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### The 90-Day DTF Interest Rate: Why Does It Remain Constant?

Peter Rowland

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# The 90-Day DTF Interest Rate: Why Does It Remain Constant?

Peter Rowland

Banco de la República\*

## Abstract

The 90-day DTF rate is the main benchmark interest rate in Colombia. Since mid-July 2002 this rate has remained more or less constant at around 7.8 percent. More importantly, it did not react to any of two 100-basis-point increases in the overnight repo rate, the main tool of monetary policy that Banco de la República has to influence domestic interest rates, which has rendered the repo rate rather inefficient as a monetary policy tool. This paper studies the DTF rate and its development over time. It shows that a significant pass-through from the overnight interest rates to the DTF rate that was present before July 2002 thereafter seems to have vanished. It also provides a number of explanations to why the DTF rate has remained constant: Overnight rates have in real terms been negative and might, therefore, have been more out of the market than the DTF rate; due to heavy government borrowing, the yield curve has been too steep to allow a further lowering of the DTF rate; competition in the financial system is low, leading to sticky interest rates; the DTF rate is not a free-market auction rate but an offer rate set by the banks; and the DTF rate is a very dominant benchmark.

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\* The opinions expressed here are those of the author and not necessarily of the Banco de la República, the Colombian Central Bank, nor of its Board of Directors. I express my thanks to Franz Hamann, Munir Jalil, Ana Fernanda Maihuasca, and Juan Mauricio Ramírez for helpful comments and suggestions. Any remaining errors are my own.

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# 1 Introduction

The 90-day DTF<sup>1</sup> interest rate is the most important benchmark rate in Colombia. This is an interest rate composite, calculated as the weighted average of the interest rates on 90-day Certificates of Deposits (CDs)<sup>2</sup> offered by Colombian banks and financial institutions.

Up until July 2002, the DTF rate responded consistently to changes in the overnight repo rate, which is the main monetary policy tool with which Banco de la República can influence the domestic interest rates and, therefore, also the domestic yield curve.<sup>3</sup>

However, since mid-July 2002, the DTF rate has remained more or less constant at around 7.8 percent, even if the overnight repo rate has been changed significantly at several points in time. The pass-through from the overnight rate to the DTF rate, which was present before July 2002, seems to have disappeared. This is highly unsatisfactory, since it has made the repo rate as a monetary policy tool rather inefficient.

This paper aims to explain why the DTF rate has remained constant after July 2002 and why it has not responded to the changes in the overnight repo rate. A number of possible explanations can be envisaged, and the paper concludes that several such explanations play important parts. From May 2002, over-night interest rates were, in real terms, negative, and might, therefore, have been more out of line with the market than the DTF rate, which in real terms remained positive. A steep yield curve, moreover, hindered a further lowering of the DTF rate. Structural factors also play important parts, such as the low competition within the banking system, the fact that the 90-day CD rates that underlie the DTF rate are not auction rates but deposit rates offered by the banks, and that the DTF rate is a very dominant benchmark.

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<sup>1</sup> *Depósitos Termino Fijo*, i.e. fixed term deposits.

<sup>2</sup> We will throughout this paper assume that CDs has an interest rate that is fixed throughout their maturity. Such CDs are in Colombia generally referred to as CDTs.

<sup>3</sup> The banks started using the overnight repo rate as an active monetary policy tool in 1998, when inflation targeting started.

The paper is organised as follows: Chapter 2 discusses the different Colombian interest rates and their development over time. Interest-rate pass-through is also analysed in this chapter. Chapter 3 discusses how and why the banks might keep the DTF rate constant. Other factors that might make the DTF rate sticky are discussed in chapter 4, and chapter 5 concludes the paper.

## **2 Colombian Interest Rates**

In this chapter we look at the DTF rate in relation to some other interest rates in Colombia. Section 2.1 defines the DTF rate and discusses its development over time, and in particular how it has responded to changes in the overnight repo rate. Section 2.2 discusses the overnight inter-bank rate and CD rates of longer maturities than the DTF rate. In section 2.3 the pass-through between the overnight rate and the DTF rate is analysed. Section 2.4 discusses the real interest rate, section 2.5 the implicit forward rate, and section 2.6 the 90-day TES rate. These rates are all important when analysing the DTF rate.

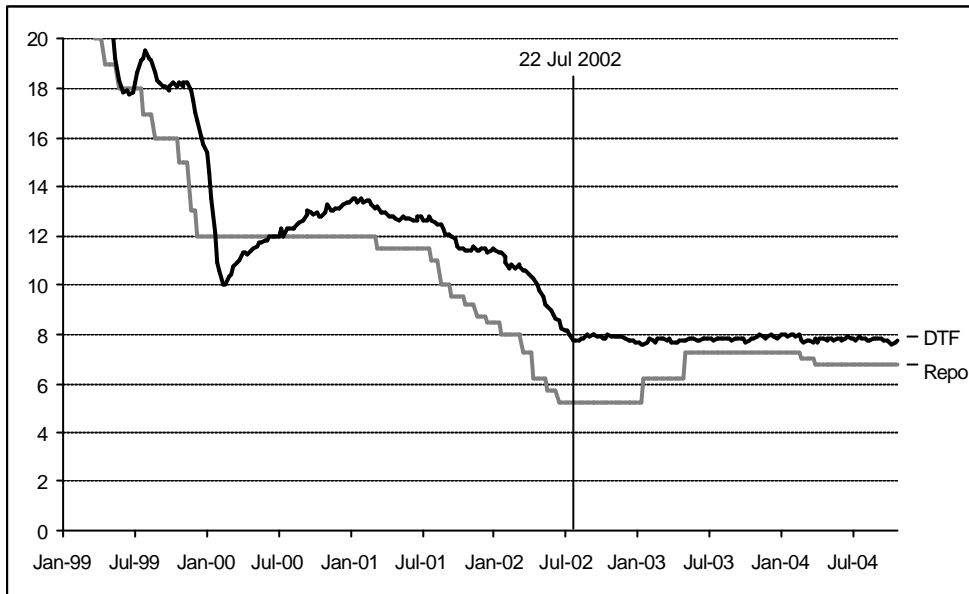
### **2.1 The DTF Interest Rate**

The 90-day DTF interest rate is the most important benchmark rate in Colombia. It is calculated weekly as a weighted average of the interest rates on 90-day Certificates of Deposits (CDs) issued by banks and other financial institutions to their clients.

As illustrated by figure 2.1, the DTF rate responded relatively consistently to changes in the overnight repo rate up until July 2002. The repo rate is the main monetary policy tool with which Banco de la República has influenced the domestic interest rates and, therefore, also the domestic yield curve.

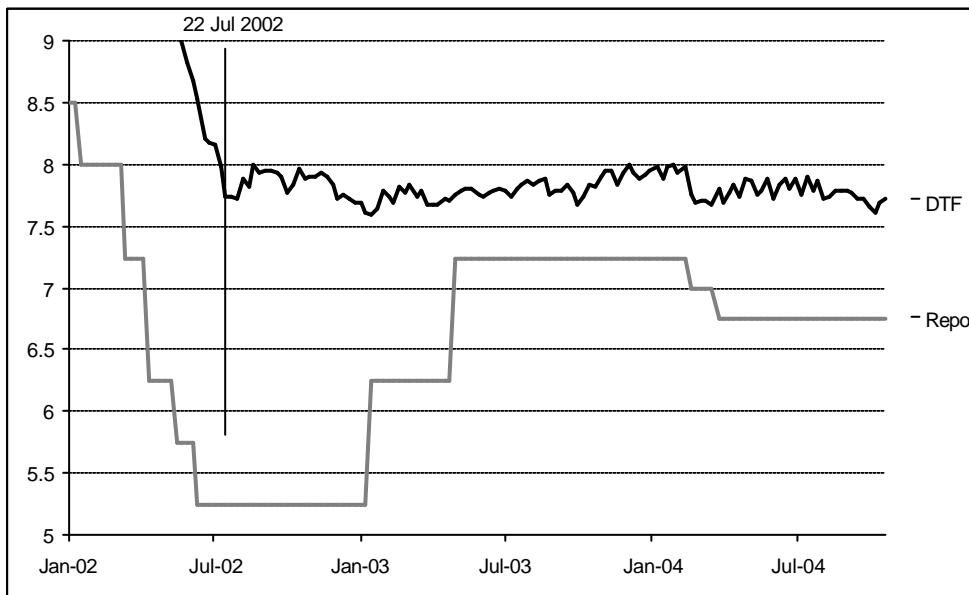
However, from 22 July 2002 and onwards, the DTF rate has remained more or less constant at around 7.8 percent, even if the overnight repo rate has been changed significantly at several points in time. The repo rate was, in fact, raised by 100 basis points in January 2003 and by a further 100 basis points in May 2003. There was no significant reaction in the DTF rate to these relatively large changes in the repo rate. This is unsatisfactory, since it has rendered the repo rate inefficient as a monetary policy tool. Figure 2.2 shows the development of the DTF rate and the repo rate after July 2002.

