'How Successful was the South African Reserve Bank in Making Monetary Policy Predictable and Transparent?'

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Declaration

I, ..., hereby declare that this dissertation entitled 'How Successful was the South African Reserve Bank in Making Monetary Policy Predictable and Transparent?' is my own work and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

Signature .....

Date .....

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I gratefully acknowledge the support given to me by my supervisor, Professor L. Loots. His insight were truly enlightening, his dedication exemplary and his patience endless. I would also like to thank Mr Vincent for his incalculable advice on the estimation of the model. Again, I thank all those who have taken the effort to be of assistance including my wife, Mrs. Ernestina Ampoful.

Dedication

This work is dedicated to my late mum, Mary Prah and my two children: Josephine and Jeffrey.

Abstract

This paper uses 3 - month and 12 - month market Negotiable Certificates of Deposit (NCD) rates to test whether greater transparency by the South African Reserve Bank has reduced expectational errors in the money markets. It does so by comparing the relative differences (between the implied forward rates-as indicators of expected future spot rates-and the actual 'future' spot rates) between the period before greater transparency and the period after greater transparency.

Empirical evidence for the sample period indicates that greater transparency by the South African Reserve Bank co-incided with reduced expectational errors in the money markets. Thus, the implied forward rates after greater transparency may well have been better predictors of future spot rates than before greater transparency, although causality has not been proved.

Key Words:

Monetary Policy, Transparency, Uncertainty, Term Structure, Financial Markets, Negotiable Certificates of Deposit (NCD), Forward Interest Rates, Expectations, Spot Interest Rates, South African Reserve Bank, Yield Curve.

Chapter 1

1.1 Introduction

In the past and until quite recently central banks around the globe operated largely in secrecy. As Saxton (1997:3) observed, secrecy by central banks often results in multiple, alternating policy goals, producing unnecessary uncertainties and fostering volatility in financial markets. According to the International Monetary Fund (2000:2), transparency in monetary policy by central banks only became common in most countries (including South Africa) during the 1990's. This, according to IMF was as a result of certain developments in the international environment. In economic theory, transparency should result in reduced conditional uncertainty since investors' expectations would be formed with a superior information set (Muller and Zelmer, 1999:5).

Jensen (2000:401) observes that transparency facilitates the formation of private sector expectations and thus inference about future economic developments. Central bank transparency about its own actions and the way it perceives the economic outlook reduces the level of uncertainty of future spot rates (Ferguson, 1999:2). This argument is in line with the pure expectations theory, which states that the yield curve at any point in time reflects implied forward interest rates in addition to spot rates (Moses and Cheney, 1992:379). Thus, according to this theory, forward rates are unbiased estimators of future spot rates.

However, empirical evidence suggests that this hypothesis often overstates future short-term interest rates (Harper, 2003:1). According to Harper (2003:1), this overstatement may be due to the higher risk premium associated with holding a long-term debt security whose yield is more uncertain due to potential changes in interest rates. It is shown by Yamashiro and Uesugi (2003:2) that another direction that the research on the relationship between forward and spot interest rates has taken has been to investigate the relationship between the predictive power of the forward interest rate and monetary policy. They observed that many of these studies attributed the unsatisfactory predictive ability of forward rates to interest rate smoothing behaviour by the Reserve bank system.

The question that this paper addresses is whether greater transparency by the South African Reserve Bank is correlated with the reduction of expectational errors in the money markets. It was consequently found that the implied forward rates after greater transparency were significantly better correlated with actual future spot rates than before greater transparency. This finding is not inconsistent with implied forward rates after greater transparency being better indicators of future spot rates, although causality could not be verified.

This work is divided into five sections. The first section deals with the introduction to the study, statement of the problem, the research question and the purpose of the study. Section two reviews the related literature on transparency and predictability of monetary policy by central banks. Section three deals with research design and methodology. Section four deals with research findings and analysis. Conclusions made by the researcher from the research work are provided in section five.

1.2 Problem Statement

When central banks conduct monetary policy in a non-transparent and unpredictable way, it prevents the financial market agents and its financial policy makers from making informed decisions. It can therefore be argued that economic agents are not able to assess and make constructive criticisms about policies made by the central banks' specific long-run objectives. Thus, unpredictable and non-transparent monetary policy distorts the money markets and increases expectational errors in the economy.

1.3 Research Question

The main question that the study seeks to answer is whether greater transparency by the South African Reserve bank since 1990 has reduced expectational uncertainty in the money markets.

Purpose of the Study

The purpose of this research is to use three and twelve months forward and actual spot Negotiable Certificates of Deposit (NCD) rates (i.e. as expected future market NCD interest rates) to test whether greater transparency by the South African Reserve Bank has improved expectations in the money markets.

Chapter 2

Literature Review

2.1 Introduction

According to Brunner (1981:5), central banking was traditionally surrounded by a peculiar and political mystique. This made it difficult for private agents to form reliable expectations about future economic developments (Neumann, 2002:353). Neumann (2002:353), also stressed that not longer than a decade ago, most central banks preferred secrecy in their conduct of monetary policy. The move towards greater transparency reflects, in part, research by academic economists that has stressed the potential benefits of making monetary policy easier to understand (Walsh, 2001:1). One of these benefits, according to Saxton (1997:1), is improvement of the workings of financial markets.

Lekalake and Nel (2002:1) argue that the IMF attributes such a change in attitude by the central banks towards greater transparency to the result of the following developments in the international environment: Firstly, the concept of transparency has called on central banks to make their policies and activities open. Secondly, globalisation requires a greater degree of transparency of monetary policies and processes to reduce market volatility. Thirdly, inflation targeting has been adopted by many central banks and disclosure to the public of what their targets are and how they aim to achieve them have led to greater transparency.

2.2 Monetary Policy

Monetary policy can be considered as a deliberate attempt or decision by the central bank to influence short-term interest rates (Mboweni, 2002:1). Thus, monetary policy can be considered as the regulation of the money supply and/or interest rates by a central bank in order to control inflation and stabilize the currency (Pilbeam, 1998:49). If the economy is heating up, the central bank can withdraw money from the banking system, raise the reserve requirement or raise the discount rate to cool it down. If growth is slowing, the central bank can

increase the money supply, lower the reserve requirement or decrease the discount rate (Pilbeam, 1998:49). The central bank can influence the monetary base by conducting open market operations (OMO), which could either be expansionary or contractionary. In expansionary monetary policy, the central bank purchases Treasury bills and other money market instruments from the private sector to increase the money supply held by the private sector and raise the price of bills thereby lowering the short-term interest rates of which the NCDs rates are no exception (Dornbusch, Fischer and Startz, 2001:399). Conversely, with a contractionary OMO the central bank takes money out of circulation by selling Treasury bills to the public in exchange for money. This increases the supply of bills lowers the price of bills and therefore raises the short-term interest rates (Dornbusch, Fischer and Startz, 2001:399).

According to IMF (2000:1), when the objectives of monetary policy are made public, the central bank can enhance the public's understanding of what it is seeking to achieve, and provides a context for articulating its own policy choices, thereby contributing to the effectiveness of monetary policy. It is emphasised further that when the central bank provides the public with adequate information about its own activities, it can establish a mechanism for strengthening its credibility by matching its actions to its public statements.

2.3 Transparency in Monetary Policy

The term transparency can be defined as 'easily seen through or detected; obvious; candid or open; clear; free from guile' (Saxton, 1997:2). Burnhardsen and Kloster (2002:1), defined transparency as the ability of the central bank to communicate with clarity its policy response pattern and view of economic developments and the functioning of the economy to the public. Geraats (2002:2) defined transparency of monetary policy as the extent to which monetary authorities disclose information that is relevant for the policymaking process; so, perfect transparency amounts to symmetric information. That is monetary policy transparency involves the absence, or at least reduction, of information asymmetries (Geraats, 2002: 2).

According to IMF, transparency can also be referred to as 'an environment in which the objectives of policy, its legal, institutional, and economic framework, policy decisions and their rationale, data and information related to monetary and financial policies and the terms of the agencies' accountability are provided to the public on an understandable, accessible and timely basis' (quoted in: Lekalake and Nel, 2002:1).

Saxton (1997:2) argues that, monetary policy transparency should include the clarification of policy goals, procedures and the time in reporting policy decisions, policy objectives, progress made and the procedures used should be disclosed on time. Geraats (2000:19) shows that economic transparency could give the central bank greater flexibility to offset economic shocks and reduce the inflation bias.

To understand the various aspects of policy transparency, it is helpful to focus on three key ingredients in the formulation and implementation of monetary policy: First, the central bank's objectives. Second, the bank's assessment of the linkages between policy actions and the economy (the bank's 'model' of the economy). Third, bank's information about economic conditions (Walsh 2001:1). First, a policy is transparent about objectives if the public can accurately gauge the central bank's intentions. Second, monetary policy is considered transparent if the public can understand the economic model the central bank uses to evaluate alternative policies. Third, a transparent policy regime is one in which the public is provided with the same information on economic conditions as is provided to the central bank. Thus, transparent monetary policy is characterised by lack of secrecy, ambiguity and should also be understandable to those outside the policy process (Saxton, 1997:2).

In the financial markets, monetary policy is said to be transparent if it enables financial market agents and their financial policy makers to make informed decisions and constructive criticisms about central bank policies (Ferguson, 2002:2).

IMF (2000:1) stressed that when the sector is provided with a clear description of the considerations guiding monetary policy decisions, transparency about the policy process makes the monetary policy transmission mechanism generally more effective, in part by ensuring that market expectations can be formed more effectively. This definition is adopted in this research paper as a working definition.

2.4 Reasons for Encouraging Transparency in Monetary Policy

It is argued that transparency allows for pareto-improving forecasts and decisions. According to Neumann (2002:353), there are different reasons why monetary policy transparency is desirable. First, from a political economy point of view, transparency is considered a necessary prerequisite of democratic accountability. Second, from a market agents' point of view, transparency is desirable because the agents' future plans are affected by the current as well as the planned future stance of monetary policy. Third, from the authority's point of view, transparency may serve as a strategy device to gain credibility and as a way to facilitate maintaining price stability.

