives their movements.

An examination of the short-end term structure of multiple countries was examined by Siklos and Wohar (1993b). They use Euro-deposit rates from 1975 to 1990, covering four different maturities (one month, three month, six month, and 12 month), for ten countries. In general they find evidence in favor of the expectations hypothesis for most countries (with exception to Japan) for most periods. A significant empirical finding is that there is a significant difference of the expectations hypothesis to explain the term structure before 1981 relative to after 1981.

This paper expands the work of Siklos and Wohar (1993b) by examining the individual countries monetary policies to determine where possible breaks may occur that effect the cointegration results, relating to the expectations hypothesis.

TESTING METHODOLOGY

New research in time series methodology has made it possible for one to test for the presence of equilibrium relationships among economic variables. In the past, time series analysis required that data be covariance stationary before any estimation of economic models was applied to the data. This stationarity could be obtained by first-differencing the economic series, however, this removes many of the long-run characteristics of the data. Engle and Granger (1987) speculated that even though an economic series may move through time, economic theory provides reasons why certain variables should react according to certain equilibrium constraints, for example, purchasing power parity or money demend. Hence, there may exist a linear combination of variables in a model, and over a period of time this linear combination may converge to an equilibrium. For example, in the case of two economic time series; if there are variables integrated of order one [I(1)] before differencing, but stationary [I(0)] after differencing, then a linear combination of these I(1) series which is stationary, are said to be cointegrated.[3]

The early tests for cointegration that Engle and Granger (1987) developed do not distinguish between the existence of one or more cointegrating vectors. Another problem with Engle and Granger's tests are that they apply Ordinary Least Squares (OLS) estimation to obtain parameter estimates of the cointegrating vector (Stock 1987). These

[3]A series that needs to be differenced d times to become stationary is denoted I(d) or ' integrated of order d.' Thus, a series that is integrated of order one is denoted as I(1).

OLS estimates will differ depending on the arbitrary normalization implicit in the selection of the dependent variables of the cointegrating regression equation. Different arbitrary normalization can cause the results of the Engle and Granger (1987) tests to differ. A procedure was developed to examine cointegration in a multivariate setting by Johansen (1988) and Johansen and Juselius (1990). This procedure results in maximum likelihood estimates of unconstrained cointegrating vectors, and also allows one to explicitly test for the number of cointegrating vectors. The Johansen method does not rely on an arbitrary normalization, and Wald statistic can be used to conduct tests on restrictions suggested by economic theory.[4] However, both the Johansen maximum likelihood cointegration technique and the Engle and Granger two-step procedure cointegration techniques are only applicable for investigating the comovement of nonstationary variables. Thus, one must test for the existence of unit roots. The testing of unit roots for Eurorates were performed by Siklos and Wohar (1993a) and these interest rates were found to be integrated of order one [I(1)].

DATA

This paper uses Euro-deposit rates for four OECD countries (Germany, Netherlands, Switzerland, and the United Kingdom). The rates were obtained from the **Financial Times of London** (FT) publication for the period of 1975 to 1990, using end

---

[4]For a detailed description of the formulas involved in the Johansen procedure refer to Johansen and Juselius (1990).

of the month rates for one month, three month, six month, and twelve month Euro-deposit rates. The decision to use Euro-deposit rates was influenced by multiple factors. First, the use of Euro-deposit rates ensure that the underlying asset is comparable. Euro-deposits denominated in different currencies are issued by banks that have similar default risk. This means that the term structures of different countries are comparable because they do not have to be adjusted for differing default risk. Furthermore, Euro-deposit rates are not subject to capital controls because they are off-shore securities. Thus, Eurocurrency deposits are comparable in terms of credit risk, maturity, and issuer, but not in terms of currency denomination. In addition, high quality data for domestic interest rates are not easily obtained for all countries. In some countries, other than the United States and Canada, domestic Treasury bill rates are not always market clearing, and hence, will not reflect the true cost of credit, while Euro-deposit rates are market clearing.

EMPIRICAL RESULTS (ARBITRARY TIME PERIODS)

All interest rates for Germany, Netherlands, Switzerland, and the United Kingdom, covering all four maturities over the full sample were examined to determine whether the series possess one or more unit roots. Siklos and Wohar (1993a) give evidence that there is a unit root in the level of yields. One must next consider the null hypothesis that *n* yields contain *n*-1 cointegrated vectors and that the cointegrating vectors are the spread vectors.[5] The Johansen (1988) and Johansen and Juselius (1990) procedure will be used for estimating the cointegrating vectors and to test restrictions on these vectors. The first sample period examined was 1975-1990 and as the tests were repeated, the beginning year of the sample was increased by one year. Thus, the second period was 1976-1990, this process of methodically advancing through the sample is warranted due to the possibility that the existence of one common stochastic trend may differ for different sample periods considered. This process also is a way to examine the possibility that the cointegration tests are sensitive to sample selection[6], as well as giving a method to analyze the evolution of any cointegrating relationship.

In order for the output to support the expectations theory of one common stochastic trend, three cointegrating vectors among the four yields must be found for each period. Detailed results concerning the output are presented in tables 1a, 2a, 3a, 4a, and are summarized for the four countries Germany, Netherlands, Switzerland, and the United Kingdom. For the period 1975 to 1990 the results support the proposition of the expectations theory that there are three cointegrating vectors among the four yields. Therefore, with the exception of the subperiods listed below, the null of one common stochastic trend between these four yields cannot be rejected. Thus, there is acceptance

[5]For this study $n=4$, which is the number of different term structure yields that are examined for each country.

[6]I am aware that a long sample is necessary in order to test for long-run cointegration between time series (Hendry 1986, Hakkio and Rush 1991). It is argued, however, that in financial markets the long-run does not represent a long span of time (Brenner and Kroner 1992).

of the restriction that the rank of the cointegrating space is not more than three, but strong rejection of the hypothesis that the rank is not more than two. The exceptions occur in the following periods: for Germany the sample periods of 1975-1990, and 1982-1990, for the Netherlands 1982-1990, for Switzerland 1975-1990, and for the United Kingdom 1975-1990, and 1977-1990. In all of these cases the resulting statistics reject the restriction that the rank of the cointegrating relation is more than three. Thus, no common stochastic trend is found.

Hall, Andersen, and Granger (1992) use Treasury bill rates in a similar analysis and find differences over varying sample periods. They examine the three different monetary regimes of the United States, as possible breaks for sample periods, and find interesting results. For the first sample period of January 1970 through September 1979 (interest rate targeting), and the third sample period from October 1982 through December 1988 (partial interest rate targeting), they accept the hypothesis that the spreads of the four shortest maturity yields form a basis for the cointegrating space, which supports the expectations theory. They find three cointegrating vectors among each of the four short-term maturity yields to maturity, therefore, the spreads form a basis for the cointegrating space. The second regime from October 1979 to September 1982, had different results. This regime occurred in a time where the Federal Reserve placed emphasis on controlling the growth of reserves. This emphasis caused the interest rates to be much higher and more volatile than the other two regimes. They found that yields are still cointegrated but that the spreads no longer define the cointegrating relationship. They find at least one extra nonstationary common stochastic trend during this period. They argue that uncertainty caused by the Federal Reserves' new operating procedure caused the risk or liquidity premia to become nonstationary over this period, resulting in a change of the cointegrating relationship.

When Hall, Anderson, and Granger (1992), examine the full sample period they find that they cannot reject the null hypothesis of ten cointegrating for their set of eleven yields. However, while conditioning on there being ten cointegrating vectors, they reject the null hypothesis that these ten linearly independent spreads formed from the eleven yields comprise a basis for the cointegrating space. They give two possible explanations for this rejection; the first is that the spreads are not cointegrated, and the second is that the rejection has been caused by structural changes. They followed the second line of reasoning by breaking the sample periods into the three regimes previously mentioned. A similar method of separating the sample periods according to changes in monetary policy will be shown for Germany, the Netherlands, Switzerland, and the United Kingdom after the next section of this paper which will discuss the monetary policies and regimes that occured in each country.