**Figure 2.1.** The DTF rate and the repo rate, 1999-2004 (%)



Source: Banco de la República

**Figure 2.2.** The DTF rate and the repo rate, 2002-2004 (%)



Source: Banco de la República

In February 2004, the repo rate was lowered by 25 basis points, and in March it was lowered by a further 25 basis points. The DTF rate did indeed react to the first of these two decreases. The five-week average of the DTF rate fell from 7.96 percent just before the change in the repo rate to 7.71 percent just after, which represents quite exactly a decrease of 25 basis points.<sup>4</sup> The DTF rate did, however, not react to the second decrease in the repo rate. The five-week average of the DTF rate, in fact, rose from 7.71 percent just before the decrease in the repo rate to 7.77 percent just after. This rise is, however, not significant at the 5-percent level.

We will in section 2.3 analyse the interest-rate pass-through from the repo rate to the DTF rate. However, first we take a look at some of the other interest rates in the Colombian economy and how these have behaved in relation to the DTF rate and the repo rate.

## **2.2 Some Different Interest Rates over Time**

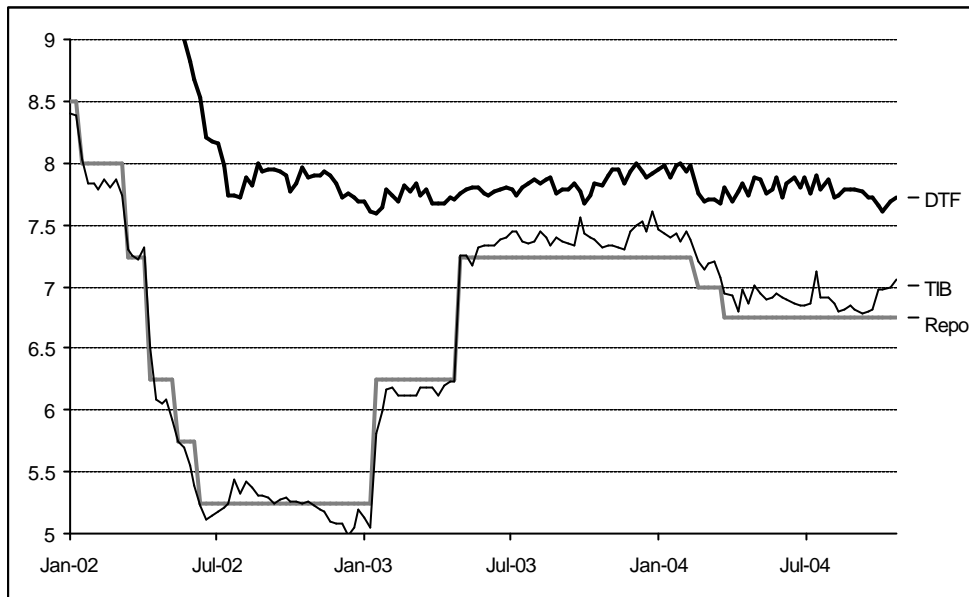
At the short end of the yield curve, in addition to the overnight repo rate, we also have the overnight inter-bank interest rate (*tasa de interés interbancaria*, TIB). As shown by figure 2.3, the TIB has closely followed the repo rate, and any change in the latter has directly generated a corresponding change in the former. So there is an apparent transfer mechanism between the repo rate and the TIB, while such a mechanism seems to be absent from the overnight rates to the 90-day DTF rate.

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<sup>4</sup> This change in the DTF rate is significant at the 1-percent level. Note also that in the dataset for the DTF rate, the data point for 8 March 2004 has been adjusted for the fact that one bank issued a large number of 90-day CDs at an interest rate significantly above the rate of other banks, and this bank has in the dataset used here been excluded from the DTF composite, but only for this specific point in time. For the rest of the time series, the unadjusted DTF rate has been used, as published by Banco de la República.



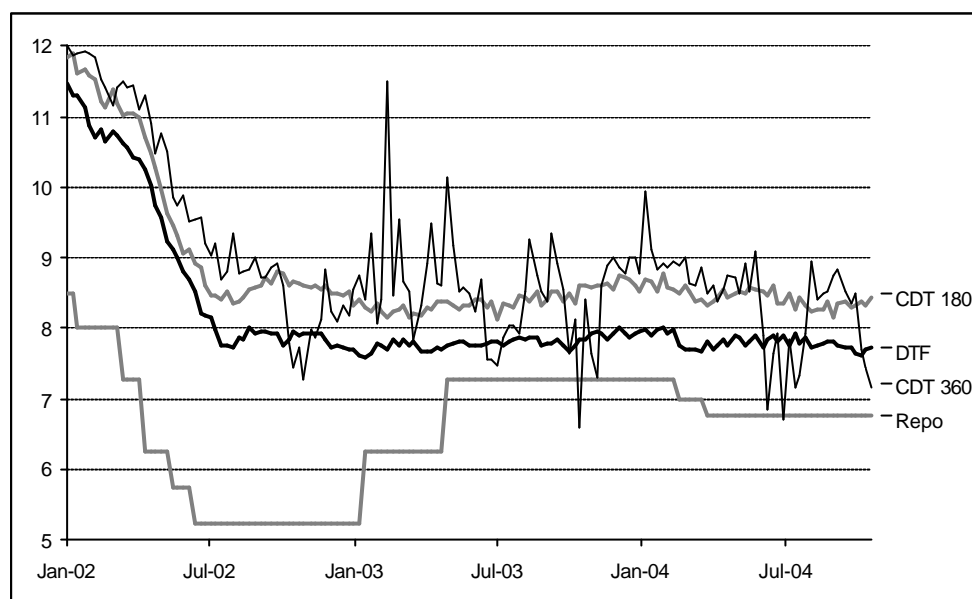
**Figure 2.3.** The repo rate, the TIB and the DTF rate, 2002-2004 (%)



*Source:* Banco de la República

If we study longer maturities, benchmark rates exist for 180 days and 360 days. The CDT 180 and the CDT 360 are both interest rate composites derived from certificate-of-deposit rates. As in the case of the DTF rate, none of these are auction rates, but rather deposit rates offered by the banks to their clients. They, therefore, suffer from some of the same shortcomings as the DTF composite. Figure 2.4 graphs the development over time of the DTF rate, the CDT 180 rate and the CDT 360 rate. It is obvious from the figure, that there has not been any apparent shift neither in the DTF rate nor in the CDT 180 rate in response to the changes in the repo rate. The CDT 360 rate is much more volatile due to the small volumes of 360-day CDs issued by the banks, so this rate is less useful as a benchmark.