Many central banks have found that increased transparency improves the efficiency of financial markets and, therefore, enhances their usefulness for market participants as well as for central banks themselves (Saxton, 1997:2). Recognizing transparency's benefits, these central banks not only have adopted explicit goals in the form of inflation targets but have also improved their reporting of progress in achieving these targets, of procedures and indicators used in conducting policy, and of policy decisions (Saxton, 1997:2). Thus, monetary policy transparency can make financial markets less volatile and can help them better reflect relevant information for monetary policy. Jensen (2000:400) also argues that transparency helps to hold independent central banks accountable for their actions and compensates for the 'democratic loss' society incurs from central bank independence.

Greater openness in procedures as well as in the dissemination of information will not only reduce the likelihood of market corrections by revealing potential

weaknesses at an earlier stage but also help to better understand the reasoning behind decisions and encourages better decisions and wider support for the policies (Gordon, 1998:5). Transparent monetary policy does not only necessarily involve the clarification of objectives but also the timely and more complete disclosure of policy decisions and their underlying rationale (Saxton, 1997:3).

However, Gersbach (1998), Cukierman (2001) and Jensen (2000), showed that transparency about economic disturbances could hamper stabilization policy. This is due to the fact that disclosure of (forecasts of) supply shocks leads to an adjustment in inflation expectations and negatively affects the contemporaneous output-inflation trade-off (Geraats 2000:2).

According to Geraats (2002:2), central bank transparency should not only be judged on the availability of information but also how relevant and accurate this information can assist the public to have a real understanding of monetary policy so as to avoid unnecessary uncertainty concerning the central bank's monetary policy.

Another important reason for encouraging greater transparency is the ability of financial markets agents to predict the intentions of the central bank. This is discussed below under the heading predictability of monetary policy.

2.5 Predictability of Monetary Policy

Monetary Policy is said to be predictable if investors and other financial policy makers can accurately gauge the intentions of the central bank (Walsh, 2001:1). Thus, monetary policy is predictable if economic agents generally expect the central bank's decisions in response to specific changes in the inflationary or macroeconomic environment. When intentions are more transparent, the economic agents are able to form more accurate forecasts of future policy actions and economic developments (Walsh, 2001:1).

In their research paper, Bernhardsen and Kloster (2002:2), argue that predictability of monetary policy could result in both credibility and effectiveness

in monetary policy. Credibility of monetary policy will enable economic agents to believe that inflation will over time be in line with the inflation target. If monetary policy is effective then it can be argued that inflation expectations will be stable and equal to the inflation target. If inflation expectations vary widely, marked changes in nominal interest rates may be necessary to attain the desired level of real interest rates. This reduces the effectiveness of monetary policy. That is to say market participants' expectations about future changes in the key rate are based on a correct understanding of the central bank's policy response pattern (Bernhardsen and Kloster (2002:2).

Bernhardsen and Kloster (2002:2) also argued that monetary policy has an effect on the economy via market interest rates. This means that monetary policy to a large extent operates through expectations. If expectations tend to be markedly different from the outcome, the effectiveness of monetary policy is limited. On this basis, we can argue that transparency is important because it can contribute to enhancing the credibility and effectiveness of monetary policy (Bernhardsen and Kloster (2002:2).

Unpredictable monetary policy has very important consequences in the economy. It often results in multiple, alternative policy goals, producing unnecessary uncertainties and fostering volatility in financial markets (Saxton 1997:3). Consequently, the market reacts to any news suggesting that the central bank is shifting policy objectives (Saxton, 1997:4). This uncertain situation causes interest rates to be higher than expected, as the rates must reflect the higher risk. Therefore, the higher rate increases the cost to the markets and the social cost of monetary policy (Saxton, 1997:4).

2.6 Trend Towards Openness and Transparency by Central Banks

Traditionally, central banks have been secretive. This reflected the view that financial markets needed to be 'surprised' if monetary policy was to have a significant effect (Ferguson, 2002:2). However, central banks in most countries have become transparent in their monetary policy implementation due to the

realisation that transparency can lead to better policy outcomes and accountability to the public (Bank of Canada Review, 2000:1).

In 1994, the Federal Open Market Committee (FOMC) in America began formally announcing, immediately after any meeting in which a policy decision had taken place, the change in the targeted Federal Funds rate and a brief rationale for the decision. Until then, policy actions of the FOMC were kept secret (Ferguson, 2002:2). This openness of FOMC was supported by the idea that, the committee's view of the economic outlook might allow financial market prices to reflect more accurately the likely future stance of monetary policy and also to reduce uncertainty and improve clarity (Ferguson, 2002:2).

Globally, the trend towards greater transparency was seen in the activities of the bank of Japan after the revision of its governing law in 1998 (Ferguson, 1999:2). The European Central Bank has also incorporated transparency in its policy process and has emphasised the importance of communication (Ferguson, 2002:3). Bank of England Act of 1998 established the operational independence of the bank and strengthened the transparency measures that had been implemented in the 1990s when the government formally announced a numerical inflation target (Ferguson, 1999:2).

Ferguson (2002:3), in his study about central banks observed the following: First, the central bank of New Zealand published forecasts for the future path of its short-term interest rates consistent with achieving its objective. Second, some emerging-market economies, namely the Bank of Mexico and the Central Bank of Brazil have announced both a long-run inflation target as well as an explicit 'glide path' in the interim toward their respective goals.

2.7 Relationship Between Monetary Policy and Short-term Interest Rates

Although the effects of monetary policy can be transmitted through many channels, according to Roley and Sellon (1995:73), there is a general belief that monetary policy actions are transmitted to the economy through their effect on market interest rates. According to this standard view, a restrictive monetary

policy by the Reserve Bank pushes up the short-term interest rates leading to less spending by interest-sensitive sectors of the economy, such as housing, consumer durable goods and business fixed investment. Conversely, an easier monetary policy results in lower interest rates that stimulate economic activities. There is considerable evidence that monetary policy has predictable effects on short-term interest rates (Roley and Sellon, 1995:2).

In his research work, Karl (2004:2) argues that money-stock targeting was generally seen as a failed policy. This is because the LM curve relationship between money and interest rates was not strong enough to allow the money targeting policy to have enough control over short-term interest rates. Money-stock targeting rather lead to very volatile short-term interest rates, which likely induced macroeconomic stability because interest rates are generally seen as the tool through which monetary policy actually affect aggregate demand.

Another area in which short-term interest rates appear to be playing a larger role in monetary policy is as informational indicator. According to Ferguson (1999:2), if the monetary authority can be clearer about what it is doing now and plans to do-in terms of explaining risks that might influence future policy then market participants can improve their expectations of future spot interest rates, and possibly reduce the premium for uncertainty. In obtaining such information from financial markets, central banks have relied on the 'expectations theory' of the term structure (Ferguson, 1999:2).

2.8 Relationship Between Forward Rates and Future Spot Rates

According to Madura (2001:415), there are four basic techniques in forecasting the future spot rates. These are: First, *technical forecasting:* this involves the use of historical data to discover trends. Second, *fundamental forecasting:* this concerns statistical investigation of economic variables and their effects on exchange rates. Third, *market-based forecasting:* this uses spot and forward rates to predict the future spot rates. Four *mixed forecasting:* this combines the above three methods.

The forward rates are indicators of expected future spot rates. The expectations are likely to be more subject to errors if there is more uncertainty in the markets. It can however be argued that the increased Reserve Bank transparency should lead to a reduction in uncertainty and therefore a reduction in the differences between the expected future spot rates and the actual future spot rates, i.e. an improvement in expectations.

There is also a large literature on the relationship between the future spot rates and forward rates. The area of research has basically been to test the rational expectations hypothesis of the term structure of interest rates. In their respective studies, Chiang (1986), Fama (1984) and Hopper (1994) have all shown that forward rates contain information to help estimate future spot rates.

2.9 Transparency of Monetary Policy in South Africa

According to Smal and De Jager (2001:2), the De Kock Commission of inquiry into the monetary system and monetary policy in South Africa laid the foundation for monetary policy implementation during the 1980s. The report proposed a monetary policy model firmly directed towards the overall objective of maintaining a stable financial environment, which was very much in line with the actions taken by most developing countries during that time. The strategy recommended by the De Kock Commission and followed by the South African Reserve Bank in its pursuance of protecting the value of the currency was initially based on monetary targeting.

Mboweni (2000:1) stated that the primary objective of monetary policy in South Africa is to protect the value of the currency in order to obtain balanced and sustainable economic growth in the country. This objective is articulated in both the Constitution of the Republic of South Africa and the South African Reserve Bank Act, No 90 of 1989. It requires the achievement of financial stability, i.e. price stability as well as stable conditions in the financial sector as a whole.

The International Monetary Fund (IMF, 2000:31) in cooperation with other appropriate institutions developed Codes of Good practices on transparency in

monetary and financial policies. The codes identify desirable transparency practices by central banks in their conduct of monetary policy. The transparency principles focus on: First clarity of roles, responsibilities and objectivities of central banks and financial agencies. Second, the processes of formulating and reporting monetary policy decisions by the central banks and of financial policies by financial agencies. Third, public availability of information on monetary and financial policies. Fourth, accountability and assurances of integrity by the central banks and financial agencies. According to these codes, the ultimate objective of monetary policy is the important long-run goal, such as price stability or non-inflationary growth that it can achieve. Monetary policy transparency only became common in most countries in the 1990s. (Lekaleke and Nel, 2002:1).

Since 1986, the South Africa authorities have used a monetary target range (which later became a guideline in 1990) for broad money demand (M3) growth to signal the monetary authority's determination to combat inflation and to guide inflationary expectations. This made their activities open to the public and uncertainty was reduced in the markets. As a result the rate of inflation fell considerably in the 1990s (Wesso, 2002:3). Wesso (2002:1) also emphasized that much research into money demand was as a result of financial innovation and financial liberalization during the 1990s. Before the 1990s, the target instrument of conducting monetary policy by the Reserve bank was growth in money supply.