At this point we will examine the period 1975-1990. Tables 1b, 2b, 3b, and 4b address the question: "do (k-1) linearly independent spreads formed from k yields belong to the cointegrating space?" This is done by first conditioning on there be three cointegrating vectors, and then testing the null hypothesis that three linearly independent spreads formed from the four yields comprise a basis for the cointegrating space. If the null hypothesis that n yields contain n-1 cointegrating vectors is rejected, one reason may be that the spreads are not cointegrated. If this is true then the expectations theory would be rejected. In order to investigate this, subsets of spreads were tested to see whether singly or jointly they are contained in the cointegrating space. A selection of possible combinations of tests of hypotheses involving subsets of the various spreads among the four yields are summarized in the tables 1c-4c.[7] The first column of the tables lists k yields, and the null hypothesis in each instance is that (k-1) linearly independent spreads formed from k yields belong to the cointegrating space. The tests are conditional on the rank of the cointegrating space being three, except for the United Kingdom during the sample period of 1984-1990. The first row reports the test results that the three linearly independent spreads span the cointegration space. The next six rows present the results of tests which consider the null hypothesis that an individual spread belongs to the cointegration space. The next four rows report results of the tests after increasing the number of yields (k) in the subset, and test the null hypothesis that a set of (k-1) linearly independent spreads formed from these yields belongs to the cointegrating space. With exception of the United Kingdom, non-rejection of the null was evident in all the combinations, thus supporting the expectations theory. The United Kingdom does support the expectation hypothesis, which is shown by the multiple combinations. However, there

[7]The combinations used are the same combinations that Hall, Andersen, and Granger (1992) use for the U.S. Treasury bill rates.

exist single combination subsets[8] that fail to support the expectations hypothesis.

The findings of the empirical work to this stage support the expectations hypothesis. However, rather than arbitrarily selecting sample periods (as was already shown) they will now be selected according to monetary regimes for all four countries. The following section is subdivided by the four countries in order to analyize the differing regimes and policies that occurred within each individual country during the sample range of 1975-1990.

COUNTRIES

Germany

Monetary policy in Germany is determined by the central bank of Germany which is called the Bundesbank. Following the rising inflation that occurred in the early 1970's, caused by rising oil prices, the Bundesbank began targeting a monetary aggregate in 1975. The monetary aggregate selected by the Bundesbank was central bank money stock (CBM). CBM is a weighted sum of currency held by residents, demand deposits, time deposits, and savings deposits. The weights are equal to one for currency and equal to the required reserve ratios of January 1974 for the rest of the components.[9] The Bundesbank considers CBM to be a broad monetary aggregate, a broad aggregate was

---

[8]These subsets are R1-R6, R3-R6, and R1-R3-R6. See notes in tables for details.

[9]16% for demand deposits, 12.4% for time deposits, and 8.2% for savings deposits. (Fratianni, 1993)

chosen in order to internalize short-run portfolio shifts between various types of bank deposits due to changes in short-term interest rates.

The Bundesbank, with its chosen aggregate CBM, confused researchers with the use of reserve ratios in the calculation of the CBM. Researchers misinterpreted the definition of CBM. For example, Fischer (1988), refers to CBM as a "required monetary base." The CBM cannot be a monetary base because in order for CBM to be a monetary base the required reserves on foreign deposits and excess reserves must be included in CBM, and these values are not included in the composition of CBM. The Bundesbank refers to CBM as a monetary stock concept, which has received criticism from Duwendag (1976), Courakis (1980), and Neumann (1975), over the different weights involved with the CBM. The Bundesbank responded to these criticisms by stating that the CBM was a reliable indicator of monetary conditions in Germany, and that the CBM maintains a more stable relationship with nominal Gross National Product (GNP) than other monetary aggregates (Deutsche Bundesbank, 1980).

The monetary targets from 1975 to 1978 were expressed as target growth rates for the average annual money stock or the year end money stock. The Bundesbank overshot the targets all four years. This overshooting caused speculation as to whether the Bundesbank was interested in the targeted growth rate. In 1979 the Bundesbank began producing target ranges around the target growth rate. The Bundesbank set the range of three percent to be the corridor around the target growth rate. In 1984 the corridor was narrowed to two percent on the basis of less external uncertainty (Deutsche Bundesbank

Monthly Report, December 1983). However, in 1987 the Bundesbank stated that the strain of the European Monetary System (EMS) was creating difficulties in the operation of Germany's monetary policy and therefore they widened the corridor around the target monetary growth back to three percent. In 1988 the Bundesbank was induced into abandoning CBM due to lack of effectiveness. The CBM lost its effectiveness because prolonged periods of low-interest rates and appreciation of the Deutsche Mark caused the currency component of the CBM to grow faster than the other components of M3[10], thus the CBM tended to overstate monetary growth (Deutsche Bundesbank Monthly Report, March 1988). This overstating of monetary growth led the Bundesbank to change the monetary aggregate used in targeting the monetary growth rate. The monetary aggregate M3 was instituted as the new monetary target of the Bundesbank. Neuman and von Hagen (1988) empirically show that when given the targeted money supply, the use of the nonweighted aggregate M3 satisfies the basic requirement of a stable money demand function, which gives the Bundesbank an adequate degree of predictability and controllability of price-level developments under monetary control. Following the change in the aggregate to M3 in 1988, the percentage band around the targeted M3 was then narrowed to two percent in 1990 as the Bundesbank tried to prove that it was committed to monetary targeting. This commitment to monetary targeting was in question due to overshooting from 1985 to 1989.

The setting of the target ranges in Germany is a public exercise. The Bundesbank

[10]M3 consists of currency held by residents, demand, time, and savings deposits.

uses three variables to develop the target range, the Bundesbank's long-term inflation goal, estimated potential output growth, and expected velocity growth[11]. Due to the short-term nature of the unemployment rate and expected transitory deviations of inflation from the long-run trend, they are not used in the setting of the target ranges. The Bundesbank gives itself the freedom to deal with these short-term variables by selecting a target range or corridor, instead of choosing a specific value. Another reason for selecting a corridor is to give the Bundesbank a means to deal with exchange-rate fluctuations. Rieke (1984, p.55)[12] states:

> In order to avoid misunderstanding and not to damage the credibility of monetary targeting, the Bundesbank has, since 1979, taken the external constraints of monetary policy into account by adopting conditional monetary targets. By specifying a "target corridor" for the intended growth of the central bank money stock, the Bundesbank shows its readiness a priori to support the goals of exchange rate policy with monetary policy adjustments if necessary, and, furthermore, indicates how much room for maneuvering is deemed necessary for this purpose.

This summation of Rieke was reaffirmed by the Deutsche Bundesbank Monthly Report in May 1988, p.20 (Fratianni, 1993):

> Whenever excessive appreciation of the Deutsche Mark rate threatened seriously to disturb domestic economic trends --- the Bundesbank of necessity tolerated the overshooting of its monetary target in order to mitigate the upward pressure by keeping interest rates down and by buying foreign exchange, and in order to bolster domestic demand.

---

[11]The velocity prediction does not account for short-run changes in actual velocity, the focus is placed on the long-run relationship between the target aggregate and potential output.

[12] Rieke's quote was found in Fratianni 1993

The Bundesbank's monetary regime can be summarized as a policy which focusses on the stability of prices through monetary targeting, where prices are stabilized through short-term fluctuations and the exchange-rate.

Germany had one monetary regime for the period 1975-1990. This regime targeted a monetary aggregate for the entire period. For the purpose of this paper, the sample periods will be separated into segments that reflect the changing of the policies concerning the different target growth corridors, and the switching of the aggregate from CBM to M3. Thus, the following periods were selected; 1975-1978, 1979-1984, 1984-1987.

Netherlands

Dutch monetary policy has been determined by Zijlstra, who was the president of the Dutch central bank from 1967 to 1980. During this period the Dutch monetary policy was directed towards a stable exchange rate and control of the liquidity ratio.[13] This policy can be translated into a monetary policy of a desired growth rate for M2. Thus, while the major industrial countries began monetary targeting after the fall of the Bretton Woods fixed exchange rate system and the inflationary problems of the oil crisis, the Netherlands had been targeting the monetary aggregate M2 since 1967 (Cesar, 1990).