**Figure 2.4.** The repo rate, the DTF rate, the CDT 180 and the CDT 360, 2002-2004 (%)



*Source:* Banco de la República

### 2.3 Interest Rate Pass-Through

By studying figure 2.1 earlier, we concluded that before July 2002 the DTF rate responded relatively consistently to changes in the overnight repo rate, while after July 2002, changes in the repo rate did not generate any significant changes in the DTF rate. We also concluded that the TIB rate relatively closely follows the repo rate. In this section, we will analyse the pass-through between the TIB rate and the DTF rate before and after July 2002. The reason why we use the TIB rate rather than the repo rate, is that the repo rate in many aspects is a discrete variable rather than a continuous variable, and the econometric technique used here requires the variables to be continuous.

To study the interest-rate pass-through, we will estimate an unrestricted vector-autoregressive model (VAR) and study the impulse response functions generated from this model. The unrestricted VAR is defined by the following two equations:

$$\Delta tib_t = \sum_{i=1}^k \mathbf{g}_{11}^i \Delta tib_{t-i} + \sum_{i=1}^k \mathbf{g}_{12}^i \Delta dtf_{t-i} + \mathbf{e}_{1t} \quad (2.1)$$

$$\Delta dtf_t = \sum_{i=1}^k \mathbf{g}_{21}^i \Delta tib_{t-i} + \sum_{i=1}^k \mathbf{g}_{22}^i \Delta dtf_{t-i} + \mathbf{e}_{2t} \quad (2.2)$$

where  $\mathbf{g}_{nm}^i$  are parameters to be estimated,  $k$  is the maximum distributed lag length,  $\Delta$  is the difference operator and  $e_{nt}$  are independent and identically distributed error terms. The time series data used for the estimations consists of the overnight TIB rate,  $tib$ , and the DTF rate,  $dtf$ .

The unrestricted VAR defined by equation (2.1) and equation (2.2) is now estimated using weekly data from 4 Jan 1999 to 15 Jul 2002 (the first period) as well as from 22 Jul 2002 to 25 Oct 2004 (the second period). The maximum lag length,  $k$ , is chosen to be long enough for the error terms to be normally distributed and not serially correlated. As shown by table 2.1, for the first period, the residual tests for the model are all passed for a maximum lag length of 2, with the exception of the kurtosis test, which should not be of serious concern. However, for the second period, none of the normality tests are passed, as shown in table 2.2, so the results might in this case be of questionable validity. The residuals are graphed in figure 2.5 and 2.6.

In order to determine the impulse response functions, the variables need to be given a plausible ordering. As discussed earlier, we assume the TIB rate to be exogenous, and the DTF rate to be caused by the TIB rate. A Granger causality test, reported in table 2.3, also suggests that the TIB is a good predictor of the DTF rate in the first period. However, for the second period, the null hypothesis that the TIB rate does *not* Granger cause the DTF rate cannot be rejected. During the second period, the Granger causality, in fact, seem to run in the opposite direction, i.e. from the DTF to the TIB.

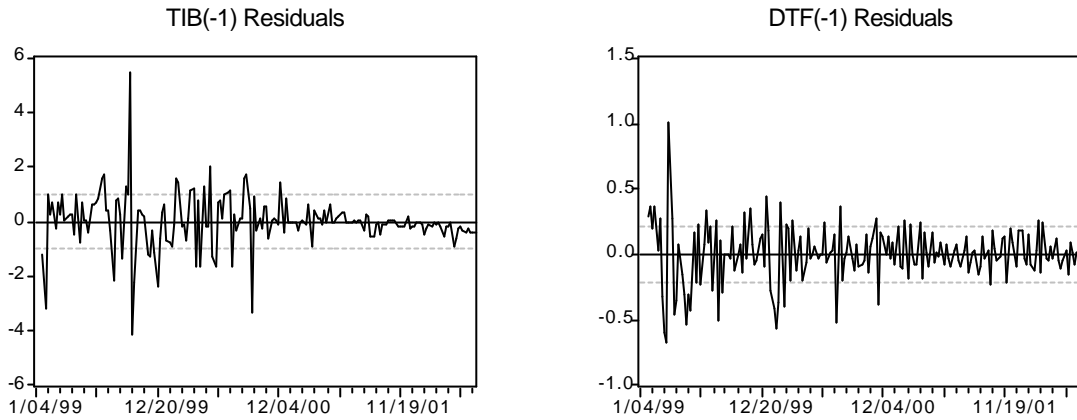
**Table 2.1.** Residual tests of the unrestricted VAR  
(using weekly data from 4 Jan 1999 to 15 Jul 2002, and a maximum lag length  $k = 2$ )

Test	Test Statistic	P-value
<b>Multivariate Normality</b>		
Joint skewness test	$\chi^2(2) = 0.223$	0.894
Joint kurtosis test	$\chi^2(2) = 483.8$	0.000
<b>Autocorrelation</b>		
Portmanteau test	Port(12) = 52.20	0.094
LM test	LM(12) = 5.21	0.266
<b>Unit Roots</b>		
ADF test residual $e_1$	ADF(13) = -14.47	
ADF test residual $e_2$	ADF(13) = -13.49	

**Table 2.2.** Residual tests of the unrestricted VAR  
(using weekly data from 22 Jul 2002 to 25 Oct 2004, and a maximum lag length  $k = 2$ )

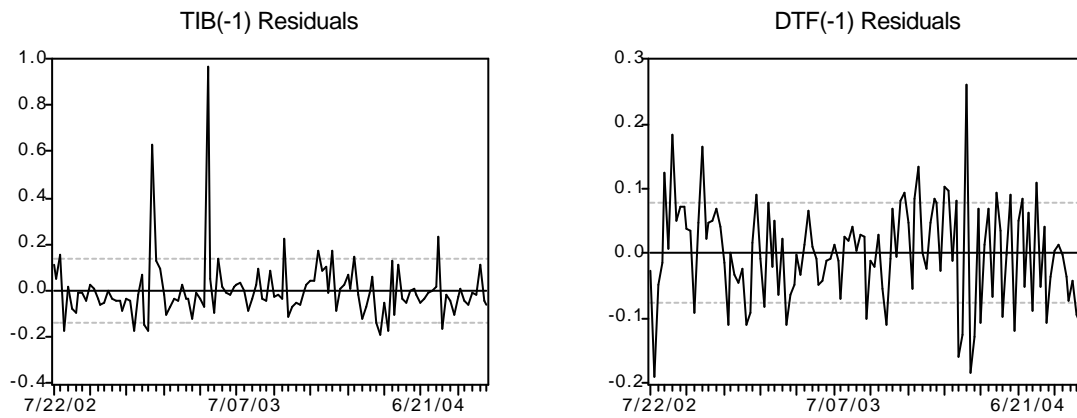
Test	Test Statistic	P-value
<b>Multivariate Normality</b>		
Joint skewness test	$\chi^2(2) = 281.9$	0.000
Joint kurtosis test	$\chi^2(2) = 2,402.1$	0.000
<b>Autocorrelation</b>		
Portmanteau test	Port(12) = 28.51	0.912
LM test	LM(12) = 2.85	0.584
<b>Unit Roots</b>		
ADF test residual $e_1$	ADF(12) = -10.92	
ADF test residual $e_2$	ADF(12) = -10.86	

**Figure 2.5.** Residuals of the VAR: First period  
(using data from 4 Jan 1999 to 15 Jul 2002)



*Note:* The residuals are  $e_{1t}$  and  $e_{2t}$  in equation (2.1) and (2.2) respectively.

**Figure 2.6.** Residuals of the VAR: Second period  
(using data from 22 Jul 2002 to 25 Oct 2004)



*Note:* The residuals are  $e_{1t}$  and  $e_{2t}$  in equation (2.1) and (2.2) respectively.