According to Mboweni (2002:4), the Reserve bank adopted an eclectic approach to monetary policy during the 1990s against the background of explicitly articulated guidelines for money supply growth. This framework recognized that the Reserve Bank had to combat inflation, as outlined in the Reserve Bank Act. However, since the adoption of the inflation targeting monetary framework in February 2000, the Reserve Bank directly targets inflation instead of targeting guidelines. It monitors and analyses a whole range of factors that can affect the rate of inflation. Such a framework for monetary policy ensures that monetary policy is transparent, in that the authorities have measurable aim in their conduct of monetary policy (Mboweni, 2001:2).

The Choice of 1990 as the demarcation date for greater transparency by the Reserve Bank is supported by the fact that the South African Reserve Bank Act 90 of 1989 which was assented on 1 June 1989 and commenced in 1 August 1989 made the activities of the Reserve bank more open. (Reserve Bank Act 90, 1989:1). It is also stated in section 3 of the Reserve Bank Act that the primary objective of the bank shall be to protect the value of the currency of the Republic in the interest of balanced and sustainable economic growth in the Republic. It can therefore be argued that the Reserve Bank made monetary policy more open in 1990.

Chapter 3

Research Design and Methodology

3.1 Introduction

Analysis of variance (ANOVA) technique will be used to test for the differences in the means of the implied forward rates (as indicators of expected future spot rates) and the actual future spot rates. This difference is then expressed as a ratio of the actual future spot rates to give the 'relative forward-spot differentials' before and after transparency by the Reserve Bank. 3-month and 12-month NCD market rates will be used for the analysis. For each analysis group (3-month and 12-month) there are two samples for each of the expectation periods, the before and after greater transparency samples. An analysis is performed for each expectation period (3-months away, 6-months away etc) for each of the analysed groups. For each one, the mean of the relative forward-spot differentials will be calculated as an indication of expectational error. This will be followed by a test to see whether the two samples come from the same population (i.e. have the same mean) or whether the two samples come from different populations (i.e. have different means). The term 'relative forward-spot differential' as used for the analysis can therefore be defined as the difference between the implied forward rates and the actual future spot rate divided by the actual future spot rate.

The paper analyses the difference between implied forward NCD spot rates (as indicators of expected future spot rates) and the actual future spot rate. These were obtained for the 3-month implied forward rates (at different intervals from the data on which the forward rate was quoted) and 12-month implied forward rates. The first group of implied NCD forward rates was derived from three sets of forward contracts (for 3-month NCDs) with maturities of three months, six months and nine months. The second was derived from two sets of 12-month NCD forward contracts with maturities of twelve months and twenty-four months. Thus a total of five sets of before and after samples are used in the analysis, each one of which will be tested for equality of the sample means before and after

greater transparency. The calculations of the implied forward rates (as indicators of expected future spot forward rate) derived from these NCD forward contracts are described in Appendix B. A more extensive description of the data is also provided in Appendix A.

The study will test whether expectations have improved due to Reserve Bank transparency. That is we wish to test whether the forward rates after greater transparency were better predictors of the future spot rates than before greater transparency. Uncertainty will be captured by the differences between the forward rates (i.e. the expected future spot rates) and the actual future spot rates. These differences were then divided by the spot rates to get the relative, rather than absolute, differences. The study tested for the relative differences (i.e. the differences divided by the spot rates) and not the absolute differences. This is due to the fact that if absolute rates change (due, for example, to inflation rates changing) the differences might also change simply because the levels of interest rates have changed and not because of greater transparency. To avoid this problem, relative differences can be compared.

3.2 One-way Analysis of Variance (ANOVA)

According to Duhan and Reinmuth (1986:412) one-way analysis of variance (ANOVA) is a procedure used for comparing sample means to see if there is sufficient evidence to infer that the means of the corresponding population distributions also differ. They observed that the main objective of ANOVA is to test for the difference between two or more means by comparing the variances 'within' sample means before groups and variances 'between' groups.

In this regard, the paper will test for the difference between the means of the relative forward-spot differentials before and after transparency by comparing the variance within the samples and the variance based solely on the sample means. These two estimates of the population variance will be the same if the samples came from the same population. The variance is a standard measure of the variability around the mean (Willemse, 1990:150).

According to Willemse (1990:150), there are three assumptions required by ANOVA: normal distribution, equal variance and observations from the populations are independent. These assumptions can equally be applied to the NCD rates. It should be noted that if there are equal sample sizes in each group, inferences based on the F-distribution may not be seriously affected by unequal variance. The decision to reject or not to reject the null hypothesis is solely based on the F-ratio and the critical (table) F-value. If the F-ratio is greater than the critical F-value, the null hypothesis is rejected and we conclude that the two means differ.

The *variation between groups* is the variation of the sample means about the grand mean $\bar{y}$. Since the samples represent groups that have been treated at different settings of one or more independent variables, this quantity is called the *sum of squares of treatments* and is denoted by the symbol SST. For two samples,

$$SST = \sum_{i=1}^{2} n_i (\bar{y}_i - \bar{y})^2 = \{\frac{n_1 n_2}{n_1 + n_2}\}(\bar{y}_1 - \bar{y}_2)^2$$

SST measures the variation between the sample means. $\bar{y}_i$ refers to the mean of each sample before and after transparency $\bar{y}$ denotes the mean for the whole group, i.e. the two combined and i = 1,2. For example: The 'treatment' in this study is the introduction of greater transparency by the Reserve Bank. The independent variable is the relative difference between the forward rate and the spot rate that has been treated by 'less transparency' before 1990 and by 'more transparency' after 1990.

The *variation within groups* represents the variation of the individual measurements about their respective means. Within sample variation is associated with random error and is called the *sum of squares for error*, denoted by SSE. For two samples, $SSE = \sum_{i=1}^{2} \sum_{j=1}^{ni} (y_{ij} - \bar{y}_i)^2$ where y_{ij} is the j^{th} observation in the i^{th} Sample and i=1, 2.

The quantities SST and SSE measure the variation between means and the variation within samples respectively as indicated above. The greater the variation between the means (that is, the larger SST) in comparison with the variation within samples (SSE), the greater the weight of evidence to indicate a difference between the sample mean before transparency (μ_2) and the mean after transparency (μ_1).

The ANOVA procedure used for the analysis tested for the null hypothesis that the means for the groups are equal (i.e. H_0: $\mu_1=\mu_2$), against the alternative hypothesis that at least one of the sample means is different (i.e. H_1: $\mu_1\neq\mu_2$). Therefore, a rejection of the null hypothesis would indicate that there is a difference between the sample means for the groups.

In this research paper, H_0 denotes the null hypothesis that there is no statistically significant difference between the sample means before and after transparency and H_1 is the alternative hypothesis that there is statistically significant difference between the sample means before and after transparency.

The Sample means for both before and after transparency are calculated by finding the average of the 'relative forward-spot differentials'. The absolute sign was used to remove the negative effects of the relative differentials.

This is given by the formula: Sample mean $= \sum_{i=1}^{n} \frac{|(Fij - Si)|/Si}{n}$

Where:

F = forward rate.

i =the particular group of spot rates.

j =one of the sets of forward rates applicable to the i group of spot rates

n = number of observations

S = actual spot rates.

Willemse (1990:156) found that the general conclusions drawn on the population are similar when either the sample means or the variances are used for the analysis. In that regard, this research paper will test for only the sample means and infer the results to the entire population. If the null hypothesis is not rejected and there are differences in the variances, then it can be argued that these differences are just by chance.

Thus, if the null hypothesis is not rejected and the variances of the differentials before and after transparency are different, then these differences can be attributed to chance.

The *mean square treatment* (MST) measures the variance due to the interaction between the samples. This is the *between group variation* divided by its degrees of freedom (k-1).Where k is the number of constraints and one (1) is any constant. For instance, if there are large variations (in the relative differences) between the sample before greater transparency and the sample after greater transparency, the value of MST will be large. On the other hand, if the variations between the sample before greater transparency and the sample after greater transparency are small, the value of MST will be small. Symbolically, the mean square treatment is given as: $\text{MST} = \frac{SST}{k-1}$

The mean square error (MSE) is the variance due to the differences within individual samples. This is the *within group variation* divided by its degrees of freedom (n-k). The larger the differences within individual samples, the larger the value of MSE and vice versa. That is, if the differences within each of the before and after transparency are large the value of MSE will also be large. Conversely, if the differences within each of the before and after transparency are small the value of MSE will also be small. $\text{MSE} = \frac{SSE}{n-k}$

3.3 Degrees of freedom (DF)

The degrees of freedom (df) indicates the effective number of observations that contribute to the sum of squares in the ANOVA. That is the total number of observations minus the number of linear constraints in the data. For instance, in section four, the 3-month NCD rates, with a forward contract maturity of three months, the total number of 'forward-spot differentials' before transparency is 23 and after transparency is 56.The total observations is 79 and the number of constraints (k) is 2. Therefore, the degrees of freedom for MSE is 77 and that of MST is 1.

3.4 The Test Statistic

In the analysis of variance, or ANOVA, the F- ratio is the test statistic upon which we rely in reaching a conclusion. It is calculated as: $F = \frac{MST}{MSE}$

Where, MST is the between-group variance and MSE is within-group variance
If MST = MSE, F-ratio will be equal to one (1). This means that the value of the two sample means before and after transparency is equal. If the value of MST is different from the value MSE, then the sample means are also different.

If the F-ratio is different from the critical (table) F-value, then the conclusion is that at least one of the sample means is different from the rest. The null hypothesis is rejected if the F-ratio is greater than the critical (table) F-value. On the other hand, the null hypothesis is not rejected if the F-ratio is less than the critical (table) F-value.

3.5 The level of significance

The significance level of a test is the alpha (α) level at which the null hypothesis would be rejected. Conventionally, a significance level of 0.05 (5%) is generally regarded as sufficiently small to reject the null hypothesis in favour of the alternative hypothesis. If the P-value is greater than 0.05, we fail to reject the null hypothesis. On the other hand, if the P-value is less than 0.05, we reject the null

hypothesis. The traditional significance levels are 0.001, 0.01, and 0.05 (Gujarati, 1999:111).