The main policy of the Dutch central bank is to influence the growth of the net-credit supply of the banking sector. Both direct and indirect methods have been used to

---

[13]The liquidity ratio is total liquidity (M2) as a percentage of net national income.

control the credit supply of the banking sector. During 1973 to 1977, an indirect system of credit control was governing the banks in the Netherlands. The central bank manipulated the banks' net-credit expansion, in an effort to control the growth rate of M2 and keep the exchange rate stabilized. During the period from 1977-1981 a direct method was used to control the banks as the central bank put credit ceilings on the net-credit expansions of the banks. This policy of attempting to control the exchange rate and the growth of M2 fell apart in 1986-1987 when the Dutch monetary authorities attempted to hold the exchange rate with the Deutsche Mark of Germany. Following this episode the bank continues to give its highest priority to a stable Dutch guilder to a German mark exchange rate.

The periods of 1975-1981, 1981-1986, and 1986-1990, were chosen as the different sample periods to be examined. These periods reflect changes that occurred in the central bank of the Netherlands.

Switzerland

The central bank in Switzerland is called the Swiss National Bank (SNB). After the fall of the Bretton Woods fixed exchange rate regime in 1973 the SNB began targeting the monetary aggregate M1 in 1974. The Swiss based the target growth rate on their long-term inflation goal, estimated potential output growth, and expected velocity trends. The announced target in Switzerland is a specific target value, with no percentage range surrounding the value (Bernanke and Mishkin, 1992). This lack of a range surrounding the target growth rate is explained, " from a psychological point of view, missing the target band is worse than missing a point target" (Fratianni, 1993; Schiltknecht, 1982 p.73). The SNB uses the target growth rate as a medium to long-term constraint and does not let the growth rate interfere with short-term decisions affecting the exchange rate or inflationary policies. An example of this policy can be seen during the exchange-rate crisis of 1978. When the Swiss franc was appreciating, the SNB eased monetary policy to let the the growth of M1 reach sixteen percent when the targeted value of M1 was only five percent.

After the exchange-rate crisis in 1978 the SNB tightened monetary policy in an attempt to resume targeting monetary growth. The SNB consistently used the monetary base as an operating instrument for their monetary policies, thus in order to control M1 the SNB was required to predict the money multiplier.[14] However, the SNB was having trouble forecasting the money multiplier, which led them to change their targeted aggregate of M1 to the monetary base in 1980. In 1980 and 1981, following increased inflation and previous overshooting of the monetary growth rate, the SNB was below the target for both years. In the next six years from 1982 to 1987 the SNB targeted the monetary growth with great accuracy, causing inflation to fall to low levels and unemployment to be insignificant. The inflation rate in 1986 fell from three percent to zero and in 1989 increased from two percent to five percent. Fluctuations in the monetary base failed to predict either the 1986 or 1989 fluctuations in the inflation rate. Thus, the

[14]The money multiplier is a ratio of M1 to the monetary base.

SNB assumed the problem to be a structural shift in the demand for base money. The two main factors cited for this shift are a reduction in legal reserve requirements and the introduction of an electronic interbank payments system. After the structural shift, for the period of 1988 to 1990, the SNB has permitted negative money growth.

The sample periods of 1975-1978, 1979-1981, and 1982-1987 were chosen in order to depict the periods where the SNB focused on monetary policies.

United Kingdom

The United Kingdom, in response to the increase in inflation that came with the oil crisis, began targeting the broad aggregate sterling M3. In order to assure that M3 targets were met, the Supplementary Special Deposits Scheme, later named the corset, was introduced in December 1973. The corset scheme tried to reduce M3 growth by taxing high interest bank deposits, which is a component of M3 (Bernanke and Mishkin, 1992). This scheme using tax policy distorted the relationship between M3 and macroeconomic variables such as nominal income and inflation. In 1976, formal publication of monetary targeting began, under the pressure of the International Monetary Fund (IMF), which had been called in to help stabilize the balance of payments (Bernanke and Mishkin, 1992).

Until 1979 and the arrival of Margaret Thatcher, the British monetary authorities were not actively targeting their monetary growth targets. Margaret Thatcher's Medium-Term Financial Strategy (MTFS) was brought before the government. It consisted of three components: a gradual deceleration in M3 growth, elimination of various controls on the economy (including the corset, exchange controls, and income policies), and a reduction of the Public Sector Borrowing Requirement (PSBR) or deficit (Fratianni, 1993). The main goal of the MTFS was to increase government credibility and reduce inflation. However, like the problems of the federal reserve monetary targeting in the United States during the period 1979-1982, the British government watched as M3 grew and overshot the targeted growth rate while the other indicators (ie. value of the pound, growth rates of narrower aggregates, unemployment rates, and inflation rates) all began to signal that monetary policy was very tight. In 1983, the instability of M3, caused the Bank of England to begin deemphasizing the aggregate M3 and began using M0, which stands for the monetary base. The use of M3 as a target aggregate was suspended in 1985, and completely dropped in 1987. The aggregate M0 has proven to be a better target than M3 because since 1984 it has been consistently close to the target range, except for 1987-1988. During 1987-1988, with rising concern about the appreciation of the pound, the exchange rate of the pound to the Deutsche Mark was capped at 3.00 DM to the pound, resulting in rapid money growth.

The three chosen sample periods are 1975-1979, 1979-1982, and 1984-1990. The first was chosen due to the lack of monetary targeting during the pre-Thatcher period. The period 1979-1982 was selected because the M3 became a very unstable predictor during this period. This also coincides with Hall, Andersen and Granger's (1992) period in the United States Treasury Bill analysis. The period 1984-1990 was selected because the targeted aggrgate M0 was consistently close to the target range. Thus, the Bank of

England was focusing on monetary policy.

EMPIRICAL RESULTS FOR SAMPLE PERIODS DEFINED BY MONETARY REGIMES

The results of the testing using the newly defined sample periods find support for the expectations hypothesis. The methodology, and tests used were the same described previously in section 3 and section 5 of this paper. There were three cointegrating vectors found for the four yields examined in all but four of the time periods. These time periods were the United Kingdom 1984-1990, Germany 1984-1987, and Switzerland 1979-1981 and 1982-1987. Table 5 shows the sample periods covered for each of the countries, with a brief description of the regime in control. The last column in table 5 shows whether three cointegrating vectors are found for the four different maturities. If three vectors are found then there is one common stochastic trend which supports the expectations theory. The lack of cointegration found during these periods supports Hall, Andersen and Granger's (1992) finding that during 1979-1982 when the United States targeted a monetary base rather than interest rates there was not a common stochastic trend, thus rejecting the expectations hypothesis. This sounds like a contradiction because in every period examined for Germany, the Netherlands, Switzerland, and the United Kingdom a monetary aggregate was being targeted. However, the Central banks were not focusing on their monetary targets for some portions of the period examined. When the banks did focus on their monetary growth rate targets, the expectations hypothesis did not hold, since there was not one common stochastic trend.

SUMMARY AND CONCLUSION

This paper has examined the short-end of the term structure using Eurodeposit rates (one-month, three-month, six-month, and twelve-month) as a cointegrated system[15] of the term structure for Germany, the Netherlands, Switzerland, and the United Kingdom. Examinations were made on arbitrary time periods ranging from 1975 to 1990 and for time periods selected according to monetary regimes.

The null hypothesis that n yields contain n-1 cointegrated vectors and that these cointegrating vectors are the spread vectors is examined. The results show that for the arbitrary and selected time periods, with noted exceptions, the null of one common stochastic trend between these four yields cannot be rejected, which supports the expectations hypothesis for the term structure.

The exceptions that reject the expectations hypothesis by rejecting the null hypothesis of one common stochastic trend are: Germany for the time periods 1975-1990, 1982-1990, and 1984-1987, Switzerland for the time periods 1975-1990, 1979-1981, and 1982-1987, the Netherlands for the time periods 1982-1990, and the United Kingdom for the time periods 1975-1990, 1977-1990, and 1984-1990.

Next we examine the question: do (k-1) yields belong to the cointegrating space? The answer to this question is, in general, positive for most of the time periods examined.

---

[15]The cointegration testing procedure of Johansen and Juselius (1990) was used.

When the null hypothesis that n yields contain n-1 cointegrating vectors is rejected, one reason for this may be that the spreads are not cointegrated, rejecting the expectations theory.