**Table 2.3.** Pair-wise Granger causality tests

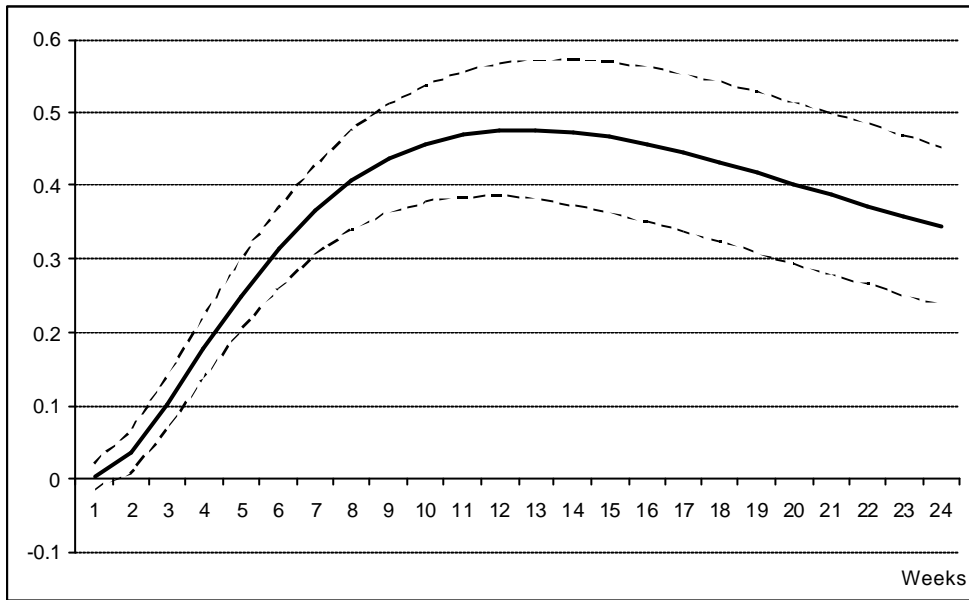
Time period	Null Hypothesis	No of Observations	F-statistic	P-value
First period (4/1/99-15/7/02)	TIB does not Granger cause DTF	183	18.80	0.000
	DTF does not Granger cause TIB	183	0.140	0.870
Second period (22/7/02-25/10/04)	TIB does not Granger cause DTF	119	1.045	0.355
	DTF does not Granger cause TIB	119	4.335	0.015

**Table 2.4.** Effects of the DTF rate to a shock in the TIB rate

	First period (4/1/99-15/7/02)	Second period (22/7/02-25/10/04)
After 3 weeks	0.10	0.00
After 6 weeks	0.31	0.02
After 12 weeks	0.48	0.02
After 24 weeks	0.34	0.02

Note: A pass-through coefficient of 0.10 indicates that a one percent increase in the *percentage rate* of the TIB, e.g. from 5.000 to 5.050 percent, results in a 0.10 percent increase in the *percentage rate* of the DTF, e.g. from 8.000 to 8.008 percent.

**Figure 2.7.** Response of the DTF rate to a shock in the TIB rate: First period (using data from 4 Jan 1999 to 15 Jul 2002)



**Figure 2.8.** Response of the DTF rate to a shock in the TIB rate: Second period (using data from 22 Jul 2002 to 25 Oct 2004)

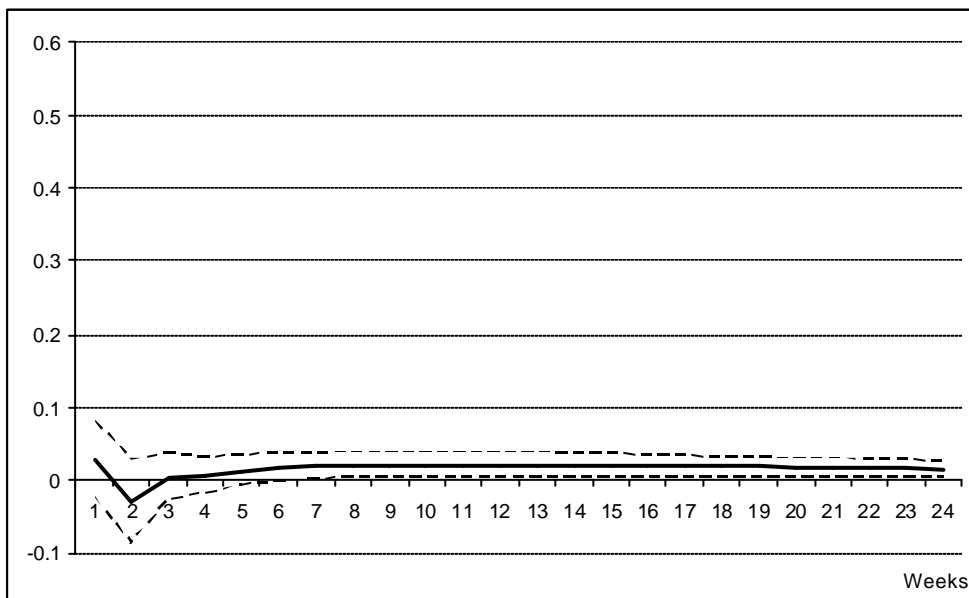


Table 2.4 displays the responses of the DTF rate to a one unit shock in the TIB rate. Figure 2.7 and 2.8 graphs the impulse-responses. It is apparent that the DTF rate responded significantly to changes in the TIB rate in the first period studied. After 12 weeks 48 percent of the change in the TIB has been passed through to the DTF rate.<sup>5</sup> However, during the second period studied, no significant pass through seem to exist, and the DTF rate does not seem to react to changes in the TIB.

#### **2.4 The Real Interest Rate: The TIB Has Been Negative**

During the second half of the 1990s the rate of inflation in Colombia fell continuously, and so did interest rates. In April 2002 the year-on-year inflation rate reached an all time low of 5.6 percent, but thereafter it started increasing again, as illustrated in by figure 2.9. The decrease in the repo rate, nevertheless, continued throughout April and May, resulting in a negative real interest rate for overnight repos. As discussed previously, the overnight inter-bank rate, the TIB, followed the repo rate closely, as illustrated earlier in figure 2.3. In real terms, the TIB was consequently also negative. This was, in fact, the first time real interest rates have been negative since 1998, when inflation targeting started.

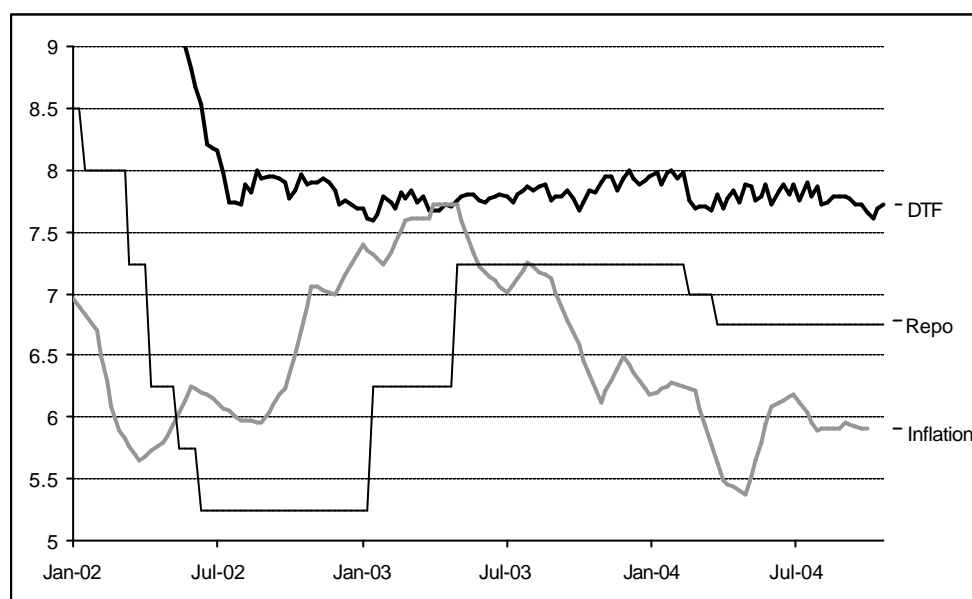
The banks may have concluded that depositors would not accept a negative real interest rate on their deposits. This could be one explanation to why the banks did not continue lowering the DTF further after July 2002, despite the fact that the gap between the TIB and the DTF widened from 200 basis points on average during 2001 to 270 basis points on average during the second half of 2002.