The probability value (p-value) is the actual probability associated with a statistical estimate; this is then compared with the significance level (α) to determine whether that value is statistically significant. For a statistically significant result, the p-value must be less than or equal to the significance level (Gujarati, 1999:113).

Other research projects on forward rates as predictors of future spot rates used a significance level of 5%. Wesso (1999:6) used a 5% significance level when analysing the relationship between forward rates and future spot rates in South Africa. Azaloff (2003:10) also used a 5% significance level in his analysis of current spot and forward rates as predictors for future spot rates.

The study will therefore use a 0.05 significance level as a benchmark for the analysis. That is to say, if the p-value is less than 0.05, we reject the null hypothesis and conclude that there is a statistically significant difference between the two periods with respect to the relative forward-spot differentials. In other words, greater transparency improves expectations about future spot rates.

Chapter 4

Research Findings and Analysis

The results of analysing the 3-month and 12-month NCD rates are shown in Tables 4.1a to 4.5b below. As noted in section 3, there are two samples for each expectation period or forward contract maturity, the before and after transparency. An analysis is performed for each expectation period (i.e. 3-month away, 6-month away and 9-month away for the 3-month rates and 12-month away and 24-month away for the 12-month rates) for each of the analysis. The mean difference was calculated for each group as an indicator of expectational uncertainty. The abbreviations BT and AT in the tables represent before and after transparency respectively. The analysis for the entire research is found in tables below. 'Relative Forward-spot differential' is the proportion by which the forward rate deviated from the future spot rate. The data for the analysis were taken from the data bank of the South African Reserve Bank. Analysis of variance (ANOVA) was done using Excel package. The 3-month and 12-month NCD rates as well as the calculations for the relative 'forward-spot differentials' are found in the appendix.

Table 4.1a

Means of the Relative Forward-spot Differentials for 3-month NCD Rates, with a Forward Contract Maturity of Three Months

ANOVO: Single Factor				
SUMMARY				
Groups (3-M; 1P NDC Rates)	Count	Sum	Mean	Variance
Before Transparency (1984-1989	23	1.9996	0.086939	0.003725
After Transparency (1990-2003)	56	3.405318	0.060809	0.003776

The results of analysing 3-month NCD rates, with forward contract maturity of three months. 'Sum' is the sum of square deviation of the differentials. 'Count' is the total sample size for both before and after transparency differentials .The sample size BT is 23 and that of AT is 56 given a total sample size (n) of 79. The

means of BT and AT are 0.0869 and 0.0608 respectively .The respective variances for both BT and AT are also 0.0037 and 0.0038.

Table 4.1b

ANOVA Results for the Means of the Relative Forward-spot Differentials for 3-month NCD Rates, with a Forward Contract Maturity of Three Months

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.011132	1	0.011132	2.959474	0.089392	3.965084
Within Groups	0.289628	77	0.003761			
Total	0.300760	78				

The variation between groups (SST) is 0.0111 and the variation within groups (SSE) is 0.2896.The mean square for error (MSE) within groups for both groups is 0.0038 with the associated degrees of freedom 77 and the mean square for treatments (MST) between groups is 0.0111 with degrees of freedom 1. Total sum of squares is 0.3008 with degrees of freedom 78.The calculated F-value is 2.9595 and the P-value is 0.0894.

In table 4.1b, the *calculated F- value* of 2.9595 is less than the *critical F- value* of 3.9651.Although the mean square for treatments is almost three times as large as the mean square for error, it is not large enough to reject the null hypothesis. Consequently, there is no statistically significant evidence to indicate a difference between the sample means for the before and after transparency periods. The probability, 0.0894 is the p-value for the test. This is greater than the chosen significance level of 0.05 and we therefore do not reject the null hypothesis.

It can be argued that there was no statistically significant difference between the two periods with respect to the relative forward-spot differentials. In other words, it cannot be concluded that there was a significant improvement in expectations after the adoption of greater transparency by the Reserve Bank.

Thus, for the 3-month NCD rates, with a forward contract maturity of three months, greater transparency by the Reserve Bank did not have any impact on expectational uncertainty in the money markets. This could be due to the fact that the forward rates were determined relatively close to the spot rates and that the uncertainty was not that high before transparency, possibly because much of the relevant information on which expectations could be based was already available.

Table 4.2a

Means of the Relative Forward-spot Differentials for 3-month NCD Rates, with a Forward Contract Maturity of Six Months

ANOVA: Single Factor				
SUMMARY				
Groups (3-M; 2Ps NCD rates)	*Count*	*Sum*	*Mean*	*Variance*
Before Transparency (1984-1989)	22	4.122844	0.187402	0.026577
After Transparency (1990-2003)	56	6.409426	0.114454	0.011403

The results of analysing 3-month NCD rates, with forward contract maturity of six months. 'Sum' is the sum of square deviation of the differentials. 'Count' is the total sample size for both before and after transparency differentials. The sample size BT is 22 and that of AT is 56 given a total sample size (n) of 78. The means of BT and AT are 0.1874 and 0.1145 respectively .The respective variances for both BT and AT are also 0.0266 and 0.0114.

Tables 4.2a and 4.2b analyse the results of 3-month NCD rates with a forward contract maturity of six months. The *calculated F- value* of 5.3894 is greater than the critical *F- value* of 3.9668. The *P- value* of 0.0229 is less than the chosen significance level of 0.05. We therefore reject the null hypothesis and conclude that the evidence is sufficient enough to indicate a difference between the two periods with respect to the relative forward-spot differentials. In other words, it can be argued that there was a significant improvement in expectations after the adoption of greater transparency by the Reserve Bank.

Table4.2b

ANOVA Results for the Means of the Relative Forward-spot Differentials for

3-month NCD rates, with a Forward Contract Maturity of Six Months

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.084051	1	0.084051	5.389353	0.022942	3.966761
Within Groups	1.185275	76	0.015596			
Total	1.269326	77				

The variation between groups (SST) is 0.0841and the variation within groups (SSE) is 1.1853 .The mean square for error (MSE) within groups for both groups is 0.0156 with the associated degrees of freedom 76 and the mean square for treatments (MST) between groups is 0.0841 with degrees of freedom 1. Total sum of squares is 1.2693 with degrees of freedom 77. The calculated F-value is 5.3894 and the P-value is 0.0229.

Table 4.3a

Means of the Relative Forward-spot Differentials for 3-month NCD Rates, with a Forward Contract Maturity of Nine Months

ANOVA: Single Factor				
SUMMARY				
Groups (3-M; 3Ps NCD rates)	*Count*	*Sum*	*Mean*	*Variance*
Before Transparency (1984-1989)	21	5.144951	0.244998	0.027605
After Transparency (1990-2003)	56	9.17556	0.163849	0.018954

The results of analysing 3-month NCD rates, with forward contract maturity of nine months. 'Sum' is the sum of square deviation of the differentials. 'Count' is the total sample size for both before and after transparency differentials. The ample size BT is 21 and that of AT is 56 given a total sample size of (n) 77. The means of BT and AT are 0.2450 and 0.1638 respectively .The respective variances for both BT and AT are also 0.0276 and 0.0190.

Table 4.3b deals with 3-month NCD rates, with a forward contract maturity of nine months .The *calculated F- value* of 4.7304 is greater than the *critical F-value* of 3.9685. The *P- value* of 0.0328 is less than the chosen significance level (α) of 0.0500. The null hypothesis is rejected and we conclude that the evidence is

sufficient to indicate a difference between the two periods with respect to the relative forward-spot differentials.

Table 4.3b

ANOVA Results for the Means of the Relative Forward-spot Differentials for 3-month NCD Rates, with a Forward Contract Maturity of Nine Months

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.100572	1	0.100572	4.730362	0.032787	3.968466
Within Groups	1.594568	75	0.021261			
Total	1.69514	76				

The variation between groups (SST) is 0.1006 and the variation within groups (SSE) is 1.5946.The mean square for error (MSE) within groups for both groups is 0.0213 with the associated degrees of freedom 75 and the mean square for treatments (MST) between groups is 0.1006 with degrees of freedom 1. Total sum of squares is 1.6951 with degrees of freedom 76. The calculated F-value is 4.7304 and the P-value is 0.0328.

The analysis below considers 12-month relative spot-forward differentials.

In table 4.4a, the *calculated F- value* of 7.8922 is greater than the *critical F- value* of 3.9651. The *P- value* of 0.0063 is less than the chosen significance level (α) of 0.05. We reject the null hypothesis and conclude that the evidence is sufficient to indicate a difference between the two periods with respect to the relative forward-spot differentials.

Table 4.4a

Means of the Relative Forward-spot Differentials for 12-month NCD Rates, with a Forward Contract Maturity of Twelve Months

ANOVA: Single Factor				
SUMMARY				

Groups (12-M; 1P NCD rates)	*Count*	*Sum*	*Mean*	*Variance*
Before Transparency (1984-1989)	23	4.309393	0.187365	0.028341
After Transparency (1990-2003)	56	6.163035	0.110054	0.00595

The results of analysing 12-month NCD rates, with forward contract maturity of 12 months. 'Sum' is the sum of square deviation of the differentials. 'Count' is the total sample size for both before and after transparency differentials. The sample size BT is 23 and that of AT is 56 given a total sample size of (n) 79. The means of BT and AT are 0.1874 and 0.1101 respectively. The respective variances for both BT and AT are also 0.0283 and 0.0060.

In table 4.5a, the *calculated F- value* of 10.1072 is greater than the *critical F-value* of 3.9668. The *P- value* of 0.0021 is also less than the *α value* of 0.0500. The null hypothesis is therefore rejected and we conclude that there is statistically significant difference between the two periods with respect to the relative forward-spot differentials.