Lastly, when the monetary policies of these four countries focused on a targeted monetary growth the cointegration results did not find three cointegrating vectors for the four yields. In these cases the existence of one common stochastic could not be found to support the expectations hypothesis. This may be the result of large volatility in interest rates when the policies reflect the goal of achieving the targeted monetary aggregate. This lack of support for the expectations theory during strict monetary targeting differs from the finding of one common stochastic trend during periods of controling the exchange rate or interest rates. Thus, the expectations theory of the term structure is supported when the central banks focuses on the exchange rate or interest rates, and the theory is not supported when the central banks focuses on a targeted monetary aggregate.

References

Belongia, Michael T., and Werner Hermann, 1989, "Can a Central Bank Influence Its Currency's Real Value? The Swiss Case," Review- Federal Reserve Bank of St Louis, 71, January/February, 47-55.

Bernanke, Ben, and Frederic Mishkin, 1992, "Central Bank Behavior and the Strategy of Monetary Policy: Observations from Six Industrialized Countries," NBER Macroeconomics Annual, 7, 183-228.

Blankart, Franz, 1990, "Economic Status of Switzerland: Past, Present, and Future," Atlantic Economic Journal, 18(3), September, 12-17.

Bradley, Michael G., and Stephen A. Lumpkin, (1992), "The Treasury Yield Curve as a Cointegrated System," Journal of Financial and Quanitative Analysis, 27, September, 449-463.

Brennan, M. J., and E. J. Schwartz, 1979, "A Continuous Time Approach to the Pricing of Bonds," Journal of Banking and Finance, 3, July, 133-155.

Brenner, Robin J., and Kenneth F. Kroner, 1992, "Arbitrage and Cointegration," mimeo, University of Arizona, May.

Burdekin, Richard C., 1987, "Swiss Monetary Policy: Central Bank Independence and Stabilization Goals," Kredit and Kapital, 4, 455-466.

Campbell, John Y., and Robert Shiller, 1987, "Cointeegration and Tests of Present Value Models," Journal of Political Economy, 95, October, 1062-1088.

Cesar, Herman, Jakob De Haan, and Jan Jacobs, 1990, "Monetary Targeting in the Netherlands: an Application of Cointegration Tests," Applied Economics, 22, 1537-1548.

Choi, Seungmook, and Mark E. Wohar, 1991, "New Evidence Concerning the Expectations Theory for the Short-end of the Maturity Spectrum: 1910-1978," Journal of Financial Research, 14, Spring, 83-92.

Chowdhury, Abdur R., 1988, "Monetary Policy, Fiscal Policy and Aggregate Economic Activity: Some Further Evidence," Applied Economics, 20, 63-71.

Courakis, A. S., 1980, "On Unicorns and Other Such Creatures," Zeitschrift fur die gesammte Staatswissenschaft, 136, 28-49.

Cox, John C., J. E. Ingersoll, and S. A. Ross, 1985, "A Theory of the Term Structure of Interest Rates," Econometrica, 53, March, 385-407.

Demopoulos, George D., George M. Katsimbris, and Stephen M. Miller, 1987, "Monetary Policy and Central-Bank Financing of Government Budget Deficits: A Cross Country Comparison," European Economic Review, 31, 1023-1050.

Deutsche Bundesbank, Monatsbericht, Frankfurt (Main), various editions.

Duwendag, Dieter, 1976, "Die neue Geldpolitik der Deutschen Bundesbank: Interpretation und kritische Anmerkungen," Konjunkturpolitik, 22, 265-306.

Engle, Robert F., and Clive W. J. Granger, 1987, "Cointegration and Error Correction: Representation, Estimation, and Testing," Econometrica, 55(2), March, 251-276.

Fischer, Stanley, 1988, "Monetary Policy and Performance in the U.S., Japan and Europe, 1973-1986," Finanzmarkt und Portfoliomanagement, 4, 1825.

Fratianni, Michele U., and Dominick Salvatore, 1993, Monetary Policy in Developed Economies, Westport, Connecticut, Greenwood Press.

Hakkio, C.G., and M. Rush, 1991, "Cointegration: How Short is the Long-Run?," Journal of International Money and Finance, 10, December, 571-581.

Hall, Anthony D., Anderson, Heather M., and Clive W. J. Granger, 1992, "A Cointegration Analysis of Treasury Bill Yields," Review of Economics and Statistics, 74, February, 116-126.

Hartog, Joop, and Jules Theeuwes, 1993, "Post-War Unemployment in the Netherlands," European Journal of Political Economy, 9, 73-112.

Hendry, D.F., 1986, "Econometric Modeling with Cointegrative Variables: An Overview," Oxford Bulletin of Economics and Statistics, 48, August, 201-212.

Johansen, Soren, 1988, "Statistical Analysis of Cointegration Vectors," Journal of Economic Dynamics and Control, 12, June/September, 231-254.

_________, 1991, "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," Econometrica, 59, November, 1551-1580.

_________, and Katarina Juselius, 1990, "Maximum Likelihood Estimation and Inference on Cointegration--With Application to the Demand for Money," Oxford Bulletin of Economics and Statistics, 52, May, 169-210.

Mishkin, Frederic S., 1991, "A Multi-country Study of the Information in the Shorter Maturity Term Structure About Future Inflation," Journal of International Money and Finance, 10, March, 2-22.

Mougoué, Mbodja, 1992, "The Term Structure of Interest Rates as a Cointegrated System: Empirical Evidence from the Eurocurrency Market," The Journal of Financial Research, 15(3), Fall, 285-296.

Neumann Manfred J. M., 1975, "Konstrukte der Zentralbankgeldmenge," Kredit und Kapital, 8, 317-345.

__________, and Jurgen von Hagen, 1988, "Instability Versus Dynamics: A Study in West German Demand for Money," Journal of Macroeconomics, 10, 327-349.

Osterwald-Lenum, M., 1992, "A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics: Four Cases," Oxford Bulletin of Economics and Statistics, 54, August, 461-472.

Rich, Georg, 1990, "Exchange-Rate Management Under Floating Exchange Rates: A Skeptical Swiss View," Journal of Banking and Finance, 14, November, 993-1021.

Richard, S. F., 1978, "An Arbitrage Model of the Term Structure of Interest Rates," Journal of Financial Economics, 6, March, 33-57.

Rieke, Wolfgang, 1984, "Die Rolle von Interventionen als Bestimmungsfaktor der Wechselkurse beim 'floating'," Devisenmarktinterventionen der zentralbanken, edited by Werner Ehrlicher and Rudolf Richter, Berlin: Duncker & Humblot.

Schiltknecht, Kurt, 1982, "Switzerland: The Pursiut of Monetary Objectives," Central Bank Views on Monetary Targeting, P. Meek et al. (eds.), Federal Reserve Bank of New York.

Sephton, P.S., and H.K.Larsen, 1991, "Tests of Exchange Market Efficiency: Fragile Evidence from Cointegration Tests," Journal of International Money and Finance, 10, December, 561-570.

Siklos, Pierre L., and Mark E. Wohar, 1993, "Convergence in Interest Rates and Inflation Rates Across Countries and Across Time," Working Paper.

Siklos, Pierre L., and Mark E. Wohar, 1993, "Cointegration and the Term Structure: A Multi-Country Comparison," Working Paper.

Stock, James H., 1987, "Asymptotic Properties of Least Squares Estimators of Cointegrating Vectors," Econometrica, 55, September, 1035-1056.

Stock, J. H., and Mark W. Watson, 1988, "Testing for Common Trends," Journal of the American Statistical Association, 83, December, 1097-1107.

Trehan, Bharat, 1988, "The Practice of Monetary Targeting: A Case Study of the West German Experience," Economic Review, Spring, 30-44.

Vasicek, O., 1977, "An Equilibrium Characterization of the Term Structure," Journal of Financial Economics, 5, November, 177-188.

Yue, Piyu, and Robert Fluri, 1991, "Divisia Monetary Services Indexes for Switzerland: Are They Useful for Monetary Targeting?," Review- Federal Reserve Bank of St Louis, 73, September/October, 19-33.

Zhang, Hua, 1993, "Treasury Yield Curves and Cointegration," Applied Economics, 25, 361-367.