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<sup>5</sup> This result is in line with those reported by other studies of interest-rate pass-through. See, for example, Espinosa-Vega and Rebucci (2003) for a study on Chile and selected European countries.



**Figure 2.9.** The repo rate, the DTF rate, and the inflation rate, 2002-2004 (%)



*Note:* The inflation rate is here defined as the year-on-year change in the consumer price index.

*Source:* Banco de la República

Analysing the real interest rates might, indeed, suggest that the DTF rate was more realistic than the TIB or the repo rate during the second half of 2002. The negative overnight rates might, actually, have been the main reason for the decoupling of the longer interest rates from the TIB. This would, consequently, suggest that the period with negative real short-term rates would be an exception, and that things returned to normal after the two 100-basis-point increases in the repo rate, which brought real overnight rates back into positive territory. This reasoning is also supported by the fact that the DTF rate reacted at least to the first of the two repo rate decreases in early 2004.

## 2.5 The Implicit Forward Rate

Figure 2.10 graphs the 90-to-180-day implicit forward rate<sup>6</sup> together with the 90-day DTF rate and the 180-day CDT rate. The implicit forward rate can be interpreted as the 90-day interest rate expected by the markets in 90 days' time.

As shown by the figure 2.10, the implicit forward rate is significantly above both the 90-day and the 180-day interest rates. If the DTF rate would decrease and the CDT 180 rate would remain constant, this would generate an increase in the forward rate.

For the forward rates not to get out of line, the steepness of the yield curve would have to increase throughout all maturities in response to the low overnight rates. However, the yield curve is already relatively steep, because the long end of the curve is kept at a high level due to the large amounts that the Government borrows at that end of the curve.

Large fiscal deficits have, indeed, led to a rapid increase in the Government debt, as illustrated by figure 2.11. Not only borrowing to finance the budget deficit puts pressure on the interest rates, but also the need to roll over maturing debt.

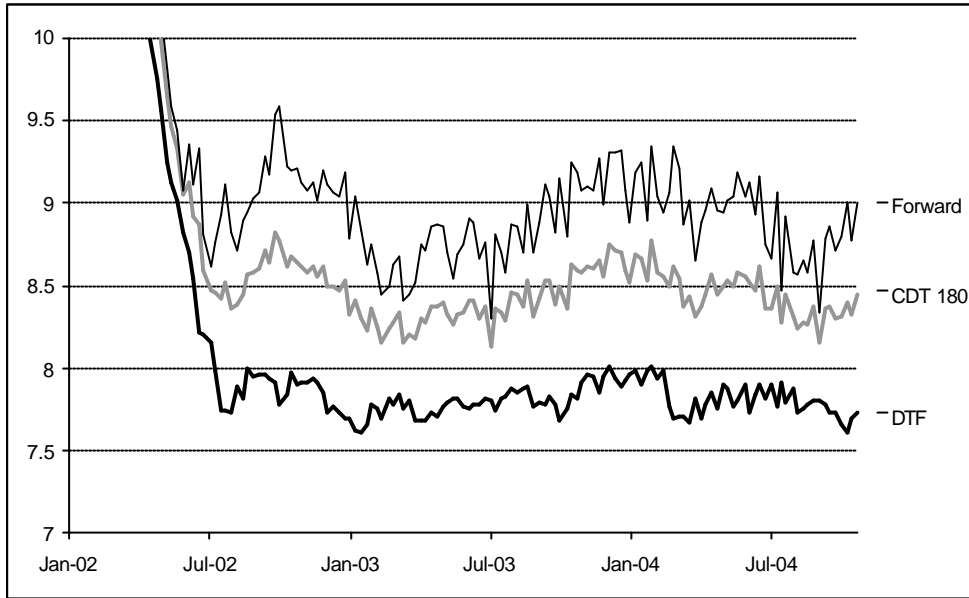
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<sup>6</sup> The 90-to-180-day implicit forward rate, *FWD*, is calculated as:

$$FWD = \frac{\left( CDT \frac{180}{360} - DTF \frac{90}{360} \right) \frac{360}{90}}{100\% + DTF \frac{90}{360}} * 100\%$$

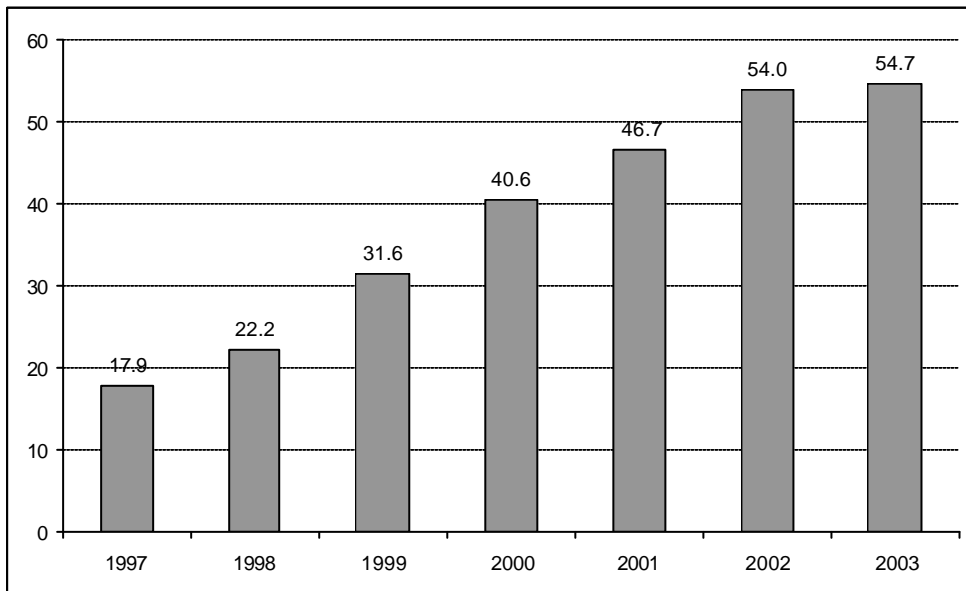
where *CDT* is the 180-day CDT rate, and *DTF* is the 90-day DTF rate, which all are expressed in percent.

**Figure 2.10.** The DTF rate, the CDT 180 rate, and the implicit 90-to-180-day forward rate, 2002-2004 (%)



Source: Banco de la República and own calculations

**Figure 2.11.** General government debt to GDP (%)



Source: Moody's Investor Service

## 2.6 The 90-day TES rate

In many countries, an important benchmark rate is the interest rate on Treasury Bills of a certain maturity. It could be envisaged that the 90-day rate paid by Colombian Treasury Bills, TES, could become an important benchmark to replace the DTF rate.

The 90-day TES rate is illustrated in figure 2.12. It is obvious from the figure that during 2002 the TES rate was significantly below the DTF rate, while since 2003 it has tended to remain above. The reason for the relatively low TES rate during 2002 was that some pension funds agreed with the Treasury to buy TES at a reduced rate, so during 2002 the TES rate cannot be regarded as a free-market rate. This practice has now ended.