Table 4.4b

ANOVA Results for the Means of the Relative Forward-spot Differentials for 12-month NCD Rates, with a Forward Contract Maturity of Twelve Months

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.097447	1	0.097447	7.89218	0.00629	3.965084
Within Groups	0.95074	77	0.012347			
Total	1.048187	78				

The variation between groups (SST) is 0.0974 and the variation within groups (SSE) is 0.9507.The mean square for error (MSE) within groups for both groups is 0.0213 with the associated degrees of freedom 77 and the mean square for treatments (MST) between groups is 0.0974 with degrees of freedom 1. Total sum of squares is 1.0482 with degrees of freedom78. The calculated F-value is 7.8922 and the P-value is 0.0063.

Table4.5a

Means of the Relative Forward-spot Differentials for 12-month NCD Rates, with a Forward Contract Maturity of Twenty-four Months

ANOVA: Single Factor				
SUMMARY				
Groups (12-M;2Ps NCD rates)	*Count*	*Sum*	*Mean*	*Variance*
Before Transparency (1984-1989)	22	6.168644	0.280393	0.042803
After Transparency (1990-2003)	56	8.952607	0.159868	0.015025

The results of analysing 3-month NCD rates, with forward contract maturity of 3 months. 'Sum' is the sum of square deviation of the differentials. 'Count' is the total sample size for both before and after transparency differentials. The sample size BT is 22 and that of AT is 56 given a total sample size of (n) 78. The means of BT and AT are 0.2804 and 0.15926 respectively. The respective variances for both BT and AT are also 0.0428 and 0.0150.

Table 4.5b

ANOVA Results for the Means of the Relative Forward-spot Differentials for 12-month NCD Rates, with a Forward Contract Maturity of Twenty-four_Months

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.22944	1	0.22944	10.10719	0.002137	3.966761
Within Groups	1.725254	76	0.022701			
Total	1.954695	77				

The variation between groups (SST) is 0.2294 and the variation within groups (SSE) is1.7253.The mean square for error (MSE) within groups for both groups is 0.0227 with the associated degrees of freedom 76 and the mean square for treatments (MST) between groups is 0.2294 with degrees of freedom 1. Total sum of squares is 1.9547 with degrees of freedom77. The calculated F-value is 10.1072 and the P-value is 0.0021.

Summarised results of the Means of the Relative Forward-spot Differentials for 3-month NCD rates with a forward contract maturity of 3, 6 and 9 months

Maturity Date	Mean BT (1)	Mean AT (2)	Difference (1-2)
3-Months	0.0869	0.0608	0.0261
6-Months	0.1874	0.1145	0.0729
9-Months	0.2450	0.1639	0.0811

BT and AT are before and after transparency respectively.

From the table above, it is observed that the values of the means before transparency for the 3-month forward-spot differentials are all greater than those after greater transparency. Also, the mean difference follows a decreasing trend. This is a manifestation of the fact that the further away from the spot rate date, the bigger is the potential improvement to expectations that the greater Reserve Bank transparency can make. Very close to the spot rates (e.g. three months or less) greater transparency may not have made a big difference as indicated by the mean difference of the 3-month NCD rates with a forward contract maturity of 3months.Thus, the further away from the spot rate date, the bigger the potential

improvement to expectations that the greater Reserve Bank transparency can make.

Summarised results of the Means of the Relative Forward-spot Differentials for 12-month NCD rates with a forward contract maturity of 12 and 24 months

Maturity Date	Mean BT (1)	Mean AT (2)	Difference (1-2)
12-Months	0.1874	0.1101	0.0773
24-Months	0.2804	0.1599	0.1205

BT and AT are before and after transparency respectively

Like the means of the 3-month forward-spot differentials, the 12-month forward-spot differential exhibits the same trend. The further away from the spot rate date, the bigger the potential improvement to expectations that the greater Reserve Bank transparency can make. Thus, there is a reduction in expectational errors the longer the forward contract maturity.

Chapter 5

Concluding Remarks

The paper uses three and twelve months NCD market rates from 1st January 1984 to 31st December 2003 to test whether greater transparency by the South African Reserve Bank reduces expectational errors in the money markets. This was done by comparing the means of the relative forward-spot differentials between the period before transparency and the period after the introduction of transparency.

Empirical analysis indicates that greater transparency by the South African Reserve Bank is correlated with the reduction of expectational errors in the money markets. Thus, the forward rates after greater transparency were better indicators of future spot rates than before greater transparency. This does, of course, not necessarily imply a causal relationship between greater transparency and improved expectations in the money markets. Apart from the 3-month NCD market rates for contracts with a maturity of three months for which the null hypothesis was not rejected, for all the other NCD market rates with different longer maturity dates, the null hypothesis was rejected indicating that greater transparency is significantly correlated with improved expectations in the money markets.

As argued in section three above, a possible explanation could be that the forward rates were determined relatively close to the spot rates and that the uncertainty was not that high before transparency, possibly because much of the relevant information on which expectations could be based were already available. However, for longer periods, where there were previously less information due to lack of transparency, the greater transparency may have enabled markets to form expectations on the basis of more relevant information.

A general conclusion can then be that the further away from the spot rate date, the bigger is the potential improvement to expectations that the greater Reserve Bank transparency can make. Very close to the spot rates (e.g. three months or less) greater transparency may not have made a big difference.

Thus, greater transparency by the South African Reserve Bank may have reduced expectational errors in the money markets as evidenced by the empirical results. It therefore suggests a strong possibility that indicates that there are positive grounds for exploring this issue further at some more depth and controlling for other factors that may have contributed to the above results.

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Appendix A: Original data for the analysis.

The original data for the analysis were taken from the data bank of the South African Reserve Bank. The rates are 3-month and 12-month forward rates on Negotiable Certificates of Deposit from 1st January1984 to 31st December 2003.

Table A

Forward Rates on Negotiable Certificates of Deposit (1984-1993)

Date	3-Month	6- Month	9-Month	12-Month	24-Month	36-Month
01-Jan-84	19.5	18.75	18.2	17.75	17.4	17
01-Apr-84	18.9	18.7	18.3	18.25	17.75	17.5
01-Jul-84	20.75	20.1	19.6	19.3	18.6	17.8
01-Oct-84	23.75	23.5	23	22.6	20.35	19.75
01-Jan-85	23.5	23.3	23.25	23	20.5	19.75
01-Apr-85	22	21	20.25	19.95	18.75	18.25
01-Jul-85	19.2	18.75	18.2	17.75	17.25	17
01-Oct-85	15	15.35	15.6	16	16.5	16.5
01-Jan-86	13.25	13.75	15.4	14.8	16.7	17.2
01-Apr-86	12.4	12.5	12.8	13.25	15.25	16.5
01-Jul-86	10.85	10.85	10.95	11	13	13.6
01-Oct-86	10.15	10.4	10.65	10.9	12.25	13.25
01-Jan-87	9.4	9.6	10	10.6	12.2	13.25
01-Apr-87	9.15	9.35	9.7	10.25	12.25	13.5
01-Jul-87	9.25	9.5	10.1	10.65	12.5	13.1
01-Oct-87	9.35	9.55	9.85	10.25	12	12.5
01-Jan-88	11.2	11.65	12.1	12.5	12.5	14.75
01-Apr-88	13.05	13.75	14.3	14.9	14.9	16.25
01-Jul-88	13.85	14.1	14.4	14.7	14.7	14.7
01-Oct-88	16	16.25	16.35	16.4	16.4	15.5
01-Jan-89	16.6	16.6	16.65	16.65	16.65	16

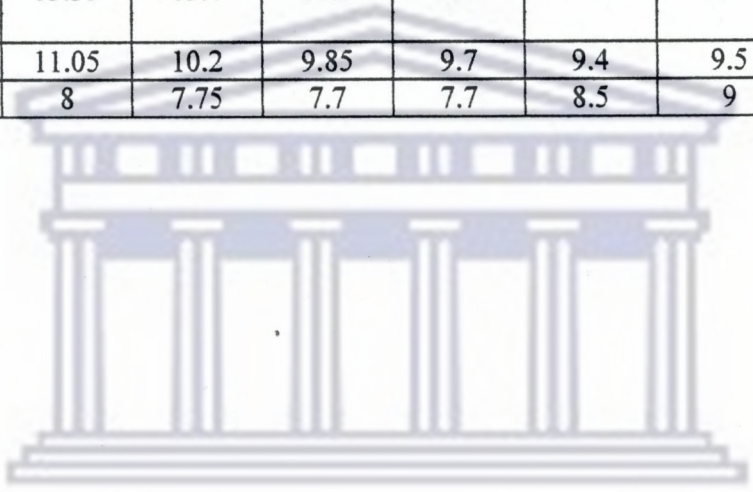
01-Apr-89	17.2	17.65	17.75	17.75	17.75	17
01-Jul-89	18.55	18.4	18.35	18.3	18.3	16.75
01-Oct-89	19.8	19.35	19.25	19.15	19.15	17.75
1-Jan-90	20.15	19.8	19.6	19.3	17	16.5
1-Apr-90	19.7	19.6	19.5	19.2	17	16.75
1-Jul-90	19.45	19.15	18.95	18.7	16.75	16.5
1-Oct-90	19	18.7	18.5	18.4	17.45	17
1-Jan-91	18.35	17.7	17.6	17.5	16.2	16.1
1-Apr-91	17.5	17.4	17.4	17.3	16.3	16.2
1-Jul-91	17.45	17.4	17.35	17.3	16.55	16.5
1-Oct-91	17.15	17.25	17.25	17.25	16.8	16.7
1-Jan-92	16.75	16.5	16.5	16.5	16	16.05
1-Apr-92	15.7	15.75	15.75	15.8	15.85	15.85
1-Jul-92	13.75	13.5	13.4	13.1	13.2	13.2
1-Oct-92	12.7	12.1	12	11.9	12	12.2
1-Jan-93	12.45	12.2	12.15	12	12.7	13.6
1-Apr-93	12.5	12.45	12.5	12.6	13.5	14
1-Jul-93	11.95	11.95	11.95	11.95	12.5	13
1-Oct-93	10.7	10.9	10.95	11	11.5	11.8

Table A Continued

Forward Rates on Negotiable Certificates of Deposit (1994-2003)