Notes to Tables

There are two types of tables presented for each country. The first table for each country represents cointegration tests to determine the number of cointegrating vectors among the set of four yields. Tests were performed with a lag length equal to four. Both the maximal (λ-max) test and the trace test are performed. Critical values for both tests are presented in the tables and can be found in Johansen and Juselius (1990 table A.2) or Osterwald-Lenum (1992 table 1.1*). The second table for each country tests the null hypothesis that the three linearly independent spreads formed from the four yields comprise a basis for the cointegrating space. R(k) is the k month eurorate. The tables which reports the R(k)'s list h yields in the left hand column. The null hypothesis in each is that (h-1) linearly independent spreads formed from these yields belong to the cointegrating space. For example, R1-R12 is a test that the three vectors take the form (-1 1 0 0), (0 -1 1 0), (0 0 -1 1). R1, R3 is a test that the single vector takes the form (0 0 -1 1). R1, R3, R6 is a test that the two vectors take the form (-1 1 0 0), (0 -1 1 0). R3, R6, R12 is the test that the two vectors take the form (0 -1 1 0), (0 0 -1 1), and so on. These tests are conditional on the rank of the cointegration space being three. The test statistics are distributed as χ_2(h-1) degrees of freedom. P-values are presented in the parentheses below these test statistics.

Germany: Table 1a

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	trace Test Statistic	5% Critical Value
1975:1 - 1990:12	r=0	115.167	27.136	231.252	48.280
	r<=1	70.941	21.074	116.085	31.525
	r<=2	36.893	14.900	45.144	17.953
	r<=3	8.251	8.176	8.251	8.176
1976:1 - 1990:12	r=0	125.757	27.136	263.990	48.280
	r<=1	72.712	21.074	138.233	31.525
	r<=2	59.609	14.900	65.521	17.953
	r<=3	5.912	8.176	5.912	8.176
1977:1 - 1990:12	r=0	125.544	27.136	252.801	48.280
	r<=1	65.705	21.074	127.257	31.525
	r<=2	56.009	14.900	61.552	17.953
	r<=3	5.543	8.176	5.543	8.176
1978:1 - 1990:12	r=0	117.666	27.136	237.462	48.280
	r<=1	62.224	21.074	119.796	31.525
	r<=2	51.848	14.900	57.572	17.953
	r<=3	5.724	8.176	5.724	8.176
1979:1 - 1990:12	r=0	106.292	27.136	218.151	48.280
	r<=1	60.482	21.074	111.859	31.525
	r<=2	45.208	14.900	51.377	17.953
	r<=3	6.168	8.176	6.168	8.176
1980:1 - 1990:12	r=0	101.228	27.136	202.722	48.280
	r<=1	55.570	21.074	101.494	31.525
	r<=2	41.864	14.900	45.924	17.953
	r<=3	4.060	8.176	4.060	8.176
1981:1 - 1990:12	r=0	94.173	27.136	183.635	48.280
	r<=1	46.322	21.074	89.463	31.525
	r<=2	38.937	14.900	43.140	17.953
	r<=3	4.203	8.176	4.203	8.176
1982:1 - 1990:12	r=0	74.401	27.136	170.541	48.280
	r<=1	53.837	21.074	96.140	31.525
	r<=2	30.711	14.900	42.302	17.953
	r<=3	11.591	8.176	11.591	8.176

Germany: **Table 1a (continued)**

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1983:1 - 1990:12	r=0	70.852	27.136	131.360	48.280
	r<=1	35.176	21.074	60.508	31.525
	r<=2	21.529	14.900	25.332	17.953
	r<=3	3.803	8.176	3.803	8.176
1984:1 - 1990:12	r=0	68.106	27.136	116.002	48.280
	r<=1	27.382	21.074	47.896	31.525
	r<=2	18.667	14.900	20.513	17.953
	r<=3	1.846	8.176	1.846	8.176

Germany: Table 1b

Spreads Between	Sample Period					DF
	75:1-90:12	76:1-90:12	77:1-90:12	78:1-90:12	79:1-90:12	
R(1)-R(12)	1.680 (.641)	4.096 (.251)	3.902 (.272)	3.610 (.307)	4.287 (.232)	3
R(1),R(3)	1.288 (.256)	1.116 (.291)	0.859 (.354)	1.031 (.310)	1.038 (.308)	1
R(1),R(6)	1.641 (.200)	3.437 (.064)	2.913 (.088)	2.816 (.093)	3.040 (.081)	1
R(1),R(12)	1.020 (.313)	2.319 (.128)	1.922 (.166)	1.748 (.186)	2.447 (.118)	1
R(3),R(6)	1.354 (.245)	3.758 (.053)	3.611 (.057)	3.191 (.074)	3.806 (.051)	1
R(3),R(12)	0.821 (.365)	1.836 (.175)	1.467 (.226)	1.254 (.263)	1.851 (.174)	1
R(6),R(12)	0.533 (.466)	1.126 (.289)	0.902 (.342)	0.744 (.388)	1.168 (.280)	1
R(1),R(3),R(6)	1.680 (.432)	3.994 (.136)	3.812 (.149)	3.486 (.175)	4.022 (.134)	2
R(1),R(3),R(12)	1.568 (.457)	2.768 (.251)	2.337 (.311)	2.262 (.323)	2.837 (.242)	2
R(1),R(6),R(12)	1.649 (.439)	3.770 (.152)	3.335 (.189)	3.188 (.203)	3.717 (.156)	2
R(3),R(6),R(12)	1.372 (.504)	3.819 (.148)	3.659 (.161)	3.263 (.196)	4.000 (.135)	2

Spreads Between	Sample Period					D F
	80:1-90:12	81:1-90:12	82:1-90:12	83:1-90:12	84:1-90:12	
R(1)-R(12)	3.464 (.325)	2.595 (.458)	3.576 (.311)	2.152 (.541)	1.050 (.789)	3
R(1),R(3)	0.977 (.323)	0.414 (.520)	0.413 (.520)	0.556 (.456)	0.121 (.728)	1
R(1),R(6)	2.586 (.108)	1.769 (.184)	0.116 (.734)	1.718 (.190)	0.098 (.754)	1
R(1),R(12)	1.990 (.158)	1.260 (.262)	0.350 (.554)	0.587 (.444)	0.826 (.363)	1
R(3),R(6)	2.925 (.087)	2.443 (.118)	2.986 (.084)	1.200 (.273)	0.931 (.335)	1
R(3),R(12)	1.453 (.228)	0.978 (.323)	0.707 (.400)	0.289 (.591)	0.908 (.341)	1
R(6),R(12)	0.949 (.330)	0.616 (.433)	0.324 (.569)	0.134 (.714)	0.788 (.375)	1
R(1),R(3),R(6)	3.237 (.198)	2.553 (.279)	3.568 (.168)	2.054 (.358)	0.969 (.616)	2
R(1),R(3),R(12)	2.425 (.298)	1.470 (.479)	1.281 (.527)	0.982 (.612)	0.909 (.635)	2
R(1),R(6),R(12)	3.127 (.209)	2.102 (.350)	0.351 (.839)	1.724 (.422)	0.834 (.659)	2
R(3),R(6),R(12)	3.074 (.215)	2.460 (.292)	3.022 (.221)	1.330 (.514)	1.042 (.594)	2

Germany:

Table 1c

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1975:1 - 1978:12	r=0	34.020	27.136	80.705	48.280
	r<=1	25.253	21.074	46.684	31.525
	r<=2	17.705	14.900	21.431	17.953
	r<=3	3.726	8.176	3.726	8.176
1979:1 - 1984:12	r=0	40.471	27.136	109.675	48.280
	r<=1	32.914	21.074	69.204	31.525
	r<=2	29.264	14.900	36.290	17.953
	r<=3	7.026	8.176	7.026	8.176
1984:1 - 1987:12	r=0	25.691	27.136	48.321	48.280
	r<=1	15.058	21.074	22.630	31.525
	r<=2	7.474	14.900	7.572	17.953
	r<=3	.097	8.176	.097	8.176