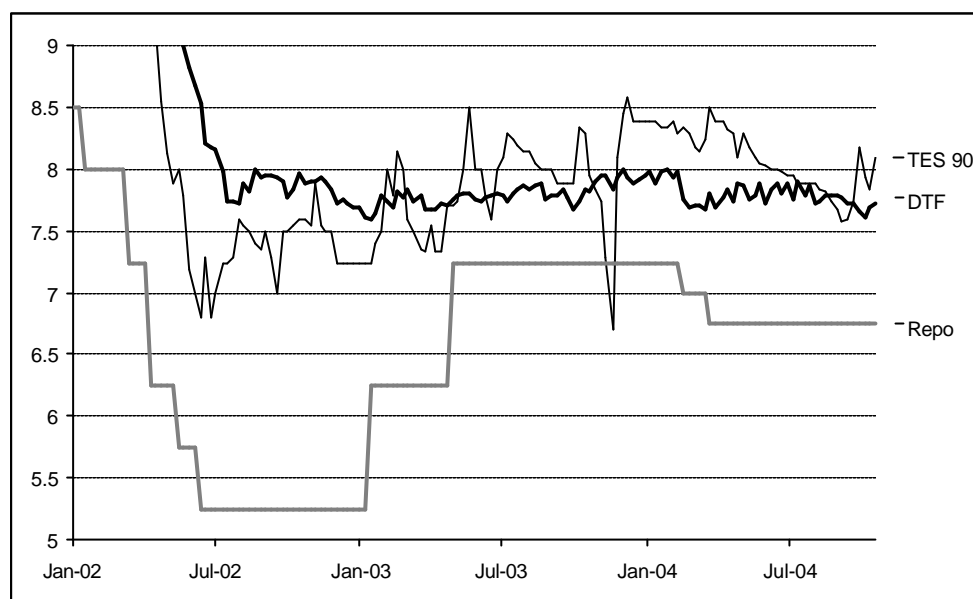
Another apparent feature of the 90-day TES rate is its high volatility relative to the DTF rate. This suggests that the TES market is relatively immature, and this volatility can be expected to fall as the market matures and the agents get better at pricing the bonds.

The 90-day TES rate can be regarded as a free market rate, since it is sold through auctions. It is, nevertheless, a primary market rate rather than a secondary market rate,<sup>7</sup> and therefore suffers from some shortcomings. The TES is, for example, sold only to a limited number of banks and financial institutions which are then reselling the bonds to clients at a margin.

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<sup>7</sup> The primary market rate relates to the rate derived from the price at the original auction of the bonds, while the secondary market rate relates to the rate derived from the prices determined by the buyers and sellers when the bond is traded.

**Figure 2.12.** The repo rate, the DTF rate, and the 90-day TES rate, 2002-2004 (%)



*Source:* Banco de la República

The 90-day TES rate might, furthermore, have reacted to the two 25-basis-point decreases in the repo rate in February and March 2004, as indicated by figure 2.12. However, due to the large volatility of the TES rate, it is not possible to show this with any statistical significance.

### 3 The Banks Might Actively Influence the DTF Rate

The banks might have an incentive to actively influence the DTF rate. First, the volatility of the DTF rate directly influences the cost of risk management. Second, the DTF rate might have a significant influence on the banks' funding cost. The cost of risk management is discussed in section 3.1, and section 3.2 compares the 90-day DTF rate with CD rates of similar maturities. Section 3.3, compares the 90-day CD rate of banks with that of other financial institutions. Changes in the banks funding cost does, however, not seem to explain the behaviour of the DTF rate, which is discussed in sections 3.4 and 3.5.

#### 3.1 Low Volatility in the DTF Rate Reduces the Cost of Risk Management

To quantify and to control for the risk of the financial system, the main regulatory body of the system, the *Superintendencia Bancaria*, has developed a methodology referred to as Value at Risk (VaR). This is a way to calculate the risk exposure of the financial institutions to changes in the prices of their financial assets, and to determine the adequate capital such institutions need to hold to protect themselves from liquidity or solvency problems.<sup>8</sup>

The VaR is defined in the following way:

$$VaR_j = \Delta VP_j = \frac{DUR_j}{1 + Y_j} VP_j \Delta i \quad (3.1)$$

where  $\Delta VP_j$  is the change in the value of position  $j$ ,  $DUR_j$  is the duration of that position,  $Y$  is the market yield of the position expressed as the annual effective interest rate,  $VP_j$  is the present value of the position (i.e. the present value of the future cash flows of the

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<sup>8</sup> This sections builds on the analysis in Hernández (2004)

position), and  $\Delta i$  is the maximum probable variation in the interest rate expressed in absolute terms.

The Superintendencia has, furthermore, identified 13 risk factors to which assets, liabilities and derivatives are exposed. The risk of changes in the DTF rate is one of the risk factors with the heaviest weight in the VaR, as shown in table 3.1.<sup>9</sup>

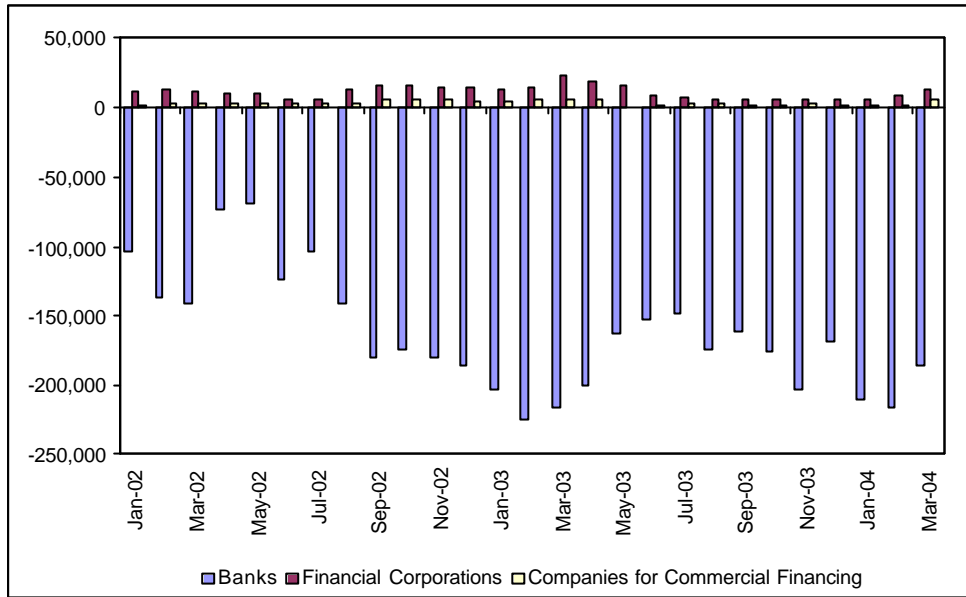
**Table 3.1.** Participation of the different risk factors in the Value at Risk, July 2004

	Participation in the VaR
DTF interest rate	16.44%
Repo interest rate	0.06%
TIB interest rate	0.02%
Real interest rate	2.99%
LIBOR	0.77%
Interest rate on consumer credit	10.92%
Money market interest rate	0.07%
TES interest rate	32.52%
UVR	15.28%
USD/COP exchange rate	1.29%
EUR/COP exchange rate	0.13%
JPY/COP exchange rate	0.01%
IGBC	19.48%

*Source:* Superintendencia Bancaria

<sup>9</sup> Only the TES interest rates and the IGBC are more important (the IGBC is the main Colombian stock market index).

**Figure 3.1:** Value at Risk for the DTF risk factor, 2002-2004



*Note:* Banco Tequendama and Confinanciera are not included.

*Source:* Superintendencia Bancaria

The methodology allows for calculating the Value at Risk,  $VaR$ , for each of these risk factors,  $f$ , in the following way:

$$VaR_f = \sum VaR_f^a - \sum VaR_f^l + \sum VaR_f^d \quad (3.2)$$

where the three sums are the sums of the Value at Risk for the asset positions,  $a$ , liability positions,  $l$ , and derivative positions,  $d$ , for a single risk factor,  $f$ .

When analysing the development of the VaR associated with the risk of changes in the DTF rate, it can be observed that the banks have maintained a negative net position in the instruments that are affected by changes in the DTF rate, as illustrated by figure 3.1. An increase in this negative net position will lead to an increase in the capital requirements of the banks. A lower volatility in the DTF rate, consequently, leads to lower capital



requirements. The banks might, therefore, have an incentive to try to minimise the volatility of the DTF rate.