Date	3-Month	6-Month	9-Month	12-Month	24-Month	36-Month
1-Jan-94	10.3	10.25	10.15	10.05	10.6	11
1-Apr-94	10.45	10.35	10.35	10.4	11.2	12.2
1-Jul-94	11.3	11.65	11.9	12.1	13.4	14
1-Oct-94	12.4	13.1	13.65	14.4	15.75	16.45
1-Jan-95	13.1	14.05	14.6	15.05	16.05	16.5
1-Apr-95	13.8	14.35	15	15.5	16.3	16.7
1-Jul-95	14.45	14.95	15.5	15.9	16	16.5
1-Oct-95	14.45	14.65	14.95	15.1	15.2	15.3
1-Jan-96	14.7	14.6	14.5	14.35	14	13.9
1-Apr-96	15.8	15.95	16.1	16.2	16.5	16.6
1-Jul-96	16	16	16	16.2	15.5	15.3
1-Oct-96	16.5	16.5	16.5	16.55	16.35	16.2
1-Jan-97	16.6	16.6	16.6	16.6	15.19	15.17
1-Apr-97	16.45	16.5	16.6	16.65	15.06	14.98
1-Jul-97	15.45	15.45	15.45	15.45	14.13	14.02
1-Oct-97	15.35	15	15	15	14.71	14.65
1-Jan-98	14.9	14.75	14.65	14.6	13.95	13.87
1-Apr-98	13.35	13.35	13.35	13.35	12.74	12.74
1-Jul-98	20.15	19	19	19	17.38	16.88
1-Oct-98	19	19	18.2	18.2	16.75	16.4
1-Jan-99	17.75	16.7	16.7	16.7	16.05	16.05
1-Apr-99	13.9	13.85	13.85	14.1	13.85	14.1

1-Oct-99	11.2	11.4	11.85	12	12.7	13.4
01-Jan-00	10	9.95	10.4	10.8	11.9	12.5
01-Apr-00	10.1	10.25	10.75	11.2	12.3	13.2
01-Jul-00	10.45	10.6	10.8	11.2	11.6	12.2
01-Jan-01	10.5	10.6	10.75	10.9	11.2	11.5
01-Apr-01	10.65	10.9	11	11.25	11.4	11.6
01-Jul-01	9.6	9.6	9.65	9.65	9.9	10
01-Oct-01	9.1	9.15	9.25	9.35	9.5	9.85
01-Jan-02	10.25	10.55	10.9	11.25	12	12.2
01-Jul-02	12.2	12.45	12.5	12.65	12.2	12
01-Oct-02	13.5	13.75	13.85	14	13.33	12.95
01-Jan-03	13.4	13.25	13.1	13	12	11.75
01-Apr-03	13.35	13.1	12.9	12.8	11.7	11.3
01-Jul-03	11.05	10.2	9.85	9.7	9.4	9.5
01-Oct-03	8	7.75	7.7	7.7	8.5	9



Appendix B: Calculations of Expected Future Spot Rates.

The 3-month implied forward rates (as indicators of the expected future 3-month spot rates) and 12-month implied forward rates (as indicators of expected future 12-month spot rates) can be found in Table B. Both spot rates and implied forward rates are used for the analysis. The figures were calculated from the calculated data in Appendix A, as derived from the original data in Appendix B, using the formula:

$ifr_t = \{(1+ir_t)^t / (1+ir_{t-1})^{t-1}\}-1$, where

ifr_t = implied forward rates for month t

ir_t = spot interest rates for month t

ir_{t-1} = spot interest rates for t 3 months earlier (for rates with maturity of 3-months) and for t 12 months earlier (for rates with maturity of 12-months)

t = term to maturity.

Table B

Actual Spot Rates and Implied Forward Rates (for Forward contracts with varying maturities) for 3-Month Negotiable Certificates of Deposit (1984-2003)

["1 Period" refers to a Forward Contract Maturity of 3 months.]

Date	Spot Rates (actual)	Implied Forward Rates		
		1 Period Away	2 Periods Away	3 Periods Away
1-Jan-84	19.50			
1-Apr-84	18.90	18.03		
1-Jul-84	20.75	18.50	17.15	
1-Oct-84	23.75	19.47	17.52	16.46
1-Jan-85	23.50	23.25	18.64	18.10
1-Apr-85	22.00	23.10	22.03	18.43
1-Jul-85	19.20	20.04	23.15	21.44
1-Oct-85	15.00	18.31	18.83	22.27
1-Jan-86	13.25	15.71	17.15	19.08
1-Apr-86	12.40	14.27	16.11	16.46
1-Jul-86	10.85	12.60	19.27	17.26
1-Oct-86	10.15	10.85	13.42	13.13
1-Jan-87	9.4	10.66	11.15	14.69
1-Apr-87	9.15	9.80	11.17	11.15
1-Jul-87	9.25	9.55	10.85	11.68
1-Oct-87	9.35	9.76	10.44	12.60
1-Jan-88	11.20	9.75	11.40	12.08
1-Apr-88	13.05	12.12	10.48	12.47

Date	Spot Rates (actual)	Implied Forward Rates		
		1 Period Away	2 Periods Away	3 Periods Away
1-Jan-94	10.30	11.10	11.95	12.90
1-Apr-94	10.45	10.20	11.05	11.95
1-Jul-94	11.30	10.25	9.95	11.15
1-Oct-94	12.40	12.01	10.35	9.76
1-Jan-95	13.10	13.84	12.41	10.55
1-Apr-95	13.80	15.06	14.82	12.72
1-Jul-95	14.45	14.92	15.76	16.89
1-Oct-95	14.45	15.47	16.38	16.48
1-Jan-96	14.70	14.85	16.66	17.10
1-Apr-96	15.80	14.50	15.57	17.16
1-Jul-96	16.00	16.10	14.30	15.56
1-Oct-96	16.50	16.00	16.40	13.91
1-Jan-97	16.60	16.50	16.00	16.50
1-Apr-97	16.45	16.60	16.50	16.81
1-Jul-97	15.45	16.55	16.60	16.70
1-Oct-97	15.35	15.45	16.80	16.60
1-Jan-98	14.9	14.66	15.45	16.80
1-Apr-98	13.35	14.60	15.00	15.45

1-Jul-88	13.85	14.48	13.05	11.54
1-Oct-88	16.00	14.35	15.46	13.77
1-Jan-89	16.60	16.50	15.02	16.84
1-Apr-89	17.20	16.60	16.55	15.64
1-Jul-89	18.55	18.11	16.75	16.55
1-Oct-89	19.80	18.25	17.95	16.65
1-Jan-90	20.15	18.91	18.25	17.75
1-Apr-90	19.70	19.46	19.05	18.15
1-Jul-90	19.45	19.50	19.21	18.85
1-Oct-90	19.00	18.85	19.30	18.43
1-Jan-91	18.35	18.40	18.56	18.33
1-Apr-91	17.50	17.07	18.11	17.97
1-Jul-91	17.45	17.30	17.40	18.10
1-Oct-91	17.15	17.35	17.40	17.20
1-Jan-92	16.75	17.35	17.25	17.00
1-Apr-92	15.70	16.25	17.25	17.15
1-Jul-92	13.75	15.80	16.50	17.25
1-Oct-92	12.70	13.25	15.75	16.50
1-Jan-93	12.45	11.53	13.20	15.95
1-Apr-93	12.5	11.95	11.80	12.24
1-Jul-93	11.95	12.40	12.05	11.60
1-Oct-93	10.7	11.95	12.60	11.56

1-Jul-98	20.15	13.35	14.45	15.00
1-Oct-98	19.00	17.91	13.35	14.45
1-Jan-99	17.75	19.00	19.00	13.35
1-Apr-99	13.9	15.71	16.69	19.00
1-Jul-99	11.95	13.80	16.70	18.20
1-Oct-99	11.20	11.95	13.85	16.70
1-Jan-00	10.00	11.60	11.95	14.88
1-Apr-00	10.10	9.90	12.80	11.95
1-Jul-00	10.45	10.40	11.36	12.46
1-Oct-00	10.55	10.75	11.82	12.09
1-Jan-01	10.50	11.26	11.21	12.66
1-Apr-01	10.65	10.70	11.82	12.48
1-Jul-01	9.60	11.16	11.06	12.44
1-Oct-01	9.10	9.60	11.20	11.36
1-Jan-02	10.25	9.20	9.75	12.03
1-Apr-02	11.40	10.86	9.45	9.65
1-Jul-02	12.20	12.21	11.63	9.66
1-Oct-02	13.50	12.70	13.20	12.36
1-Jan-03	13.40	14.00	12.60	14.37
1-Apr-03	13.35	13.10	14.05	13.11
1-Jul-03	11.05	12.85	12.80	14.46
1-Oct-03	8.00	9.41	12.51	12.70

Table B Continued

Actual Spot Rates and Implied Forward Rates (for Forward contracts with varying maturities) for 12-Month Negotiable Certificates of Deposit (1984-2003)

["1 Period" refers to a Forward Contract Maturity of 12 months.]