Table 1d

Spreads Between	Sample Period		DF
	1975:1-1978:12	1979:1-1984:12	
R(1)-R(12)	15.590 (.001)	13.636 (.003)	3
R(1),R(3)	.0250 (.617)	4.088 (.043)	1
R(1),R(6)	1.676 (.195)	10.470 (.001)	1
R(1),R(12)	10.998 (.001)	2.539 (.111)	1
R(3),R(6)	2.413 (.120)	11.730 (.001)	1
R(3),R(12)	12.228 (.000)	1.224 (.269)	1
R(6),R(12)	13.822 (.000)	.252 (.616)	1
R(1),R(3),R(6)	2.777 (.249)	12.863 (.002)	2
R(1),R(3),R(12)	13.165 (.001)	6.071 (.048)	2
R(1),R(6),R(12)	15.227 (.000)	11.373 (.003)	2
R(3),R(6),R(12)	15.319 (.000)	12.142 (.002)	2

Netherlands: Table 2a

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1975:1 - 1990:12	r=0	131.675	27.136	265.209	48.280
	r<=1	74.981	21.074	133.534	31.525
	r<=2	53.913	14.900	58.553	17.953
	r<=3	4.639	8.176	4.639	8.176
1976:1 - 1990:12	r=0	127.615	27.136	263.615	48.280
	r<=1	87.363	21.074	136.000	31.525
	r<=2	44.356	14.900	48.636	17.953
	r<=3	4.280	8.176	4.280	8.176
1977:1 - 1990:12	r=0	122.127	27.136	265.749	48.280
	r<=1	86.026	21.074	143.622	31.525
	r<=2	53.339	14.900	57.595	17.953
	r<=3	4.257	8.176	4.257	8.176
1978:1 - 1990:12	r=0	116.629	27.136	249.284	48.280
	r<=1	80.334	21.074	132.655	31.525
	r<=2	47.290	14.900	52.321	17.953
	r<=3	5.031	8.176	5.031	8.176
1979:1 - 1990:12	r=0	104.526	27.136	236.951	48.280
	r<=1	80.060	21.074	132.425	31.525
	r<=2	48.409	14.900	52.365	17.953
	r<=3	3.955	8.176	3.955	8.176
1980:1 - 1990:12	r=0	100.429	27.136	210.178	48.280
	r<=1	63.313	21.074	109.750	31.525
	r<=2	41.371	14.900	46.436	17.953
	r<=3	5.065	8.176	5.065	8.176
1981:1 - 1990:12	r=0	100.177	27.136	203.297	48.280
	r<=1	61.436	21.074	103.120	31.525
	r<=2	38.590	14.900	41.684	17.953
	r<=3	3.093	8.176	3.093	8.176
1982:1 - 1990:12	r=0	80.670	27.136	185.561	48.280
	r<=1	60.846	21.074	104.891	31.525
	r<=2	29.072	14.900	44.045	17.953
	r<=3	14.972	8.176	14.972	8.176

Netherlands: **Table2a (continued)**

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	trace Test Statistic	5% Critical Value
1983:1 - 1990:12	r=0	74.956	27.136	148.956	48.280
	r<=1	45.801	21.074	74.000	31.525
	r<=2	22.507	14.900	28.199	17.953
	r<=3	5.692	8.176	5.692	8.176
1984:1 - 1990:12	r=0	67.131	27.136	114.825	48.280
	r<=1	27.710	21.074	47.695	31.525
	r<=2	18.982	14.900	19.985	17.953
	r<=3	1.003	8.176	1.003	8.176

Netherlands:

Table 2b

Spreads Between	Sample Period					DF
	75:1-90:12	76:1-90:12	77:1-90:12	78:1-90:12	79:1-90:12	
R(1)-R(12)	1.733 (.630)	1.069 (.784)	0.959 (.811)	2.928 (.403)	2.784 (.426)	3
R(1),R(3)	0.030 (.862)	0.033 (.857)	0.554 (.457)	1.854 (.173)	2.197 (.138)	1
R(1),R(6)	0.486 (.486)	0.097 (.756)	0.063 (.801)	0.432 (.511)	1.000 (.317)	1
R(1),R(12)	0.944 (.331)	0.500 (.480)	0.113 (.737)	0.394 (.530)	0.280 (.597)	1
R(3),R(6)	1.120 (.290)	0.605 (.437)	0.166 (.683)	0.233 (.629)	0.079 (.778)	1
R(3),R(12)	1.096 (.295)	0.639 (.424)	0.274 (.600)	0.976 (.323)	0.828 (.363)	1
R(6),R(12)	0.774 (.379)	0.450 (.502)	0.229 (.632)	0.908 (.341)	0.811 (.368)	1
R(1),R(3),R(6)	1.608 (.447)	0.916 (.633)	0.886 (.642)	2.403 (.301)	2.265 (.322)	2
R(1),R(3),R(12)	1.140 (.565)	0.693 (.707)	0.834 (.659)	2.808 (.246)	2.784 (.249)	2
R(1),R(6),R(12)	0.944 (.624)	0.505 (.777)	0.342 (.843)	1.496 (.473)	1.850 (.397)	2
R(3),R(6),R(12)	1.328 (.515)	0.838 (.658)	0.302 (.860)	0.979 (.613)	0.830 (.660)	2

Spreads Between	Sample Period					D F
	80:1-90:12	81:1-90:12	82:1-90:12	83:1-90:12	84:1-90:12	
R(1)-R(12)	3.347 (.341)	0.863 (.834)	0.272 (.965)	0.520 (.915)	2.357 (.502)	3
R(1),R(3)	2.197 (.138)	0.407 (.523)	0.246 (.620)	0.329 (.566)	1.372 (.242)	1
R(1),R(6)	0.700 (.403)	0.055 (.815)	0.231 (.631)	0.259 (.611)	1.871 (.171)	1
R(1),R(12)	0.321 (.571)	0.002 (.960)	0.128 (.721)	0.284 (.594)	0.008 (.927)	1
R(3),R(6)	0.215 (.643)	0.190 (.663)	0.072 (.788)	0.026 (.872)	0.397 (.529)	1
R(3),R(12)	0.880 (.348)	0.049 (.824)	0.045 (.832)	0.141 (.708)	0.067 (.796)	1
R(6),R(12)	0.784 (.376)	0.023 (.878)	0.028 (.866)	0.150 (.698)	0.193 (.661)	1
R(1),R(3),R(6)	2.558 (.278)	0.852 (.653)	0.251 (.882)	0.329 (.848)	1.875 (.392)	2
R(1),R(3),R(12)	3.244 (.197)	0.570 (.752)	0.271 (.873)	0.444 (.801)	1.373 (.503)	2
R(1),R(6),R(12)	1.657 (.437)	0.115 (.944)	0.239 (.887)	0.336 (.845)	2.199 (.333)	2
R(3),R(6),R(12)	0.918 (.632)	0.190 (.909)	0.079 (.961)	0.151 (.927)	1.421 (.491)	2

Netherlands:

Table 2c

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1975:1 1981:12	r=0	50.884	27.136	113.169	48.280
	r<=1	37.372	21.074	62.286	31.525
	r<=2	24.476	14.900	24.914	17.953
	r<=3	.438	8.176	.438	8.176
1981:1 - 1986:12	r=0	67.361	27.136	133.718	48.280
	r<=1	39.676	21.074	66.356	31.525
	r<=2	25.387	14.900	26.680	17.953
	r<=3	1.293	8.176	1.293	8.176
1986:1 - 1990:12	r=0	53.410	27.136	95.643	48.280
	r<=1	25.651	21.074	42.233	31.525
	r<=2	16.319	14.900	16.581	17.953
	r<=3	.263	8.176	.263	8.176

Table 2d

Spreads Between	Sample Period			DF
	1975:1-1981:12	1981:1-1986:12	1986:1-1990:12	
R(1)-R(12)	3.503 (.320)	3.915 (.271)	6.794 (.079)	3
R(1),R(3)	.016 (.899)	1.261 (.261)	3.779 (.052)	1
R(1),R(6)	.270 (.603)	.499 (.480)	5.679 (.017)	1
R(1),R(12)	1.360 (.244)	.105 (.746)	.095 (.758)	1
R(3),R(6)	.952 (.329)	.052 (.820)	1.384 (.239)	1
R(3),R(12)	1.917 (.166)	.410 (.522)	.022 (.881)	1
R(6),R(12)	1.815 (.178)	.391 (.532)	.188 (.665)	1
R(1),R(3),R(6)	2.562 (.278)	2.011 (.366)	5.734 (.057)	2
R(1),R(3),R(12)	2.987 (.225)	3.208 (.201)	4.051 (.132)	2
R(1),R(6),R(12)	1.838 (.399)	1.420 (.492)	6.340 (.042)	2
R(3),R(6),R(12)	1.921 (.383)	.413 (.814)	4.459 (.108)	2