Table 3.2 shows the volatility of the interest rates of CDs with different maturities. It is apparent that the DTF rate shows a low volatility in relation to the interest rates of CDs of many other maturities. This might suggest that the volatility of the DTF rate is kept artificially low. However, the volume of outstanding 90-day CDs is larger than that of any of any other maturities, which will act to bring down the volatility, and 120-day and 180-day CDs do, in fact, show lower volatility than that of 90-day CDs. From the data presented in this table, we can, therefore, *not* conclude that the volatility of the DTF rate is kept artificially low.

**Table 3.2.** Volatility of the interest rates of CDs of different maturity (July 2002-July 2004)

	Interest rate volatility	Part of total volume outstanding
Less than 30 days	0.49	5%
31-44 days	0.93	3%
45 days	0.96	0%
46-59 days	1.15	1%
60 days	0.52	2%
61-89 days	0.40	4%
90 days (DTF)	0.26	29%
91-119 days	0.28	15%
120 days	0.23	6%
121-179 days	0.29	10%
180 days	0.23	13%
181-359 days	0.29	7%
360 days	0.74	2%
More than 360 days	0.95	4%

*Source:* Superintendencia Bancaria, and Hernández (2004)

Another argument against the suggestion that banks have a clear incentive to control the DTF rate to lower their capital requirements is that the DTF volatility measure in the VaR used to calculate the capital requirements uses interest rate data from 1984 up until present. If the banks would actively keep the DTF rate constant since 2002 and onwards, this would have a very limited impact on their capital requirements.

In addition, the capital requirements in the banking system have not been a binding condition. On average, the capital requirements are currently around 9 percent of risk adjusted assets, while the banks are keeping the level of capital at around 13 percent.

### **3.2 The DTF Rate versus CD Rates of Similar Maturities**

The DTF rate is calculated as the average interest rate of all 90-day CDs issued during a particular week. CDs of other maturities, e.g. 89 days or 91 days, are not included in the DTF composite.

If we compare the 90-day DTF rate with the average interest rate of CDs of 61 to 89 days maturity as well as that of CDs of 91 to 119 days maturity, we can conclude that the two latter did indeed react to the rises in the repo rate, while the DTF rate remained more or less constant. Figure 3.2 illustrates the development of these three CD rates together with the repo rate. Between mid-July 2002 and mid-January 2003 the average DTF rate was 7.84 percent. Between mid-May 2003 and mid-November 2003 the average DTF rate was 7.81 percent. It had consequently fallen 3 basis points.<sup>10</sup> Between the same reference periods, the average 61-to-89-day CD rate had increased by 4 basis points<sup>11</sup> from 7.67 percent to 7.71 percent, and the average 91-to-119 day CD rate had increased from 8.24 percent to 8.43 percent, i.e. by 19 basis points.<sup>12</sup> At least the latter of these two rates had,

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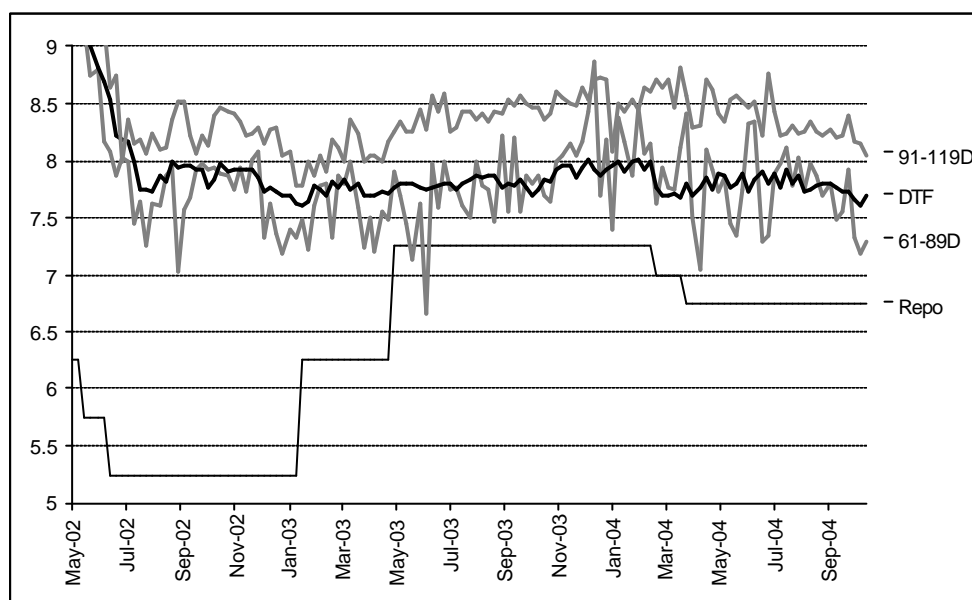
<sup>10</sup> This change is not significant at the 10-percent level.

<sup>11</sup> Not significant at the 10-percent level.

<sup>12</sup> Significant at the 1-percent level.

consequently, responded to the two 100-basis-point increases in the repo rate, while the DTF rate remained constant. All three rates did, however, react to the two 25-basis-point decreases in the repo rate in 2004. If we compare a 25-week average just before the first decrease with a 25-week average just after the second decrease, the DTF rate fell by 8 basis points, the 61-to-89-day CD rate fell by 25 basis points and the 91-to-119-day CD rate fell by 14 basis points.<sup>13</sup>

**Figure 3.2:** The repo rate, the DTF rate, the 61-89 day CD rate, and the 91-119 day CD rate (%)



Source: Banco de la República

One strategy that could be used by the banks to control the 90-day DTF rate is to offer 90-day CDs at a constant rate of interest to smaller clients while offering CDs of other maturities at more attractive rates to larger clients. The rationale behind this strategy would be that smaller clients normally have only one bank and faces a significant switching cost if considering changing to another bank. Larger clients, on the other hand,

<sup>13</sup> All these changes are significant at the 5-percent level. In the case of the DTF rate and the 91-to-119-day CD rates, the changes are significant at the 1-percent level as well.

normally have several banks and can, therefore, choose the bank that offers the best rate. Data to support or reject this theory is not readily available. However, even if the banks did not actively use this strategy, they would be assumed to offer 90-day standardised CDs to both small and large clients, while offering tailor made CDs of other maturities exclusively to large clients. So even if this strategy is actively used, it would be almost impossible to find quantitative evidence that this is the case.

### **3.3 The 90-day CD Rates of Banks and of Other Financial Institutions**

Figure 3.3 compares the 90-day CD rate of banks with that of financial corporations (FCs) and that of companies for commercial financing (CCFs).<sup>14</sup> It is obvious from the figure that the CD rate of the banks is much more stable than those of the other financial institutions.

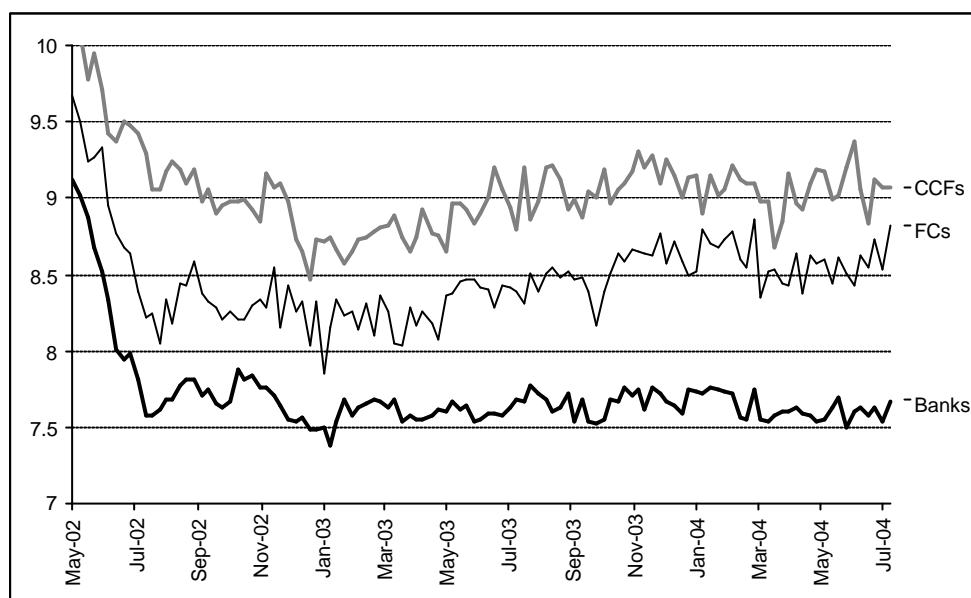
The average weekly change in the 90-day CD rate of banks between July 2002 and July 2004 was 6 basis points, while the corresponding figures for financial corporations and companies for commercial financing was 13 and 12 basis points respectively. This could, nevertheless, be expected, since the volume of CDs issued by banks is much larger than that of the other institutions. Banks do, indeed, issue 81 percent of all 90-day CDs, while FCs issue 12 percent and CCFs issue only 7 percent.<sup>15</sup>