Date	Spot Rates (actual)	Implied Forward Rates	
		1 Period Away	2 Periods Away
1-Jan-84	17.75		
1-Apr-84	18.25	17.06	
1-Jul-84	19.30	17.26	16.23
1-Oct-84	22.60	17.92	17.01
1-Jan-85	23.00	18.31	16.30
1-Apr-85	19.95	18.26	18.60
1-Jul-85	17.75	17.62	18.33
1-Oct-85	16.00	16.76	17.29
1-Jan-86	14.80	17.01	16.51
1-Apr-86	13.25	18.83	16.50
1-Jul-86	11.00	17.53	18.24
1-Oct-86	10.90	15.33	19.30
1-Jan-87	10.60	13.75	14.88
1-Apr-87	10.25	14.02	15.48
1-Jul-87	10.65	14.61	15.61
1-Oct-87	10.25	14.64	16.36
1-Jan-88	12.50	14.02	14.38
1-Apr-88	14.90	12.50	13.56
1-Jul-88	14.70	14.90	20.44
1-Oct-88	16.40	14.70	19.30
1-Jan-89	16.65	16.40	14.70
1-Apr-89	17.75	16.65	13.84
1-Jul-89	18.30	17.75	14.77
1-Oct-89	19.15	18.30	15.59
1-Jan-90	19.30	19.15	14.01
1-Apr-90	19.20	14.96	15.24
1-Jul-90	18.70	15.04	15.54
1-Oct-90	18.40	14.99	16.26
1-Jan-91	17.50	16.55	16.01
1-Apr-91	17.30	14.99	16.13
1-Jul-91	17.30	15.35	15.90
1-Oct-91	17.25	15.83	16.00
1-Jan-92	16.50	16.36	16.40
1-Apr-92	15.80	15.51	16.50
1-Jul-92	13.10	15.90	16.15

Date	Spot Rates (actual)	Implied Forward Rates	
		1 Period Away	2 Periods Away
1-Jan-94	10.05	12.02	14.06
1-Apr-94	10.40	11.18	12.42
1-Jul-94	12.10	12.06	11.84
1-Oct-94	14.40	14.83	14.45
1-Jan-95	15.05	17.22	15.28
1-Apr-95	15.50	17.11	17.94
1-Jul-95	15.90	17.14	17.44
1-Oct-95	15.10	16.10	17.53
1-Jan-96	14.35	15.30	17.54
1-Apr-96	16.20	13.66	15.50
1-Jul-96	16.20	16.81	13.70
1-Oct-96	16.55	14.83	16.80
1-Jan-97	16.60	16.15	14.91
1-Apr-97	16.65	13.89	15.90
1-Jul-97	15.45	13.61	15.13
1-Oct-97	15.00	12.92	14.82
1-Jan-98	14.60	14.43	13.80
1-Apr-98	13.35	13.33	14.53
1-Jul-98	19.00	12.16	13.71
1-Oct-98	18.20	15.89	12.74
1-Jan-99	16.70	15.41	15.92
1-Apr-99	14.10	15.42	15.72
1-Jul-99	11.95	13.60	16.05
1-Oct-99	12.00	13.71	14.61
1-Jan-00	10.80	13.44	16.02
1-Apr-00	11.20	13.10	14.91
1-Jul-00	11.20	13.50	13.79
1-Oct-00	11.50	12.01	15.19
1-Jan-01	10.90	12.52	13.49
1-Apr-01	11.25	11.51	13.56
1-Jul-01	9.65	11.55	12.12
1-Oct-01	9.35	10.16	12.01
1-Jan-02	11.25	9.65	10.20
1-Apr-02	12.75	12.80	10.59
1-Jul-02	12.65	12.75	12.61

1-Oct-92	11.90	13.30	15.85
1-Jan-93	12.00	12.10	13.20
1-Apr-93	12.60	13.44	12.61
1-Jul-93	11.95	14.46	15.58
1-Oct-93	11.00	13.07	15.05

1-Oct-02	14.00	11.76	12.75
1-Jan-03	13.00	12.69	11.61
1-Apr-03	12.80	11.07	12.22
1-Jul-03	9.70	10.69	11.26
1-Oct-03	7.70	9.11	10.54

Appendix C: Result of the analysis

Table C1

Relative forward-spot differentials on 3-month NCDs with forward contracts of three months maturity

Date	3-M (1P)-BT 1984-1989 (Fi-Si)/Si	Date	3-M(1P)-AT 1990-1994 (Fi-Si)/Si	Date	3-M (1P)-AT 1995-1999 (Fi-Si)/Si	Date	3-M (1P)-AT 2000-2003 (Fi-Si)/Si
1-Apr-84	0.0462	1-Jan-90	0.0616	1-Jan-95	0.0562	1-Jan-00	0.1603
1-Jul-84	0.1083	1-Apr-90	0.0124	1-Apr-95	0.0916	1-Apr-00	0.0198
1-Oct-84	0.1802	1-Jul-90	0.0026	1-Jul-95	0.0326	1-Jul-00	0.0046
1-Jan-85	0.0105	1-Oct-90	0.0077	1-Oct-95	0.0703	1-Oct-00	0.0191
1-Apr-85	0.0501	1-Jan-91	0.0030	1-Jan-96	0.0104	1-Jan-01	0.0724
1-Jul-85	0.0439	1-Apr-91	0.0245	1-Apr-96	0.0822	1-Apr-01	0.0048
1-Oct-85	0.2207	1-Jul-91	0.0086	1-Jul-96	0.0063	1-Jul-01	0.1620
1-Jan-86	0.1855	1-Oct-91	0.0117	1-Oct-96	0.0303	1-Oct-01	0.0549
1-Apr-86	0.1506	1-Jan-92	0.0359	1-Jan-97	0.0060	1-Jan-02	0.1024
1-Jul-86	0.1614	1-Apr-92	0.0353	1-Apr-97	0.0091	1-Apr-02	0.0475
1-Oct-86	0.0690	1-Jul-92	0.1491	1-Jul-97	0.0712	1-Jul-02	0.0011
1-Jan-87	0.1336	1-Oct-92	0.0436	1-Oct-97	0.0065	1-Oct-02	0.0589
1-Apr-87	0.0715	1-Jan-93	0.0742	1-Jan-98	0.0163	1-Jan-03	0.0451

1-Jul-87	0.0329	1-Apr-93	0.0436	1-Apr-98	0.0937	1-Apr-03	0.0186
1-Oct-87	0.0434	1-Jul-93	0.0377	1-Jul-98	0.3375	1-Jul-03	0.1633
1-Jan-88	0.1291	1-Oct-93	0.1168	1-Oct-98	0.0572	1-Oct-03	0.1762
1-Apr-88	0.0715	1-Jan-94	0.0780	1-Jan-99	0.0704		
1-Jul-88	0.0458	1-Apr-94	0.0239	1-Apr-99	0.1301		
1-Oct-88	0.1029	1-Jul-94	0.0928	1-Jul-99	0.1548		
1-Jan-89	0.0058	1-Oct-94	0.0315	1-Oct-99	0.0670		
1-Apr-89	0.0349						
1-Jul-89	0.0237						
1-Oct-89	0.0782						

Quarterly 1-period 3-month away forward-spot differentials (Fi-Si)/Si) before transparency (BT) from 1st April 1984 to 31st December 1989 and quarterly forward-spot differentials (Fi-Si)/Si) after transparency (AF) from 1st January 1990 to 31st December 2003.The forward-spot differentials are the proportion by which the forward rate deviated from the future spot rate. 3-M (1P) indicates 3-month 1-period away NCD differentials. One period is three months away from the prevailing spot rate.

Table C2

Relative forward-spot differentials on 3-month NCDs with forward contracts of six months maturity

Date	3-M (2Ps)-BT 1984-1989 (Fi-Si)/Si	Date	3-M (2Ps)- AT 1990-1994 (Fi-Si)/Si	Date	3-M (2Ps)- AT 1995-1999 (Fi-Si)/Si	Date	3-M (2Ps)- AT 2000-2003 (Fi-Si)/Si
1-Jul-84	0.1737	1-Jan-90	0.0943	1-Jan-95	0.0523	1-Jan-00	0.1950
1-Oct-84	0.2621	1-Apr-90	0.0329	1-Apr-95	0.0736	1-Apr-00	0.2673
1-Jan-85	0.2070	1-Jul-90	0.0126	1-Jul-95	0.0907	1-Jul-00	0.0867
1-Apr-85	0.0014	1-Oct-90	0.0159	1-Oct-95	0.1338	1-Oct-00	0.1202
1-Jul-85	0.2057	1-Jan-91	0.0112	1-Jan-96	0.1332	1-Jan-01	0.0677
1-Oct-85	0.2551	1-Apr-91	0.0346	1-Apr-96	0.0147	1-Apr-01	0.1101
1-Jan-86	0.2940	1-Jul-91	0.0028	1-Jul-96	0.1061	1-Jul-01	0.1517
1-Apr-86	0.2993	1-Oct-91	0.0146	1-Oct-96	0.0058	1-Oct-01	0.2310
1-Jul-86	0.7764	1-Jan-92	0.0299	1-Jan-97	0.0361	1-Jan-02	0.0487
1-Oct-86	0.3222	1-Apr-92	0.0987	1-Apr-97	0.0030	1-Apr-02	0.1708
1-Jan-87	0.1864	1-Jul-92	0.2000	1-Jul-97	0.0744	1-Jul-02	0.0465
1-Apr-87	0.2204	1-Oct-92	0.2402	1-Oct-97	0.0946	1-Oct-02	0.0224
1-Jul-87	0.1725	1-Jan-93	0.0604	1-Jan-98	0.0369	1-Jan-03	0.0597
1-Oct-87	0.1161	1-Apr-93	0.0558	1-Apr-98	0.1236	1-Apr-03	0.0526
1-Jan-88	0.0183	1-Jul-93	0.0084	1-Jul-98	0.2828	1-Jul-03	0.1588
1-Apr-88	0.1973	1-Oct-93	0.1776	1-Oct-98	0.2974	1-Oct-03	0.5636
1-Jul-88	0.0579	1-Jan-94	0.1602	1-Jan-99	0.0704		
1-Oct-88	0.0336	1-Apr-94	0.0575	1-Apr-99	0.2011		
1-Jan-89	0.0953	1-Jul-94	0.1192	1-Jul-99	0.3975		

1-Apr-89	0.0377		1-Oct-94	0.1653		1-Oct-99	0.2366			
1-Jul-89	0.0970									
1-Oct-89	0.0934									

Quarterly 2-periods 3-month away forward-spot differentials (Fi-Si)/Si) before transparency (BT) from 1st July 1984 to 31st December 1989 and quarterly forward-spot differentials (Fi-Si)/Si) after transparency (AF) from 1st January 1990 to 31st December 2003.The forward-spot differentials are the proportion by which the forward rate deviated from the future spot rate. 3-M (2Ps) indicates 3-month 2-periods away NCD differentials. Two periods is six months away from the prevailing spot rate.