Switzerland: **Table 3a**

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1975:1 - 1990:12	r=0	92.345	27.136	200.472	48.280
	r<=1	60.564	21.074	108.127	31.525
	r<=2	38.324	14.900	47.563	17.953
	r<=3	9.239	8.176	9.239	8.176
1976:1 - 1990:12	r=0	94.546	27.136	224.210	48.280
	r<=1	75.034	21.074	129.664	31.525
	r<=2	50.961	14.900	54.630	17.953
	r<=3	3.670	8.176	3.670	8.176
1977:1 - 1990:12	r=0	87.725	27.136	205.965	48.280
	r<=1	67.903	21.074	118.240	31.525
	r<=2	47.286	14.900	50.337	17.953
	r<=3	3.051	8.176	3.051	8.176
1978:1 - 1990:12	r=0	79.232	27.136	188.574	48.280
	r<=1	61.910	21.074	109.342	31.525
	r<=2	44.272	14.900	47.432	17.953
	r<=3	3.160	8.176	3.160	8.176
1979:1 - 1990:12	r=0	75.332	27.136	167.562	48.280
	r<=1	52.937	21.074	92.230	31.525
	r<=2	33.747	14.900	39.293	17.953
	r<=3	5.546	8.176	5.546	8.176
1980:1 - 1990:12	r=0	72.132	27.136	156.670	48.280
	r<=1	49.799	21.074	84.538	31.525
	r<=2	30.728	14.900	34.739	17.953
	r<=3	4.010	8.176	4.010	8.176
1981:1 - 1990:12	r=0	61.281	27.136	132.945	48.280
	r<=1	42.464	21.074	71.664	31.525
	r<=2	26.069	14.900	29.200	17.953
	r<=3	3.132	8.176	3.132	8.176
1982:1 - 1990:12	r=0	58.424	27.136	144.961	48.280
	r<=1	46.773	21.074	86.537	31.525
	r<=2	32.617	14.900	39.763	17.953
	r<=3	7.147	8.176	7.147	8.176

Switzerland: **Table 3a (continued)**

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1983:1 - 1990:12	r=0	53.422	27.136	113.997	48.280
	r<=1	34.531	21.074	60.575	31.525
	r<=2	23.825	14.900	26.044	17.953
	r<=3	2.219	8.176	2.219	8.176
1984:1 - 1990:12	r=0	43.782	27.136	95.872	48.280
	r<=1	28.429	21.074	52.090	31.525
	r<=2	22.704	14.900	23.661	17.953
	r<=3	0.958	8.176	0.958	8.176

Switzerland: **Table 3b**

Spreads Between	Sample Period					DF
	75:1-90:12	76:1-90:12	77:1-90:12	78:1-90:12	79:1-90:12	
R(1)-R(12)	3.898 (.273)	3.464 (.325)	5.229 (.156)	5.002 (.172)	5.023 (.170)	3
R(1),R(3)	2.183 (.140)	1.509 (.219)	1.990 (.158)	2.814 (.093)	2.768 (.096)	1
R(1),R(6)	0.094 (.759)	0.026 (.872)	0.036 (.850)	0.307 (.580)	0.266 (.606)	1
R(1),R(12)	0.565 (.452)	0.250 (.617)	0.392 (.531)	0.178 (.673)	0.013 (.910)	1
R(3),R(6)	1.219 (.269)	1.334 (.248)	1.472 (.225)	0.715 (.398)	0.609 (.435)	1
R(3),R(12)	1.106 (.293)	0.780 (.377)	1.254 (.263)	0.970 (.325)	0.452 (.501)	1
R(6),R(12)	0.761 (.383)	0.374 (.541)	0.661 (.416)	0.615 (.433)	0.186 (.667)	1
R(1),R(3),R(6)	3.890 (.143)	3.443 (.179)	5.035 (.081)	4.766 (.092)	4.996 (.082)	2
R(1),R(3),R(12)	3.444 (.179)	1.846 (.397)	3.207 (.201)	3.825 (.148)	3.238 (.198)	2
R(1),R(6),R(12)	0.785 (.675)	0.381 (.827)	0.692 (.708)	0.929 (.629)	0.425 (.808)	2
R(3),R(6),R(12)	1.289 (.525)	1.513 (.469)	1.978 (.372)	1.218 (.544)	0.794 (.672)	2

Spreads Between	Sample Period					D F
	80:1-90:12	81:1-90:12	82:1-90:12	83:1-90:12	84:1-90:12	
R(1)-R(12)	2.807 (.422)	1.536 (.674)	2.360 (.501)	2.199 (.530)	5.075 (.166)	3
R(1),R(3)	1.785 (.182)	1.524 (.217)	1.256 (.262)	2.083 (.149)	4.376 (.036)	1
R(1),R(6)	0.404 (.525)	1.167 (.280)	0.437 (.509)	0.866 (.352)	3.488 (.062)	1
R(1),R(12)	0.011 (.915)	0.019 (.890)	0.027 (.869)	0.061 (.805)	0.014 (.906)	1
R(3),R(6)	0.091 (.763)	0.431 (.512)	0.035 (.852)	0.150 (.699)	1.223 (.269)	1
R(3),R(12)	0.327 (.568)	0.057 (.812)	0.247 (.619)	0.005 (.942)	0.136 (.712)	1
R(6),R(12)	0.249 (.618)	0.223 (.637)	0.483 (.487)	0.066 (.797)	0.649 (.420)	1
R(1),R(3),R(6)	2.721 (.257)	1.524 (.467)	1.587 (.452)	2.186 (.335)	4.557 (.102)	2
R(1),R(3),R(12)	2.147 (.342)	1.534 (.464)	2.359 (.307)	2.167 (.338)	4.520 (.104)	2
R(1),R(6),R(12)	0.608 (.738)	1.295 (.525)	1.367 (.505)	1.082 (.582)	4.495 (.106)	2
R(3),R(6),R(12)	0.342 (.843)	0.737 (.692)	0.683 (.711)	0.310 (.857)	2.442 (.295)	2

Switzerland:

Table 3c

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1975:1 - 1978:12	r=0	25.388	27.136	65.276	48.280
	r<=1	20.379	21.074	39.888	31.525
	r<=2	15.802	14.900	19.509	17.953
	r<=3	3.707	8.176	3.707	8.176
1979:1 - 1981:12	r=0	33.888	27.136	59.759	48.280
	r<=1	17.946	21.074	25.871	31.525
	r<=2	7.728	14.900	7.925	17.953
	r<=3	.197	8.176	.197	8.176
1982:1 - 1987:12	r=0	57.787	27.136	128.786	48.280
	r<=1	32.135	21.074	71.000	31.525
	r<=2	20.556	14.900	38.865	17.953
	r<=3	18.308	8.176	18.308	8.176

Table 3d

Spreads Between	Sample Period	DF
	1975:1-1978:12	
R(1)-R(12)	12.603 (.006)	3
R(1),R(3)	2.578 (.108)	1
R(1),R(6)	2.521 (.112)	1
R(1),R(12)	11.375 (.001)	1
R(3),R(6)	6.591 (.010)	1
R(3),R(12)	11.224 (.001)	1
R(6),R(12)	8.655 (.003)	1
R(1),R(3),R(6)	7.522 (.023)	2
R(1),R(3),R(12)	11.376 (.003)	2
R(1),R(6),R(12)	12.332 (.002)	2
R(3),R(6),R(12)	12.428 (.002)	2