Table C3

Relative forward-spot differentials on 3-month NCDs with forward contracts of nine months maturity

Date	3-M (1P)-BT 1984-1989 (Fi-Si)/Si	Date	3-M(1P)-AT 1990-1994 (Fi-Si)/Si	Date	3-M (1P)-AT 1995-1999 (Fi-Si)/Si	Date	3-M (1P)-AT 2000-2003 (Fi-Si)/Si
1-Oct-84	0.3069	1-Jan-90	0.1191	1-Jan-95	0.1946	1-Jan-00	0.4876
1-Jan-85	0.2298	1-Apr-90	0.0786	1-Apr-95	0.0783	1-Apr-00	0.1832
1-Apr-85	0.1625	1-Jul-90	0.0307	1-Jul-95	0.1687	1-Jul-00	0.1924
1-Jul-85	0.1166	1-Oct-90	0.0302	1-Oct-95	0.1404	1-Oct-00	0.1456
1-Oct-85	0.4844	1-Jan-91	0.0013	1-Jan-96	0.1630	1-Jan-01	0.2053
1-Jan-86	0.4396	1-Apr-91	0.0268	1-Apr-96	0.0860	1-Apr-01	0.1721
1-Apr-86	0.3276	1-Jul-91	0.0374	1-Jul-96	0.0276	1-Jul-01	0.2964
1-Jul-86	0.5907	1-Oct-91	0.0031	1-Oct-96	0.1571	1-Oct-01	0.2485
1-Oct-86	0.2935	1-Jan-92	0.0151	1-Jan-97	0.0058	1-Jan-02	0.1738
1-Jan-87	0.5628	1-Apr-92	0.0924	1-Apr-97	0.0221	1-Apr-02	0.1535
1-Apr-87	0.2187	1-Jul-92	0.2545	1-Jul-97	0.0810	1-Jul-02	0.2085
1-Jul-87	0.2630	1-Oct-92	0.2992	1-Oct-97	0.0814	1-Oct-02	0.0842
1-Oct-87	0.3480	1-Jan-93	0.2812	1-Jan-98	0.1276	1-Jan-03	0.0721
1-Jan-88	0.0782	1-Apr-93	0.0210	1-Apr-98	0.1573	1-Apr-03	0.0180
1-Apr-88	0.0445	1-Jul-93	0.0289	1-Jul-98	0.2556	1-Jul-03	0.3085
1-Jul-88	0.1667	1-Oct-93	0.0804	1-Oct-98	0.2394	1-Oct-03	0.5880
1-Oct-88	0.1391	1-Jan-94	0.2529	1-Jan-99	0.2479		
1-Jan-89	0.0148	1-Apr-94	0.1435	1-Apr-99	0.3669		
1-Apr-89	0.0910	1-Jul-94	0.0132	1-Jul-99	0.5230		
1-Jul-89	0.1078	1-Oct-94	0.2133	1-Oct-99	0.4911		

1-Oct-89	0.1591									

Quarterly 3-periods 3-month forward-spot differentials (Fi-Si)/Si) before transparency (BT) from 1st October 1984 to 31st December 1989 and quarterly forward-spot differentials (Fi-Si)/Si) after transparency (AF) from 1st January 1990 to 31st December 2003.The forward-spot differentials are the proportion by which the forward rate deviated from the future spot rate. 3-M (3Ps) indicates 3-month 3-periods away NCD differentials. Three periods is nine months away from the prevailing spot rate.

Table C4

Relative forward-spot differentials on 12-month NCDs with forward contracts of twelve months maturity

Date	12-M (1P)-BT 1984-1989 (Fi-Si)/Si	Date	12-M(1P)-AT 1990-1994 (Fi-Si)/Si	Date	12-M (1P)-AT 1995-1999 (Fi-Si)/Si	Date	12-M (1P)-AT 2000-2003 (Fi-Si)/Si
1-Jan-84	0.0654	1-Jan-90	0.0078	1-Jan-95	0.1441	1-Jan-00	0.2442
1-Apr-84	0.1055	1-Apr-90	0.2208	1-Apr-95	0.1040	1-Apr-00	0.1699
1-Oct-84	0.2069	1-Jul-90	0.1957	1-Jul-95	0.0779	1-Jul-00	0.2053
1-Jan-85	0.2037	1-Oct-90	0.1852	1-Oct-95	0.0663	1-Oct-00	0.0446
1-Apr-85	0.0847	1-Jan-91	0.0545	1-Jan-96	0.0662	1-Jan-01	0.1486
1-Jul-85	0.0074	1-Apr-91	0.1334	1-Apr-96	0.1569	1-Apr-01	0.0229
1-Oct-85	0.0477	1-Jul-91	0.1124	1-Jul-96	0.0374	1-Jul-01	0.1971
1-Jan-86	0.1496	1-Oct-91	0.0823	1-Oct-96	0.1040	1-Oct-01	0.0862
1-Apr-86	0.4210	1-Jan-92	0.0084	1-Jan-97	0.0270	1-Jan-02	0.1420
1-Jul-86	0.5937	1-Apr-92	0.0181	1-Apr-97	0.1656	1-Apr-02	0.0036
1-Oct-86	0.4067	1-Jul-92	0.2138	1-Jul-97	0.1189	1-Jul-02	0.0079
1-Jan-87	0.2975	1-Oct-92	0.1177	1-Oct-97	0.1389	1-Oct-02	0.1597
1-Apr-87	0.3679	1-Jan-93	0.0084	1-Jan-98	0.0120	1-Jan-03	0.0239
1-Jul-87	0.3714	1-Apr-93	0.0665	1-Apr-98	0.0017	1-Apr-03	0.1350
1-Oct-87	0.4287	1-Jul-93	0.2100	1-Jul-98	0.3602	1-Jul-03	0.1018
1-Jan-88	0.1218	1-Oct-93	0.1885	1-Oct-98	0.1269	1-Oct-03	0.1829
1-Apr-88	0.1611	1-Jan-94	0.1961	1-Jan-99	0.0773		
1-Jul-88	0.0136	1-Apr-94	0.0747	1-Apr-99	0.0939		
1-Oct-88	0.1037	1-Jul-94	0.0036	1-Jul-99	0.1384		
1-Jan-89	0.0150	1-Oct-94	0.0298	1-Oct-99	0.1421		

1-Apr-89	0.0620									
1-Jul-89	0.0301									
1-Oct-89	0.0444									

Quarterly1-period 12-month forward-spot differentials (Fi-Si)/Si) before transparency (BT) from 1st April 1984 to 31st December 1989 and quarterly forward-spot differentials (Fi-Si)/Si) after transparency (AF) from 1st January 1990 to 31st December 2003.The forward-spot differentials are the proportion by which the forward rate deviated from the future spot rate. 12-M (1P) indicates 12-month 1-period away NCD differentials. One period is twelve months away from the prevailing spot rate.

Table C5

Relative forward-spot differentials on 12-month NCDs with forward contracts of twenty-four months maturity

Date	12-M (1P)-BT 1984-1989 (Fi-Si)/Si		Date	12-M(1P)-AT 1990-1994 (Fi-Si)/Si		Date	12-M (1P)-AT 1995-1999 (Fi-Si)/Si		Date	12-M (1P)-AT 2000-2003 (Fi-Si)/Si
1-Jul-84	0.1593		1-Jan-90	0.2739		1-Jan-95	0.0150		1-Jan-00	0.4836
1-Oct-84	0.2473		1-Apr-90	0.2065		1-Apr-95	0.1574		1-Apr-00	0.3312

1-Jan-85	0.2915	1-Jul-90	0.1689	1-Jul-95	0.0966	1-Jul-00	0.2308
1-Apr-85	0.0677	1-Oct-90	0.1163	1-Oct-95	0.1608	1-Oct-00	0.3206
1-Jul-85	0.0325	1-Jan-91	0.0851	1-Jan-96	0.2226	1-Jan-01	0.2373
1-Oct-85	0.0805	1-Apr-91	0.0675	1-Apr-96	0.0431	1-Apr-01	0.2052
1-Jan-86	0.1156	1-Jul-91	0.0808	1-Jul-96	0.1542	1-Jul-01	0.2562
1-Apr-86	0.2453	1-Oct-91	0.0724	1-Oct-96	0.0152	1-Oct-01	0.2845
1-Jul-86	0.6584	1-Jan-92	0.0060	1-Jan-97	0.1020	1-Jan-02	0.0931
1-Oct-86	0.7703	1-Apr-92	0.0444	1-Apr-97	0.0448	1-Apr-02	0.1698
1-Jan-87	0.4036	1-Jul-92	0.2329	1-Jul-97	0.0207	1-Jul-02	0.0032
1-Apr-87	0.5104	1-Oct-92	0.3319	1-Oct-97	0.0119	1-Oct-02	0.0893
1-Jul-87	0.4655	1-Jan-93	0.1000	1-Jan-98	0.0546	1-Jan-03	0.1070
1-Oct-87	0.5966	1-Apr-93	0.0007	1-Apr-98	0.0884	1-Apr-03	0.0453
1-Jan-88	0.1505	1-Jul-93	0.3039	1-Jul-98	0.2784	1-Jul-03	0.1613
1-Apr-88	0.0900	1-Oct-93	0.3684	1-Oct-98	0.3000	1-Oct-03	0.3685
1-Jul-88	0.3903	1-Jan-94	0.3986	1-Jan-99	0.0467		
1-Oct-88	0.1770	1-Apr-94	0.1944	1-Apr-99	0.1149		
1-Jan-89	0.1171	1-Jul-94	0.0213	1-Jul-99	0.3431		
1-Apr-89	0.2204	1-Oct-94	0.0037	1-Oct-99	0.2177		
1-Jul-89	0.1928						
1-Oct-89	0.1860						

Quarterly 2-periods 12-month forward-spot differentials (Fi-Si)/Si) before transparency (BT) from 1st July 1984 to 31st December 1989 and quarterly forward-spot differentials (Fi-Si)/Si) after transparency (AF) from 1st January 1990 to 31st December 2003.The forward-spot differentials are the proportion by which the forward rate deviated from the future spot rate. 12-M (2Ps) indicates

12-month 2-periods away NCD differentials. Two periods is twenty-four months away from the prevailing spot rate.