United Kingdom: **Table 4a**

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1975:1 - 1990:12	r=0	116.498	27.136	276.604	48.280
	r<=1	82.005	21.074	160.106	31.525
	r<=2	69.717	14.900	78.100	17.953
	r<=3	8.384	8.176	8.384	8.176
1976:1 - 1990:12	r=0	89.066	27.136	218.788	48.280
	r<=1	79.235	21.074	129.721	31.525
	r<=2	44.153	14.900	50.486	17.953
	r<=3	6.333	8.176	6.333	8.176
1977:1 - 1990:12	r=0	82.846	27.136	210.198	48.280
	r<=1	75.572	21.074	127.352	31.525
	r<=2	43.101	14.900	51.780	17.953
	r<=3	8.679	8.176	8.679	8.176
1978:1 - 1990:12	r=0	80.351	27.136	203.489	48.280
	r<=1	65.488	21.074	123.138	31.525
	r<=2	51.088	14.900	57.650	17.953
	r<=3	6.562	8.176	6.562	8.176
1979:1 - 1990:12	r=0	75.196	27.136	183.774	48.280
	r<=1	62.279	21.074	108.578	31.525
	r<=2	41.777	14.900	46.230	17.953
	r<=3	4.523	8.176	4.523	8.176
1980:1 - 1990:12	r=0	67.086	.136	169.046	48.280
	r<=1	57.469	21.074	101.960	31.525
	r<=2	39.498	14.900	44.491	17.953
	r<=3	4.993	8.176	4.993	8.176
1981:1 - 1990:12	r=0	63.180	27.136	155.617	48.280
	r<=1	52.938	21.074	92.437	31.525
	r<=2	35.019	14.900	39.500	17.953
	r<=3	4.481	8.176	4.481	8.176
1982:1 - 1990:12	r=0	55.621	27.136	139.765	48.280
	r<=1	49.237	21.074	84.144	31.525
	r<=2	29.286	14.900	34.906	17.953
	r<=3	5.621	8.176	5.621	8.176

United Kingdom: **Table 4a (continued)**

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1983:1 - 1990:12	r=0	49.442	27.136	125.037	48.280
	r<=1	47.775	21.074	75.594	31.525
	r<=2	25.367	14.900	27.819	17.953
	r<=3	2.453	8.176	2.453	8.176
1984:1 - 1990:12	r=0	93.867	27.136	142.797	48.280
	r<=1	32.479	21.074	48.930	31.525
	r<=2	14.397	14.900	16.451	17.953
	r<=3	2.054	8.176	2.054	8.176

United Kingdom: Table 4b

Spreads Between	Sample Period					DF
	75:1-90:12	76:1-90:12	77:1-90:12	78:1-90:12	79:1-90:12	
R(1)-R(12)	8.057 (.045)	4.365 (.225)	6.078 (.108)	7.071 (.070)	6.946 (.074)	3
R(1),R(3)	5.664 (.017)	1.939 (.164)	1.910 (.167)	3.062 (.080)	2.554 (.110)	1
R(1),R(6)	7.947 (.005)	3.721 (.054)	4.516 (.034)	6.753 (.009)	5.849 (.016)	1
R(1),R(12)	4.271 (.039)	2.423 (.120)	2.871 (.090)	3.561 (.059)	4.388 (.036)	1
R(3),R(6)	6.934 (.008)	4.239 (.040)	6.062 (.014)	6.159 (.013)	5.808 (.016)	1
R(3),R(12)	2.713 (.100)	1.634 (.201)	2.114 (.146)	2.733 (.098)	3.616 (.057)	1
R(6),R(12)	1.006 (.316)	0.532 (.466)	0.718 (.397)	1.073 (.300)	1.638 (.201)	1
R(1),R(3),R(6)	7.987 (.018)	4.323 (.115)	6.063 (.048)	6.958 (.031)	6.292 (.043)	2
R(1),R(3),R(12)	6.720 (.035)	2.865 (.239)	3.174 (.205)	4.458 (.108)	4.706 (.095)	2
R(1),R(6),R(12)	8.038 (.018)	3.848 (.146)	4.642 (.098)	6.864 (.032)	6.421 (.040)	2
R(3),R(6),R(12)	6.968 (.031)	4.272 (.118)	6.078 (.048)	6.379 (.041)	6.668 (.036)	2

Spreads Between	Sample Period				D F
	80:1-90:12	81:1-90:12	82:1-90:12	83:1-90:12	
R(1)-R(12)	4.691 (.196)	1.675 (.642)	0.661 (.882)	0.988 (.804)	3
R(1),R(3)	1.338 (.247)	0.182 (.670)	0.471 (.492)	0.364 (.546)	1
R(1),R(6)	3.682 (.055)	0.781 (.377)	0.196 (.658)	0.837 (.360)	1
R(1),R(12)	3.079 (.079)	1.447 (.229)	0.321 (.571)	0.535 (.465)	1
R(3),R(6)	3.800 (.051)	0.824 (.364)	0.004 (.948)	0.474 (.491)	1
R(3),R(12)	2.670 (.102)	1.378 (.240)	0.135 (.713)	0.312 (.577)	1
R(6),R(12)	1.429 (.232)	0.926 (.336)	0.169 (.681)	0.126 (.722)	1
R(1),R(3),R(6)	4.149 (.126)	0.919 (.632)	0.486 (.784)	0.855 (.652)	2
R(1),R(3),R(12)	3.157 (.206)	1.453 (.484)	0.596 (.742)	0.672 (.715)	2
R(1),R(6),R(12)	4.182 (.124)	1.527 (.466)	0.363 (.834)	0.967 (.616)	2
R(2),R(6),R(12)	4.504 (.105)	1.623 (.444)	0.174 (.917)	0.613 (.736)	2

United Kingdom:

Table 4c

Sample	Null Hypothesis rank r	λ-max Test Statistic	5% Critical Value	*trace* Test Statistic	5% Critical Value
1975:1 - 1979:12	r=0	64.372	27.136	120.975	48.280
	r<=1	28.161	21.074	56.603	31.525
	r<=2	22.190	14.900	28.442	17.953
	r<=3	6.252	8.176	6.252	8.176
1979:1 - 1982:12	r=0	46.958	27.136	93.023	48.280
	r<=1	26.956	21.074	46.664	31.525
	r<=2	16.156	14.900	19.109	17.953
	r<=3	2.952	8.176	2.952	8.176
1984:1 - 1990:12	r=0	93.867	27.136	142.797	48.280
	r<=1	32.479	21.074	48.930	31.525
	r<=2	14.397	14.900	16.451	17.953
	r<=3	2.054	8.176	2.054	8.176

Table 4d

Spreads Between	Sample Period		DF
	1975:1-1979:12	1979:1-1982:12	
R(1)-R(12)	9.583 (.022)	9.930 (.019)	3
R(1),R(3)	4.601 (.032)	6.470 (.011)	1
R(1),R(6)	7.333 (.007)	8.373 (.004)	1
R(1),R(12)	1.616 (.204)	4.602 (.032)	1
R(3),R(6)	7.855 (.005)	8.819 (.003)	1
R(3),R(12)	.891 (.345)	3.596 (.058)	1
R(6),R(12)	.060 (.807)	1.029 (.310)	1
R(1),R(3),R(6)	7.863 (.020)	8.855 (.012)	2
R(1),R(3),R(12)	4.728 (.094)	6.754 (.034)	2
R(1),R(6),R(12)	7.830 (.020)	8.591 (.014)	2
R(3),R(6),R(12)	9.330 (.009)	9.321 (.009)	2

Table 5

Country	Time Period	Policy	3 Cointegrating Vectors Present
Germany	1975-1978	Bundesbank not interested in target growth rate.	Y
	1979-1984	Range around target growth rate set at 3 percent.	Y
	1984-1987	Range around target growth rate set at 2 percent.	N
Netherlands	1975-1981	Policy focused on stable exchange rate.	Y
	1981-1986	Attempted to control exchange rate and growth of M2.	Y
	1986-1990	Attempted to hold exchange rate with Deutsche Mark.	Y
Switzerland	1975-1978	Targeted M1 as a long-run constraint.	Y
	1979-1981	Tight policy but had trouble with aggregate M1.	N
	1982-1987	Tight policy using monetary base as target aggregate.	N
United Kingdom	1975-1979	Pre-Thatcher, lacked monetary growth rate targeting	Y
	1979-1982	Trouble with chosen aggregate M3.	Y
	1984-1990	Switched aggregate to M0 and focused on target.	N