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<sup>14</sup> In Colombia those are referred to as *corporaciones financieras* and *compañías de financiamiento comercial*.

<sup>15</sup> Hernández (2004), p. 2.

**Figure 3.3:** The 90-day CD rates for banks and other financial institutions (%)



Source: Banco de la República

However, there is a stronger relationship between the weekly overnight TIB and the weekly 90-day CD rates of financial corporations and companies for commercial financing than between the TIB and the 90-day CD rate of banks.<sup>16</sup> The correlation coefficient between the TIB and the 90-day CD rate of banks was actually negative at -0.02 for the period July 2002 to July 2004 while the correlation coefficient between the TIB and the 90-day CD rates of FCs and CCFs was 0.61 and 0.34 respectively.

The 90-day CD rates of financial corporations and of companies of commercial financing also seem to have reacted to the two 100-basis-point increases in the repo rate in January and May 2003. If we look at the two 26-week periods from 26 July 2002 to 17 January 2003 (first period) and 23 May 2003 to 17 November 2003 (second period), i.e. the same periods as we studied in the previous section, we can show that the 90-day CD rate of banks fell from an average of 7.66 percent in the first period to an average of 7.64 percent

<sup>16</sup> See Hernández (2004).

in the second period, i.e. by 2 basis points.<sup>17</sup> If we analyse the corresponding rate for FCs, this increased by 19 basis points<sup>18</sup> from 8.27 percent to 8.46 percent, and for CCFs the rate increased by 7 basis points<sup>19</sup> from 8.96 percent to 9.03 percent.

### **3.4 The Reduced Spread Cannot Be Explained by Changes in the Banks' Funding**

As discussed earlier, the repo rate was increased by 100 basis points in January 2003 and by a further 100 basis points in May that same year. The DTF rate did not react to any of these rate hikes. This implied that the spread between the two interest rates decreased by 200 basis points from around 250 basis points in the beginning of 2003 to approximately 50 basis points five months later.

One possible explanation could be that the banks funding cost had changed due to a reallocation in their liabilities, from CDs to shorter term liabilities, and that the importance of CDs as a source of financing had decreased. In such a case, inter-bank credit and repos should have increased significantly as part of the banks liabilities, while CDs should have decreased.

To investigate whether this has been the case, we start by looking at the composition of the banks' liabilities, which is illustrated by figure 3.4. We can see that CDs were the largest liability class, accounting for 26.4 percent of total assets, followed by savings accounts, accounting for some 25.5 percent. Bank credit, of which a part is overnight credit, accounted for some 6.5 percent, and repos accounted for some 5.2 percent. The volume of bank credit and repos is, consequently, small in comparison to CDs.

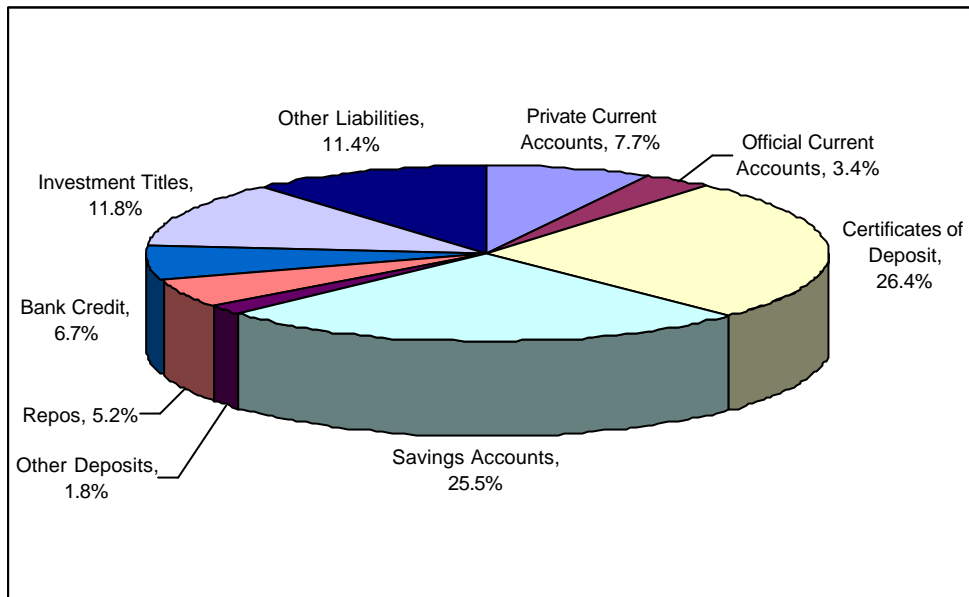
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<sup>17</sup> This change is not significant at the 15-percent level.

<sup>18</sup> Significant at the 1-percent level.

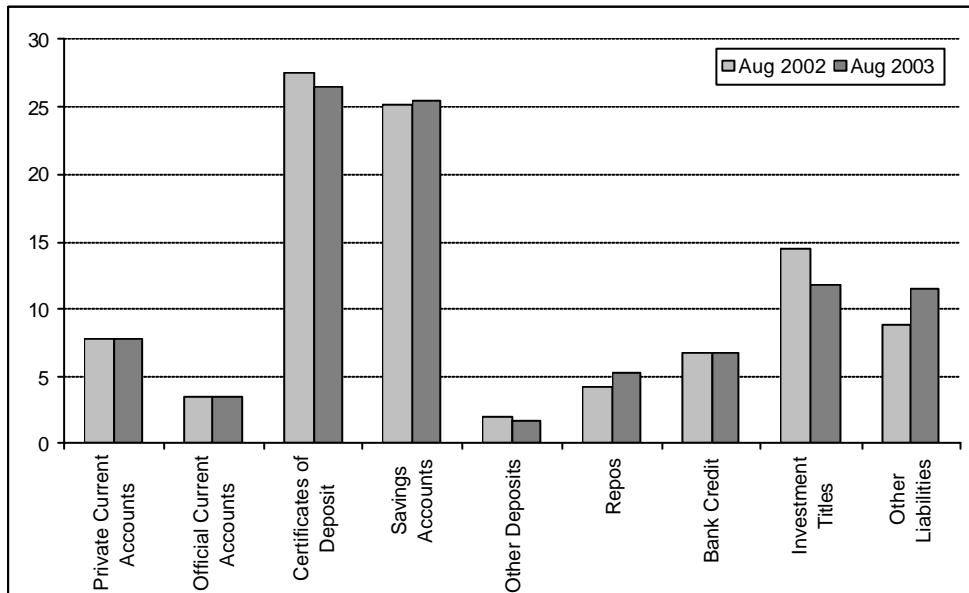
<sup>19</sup> Significant only at the 15-percent level.

**Figure 3.4:** The composition of the assets of the banks, August 2003



Source: Superintendencia Bancaria

**Figure 3.5:** Changes in the composition of the assets of the banks, August 2002 – August 2003



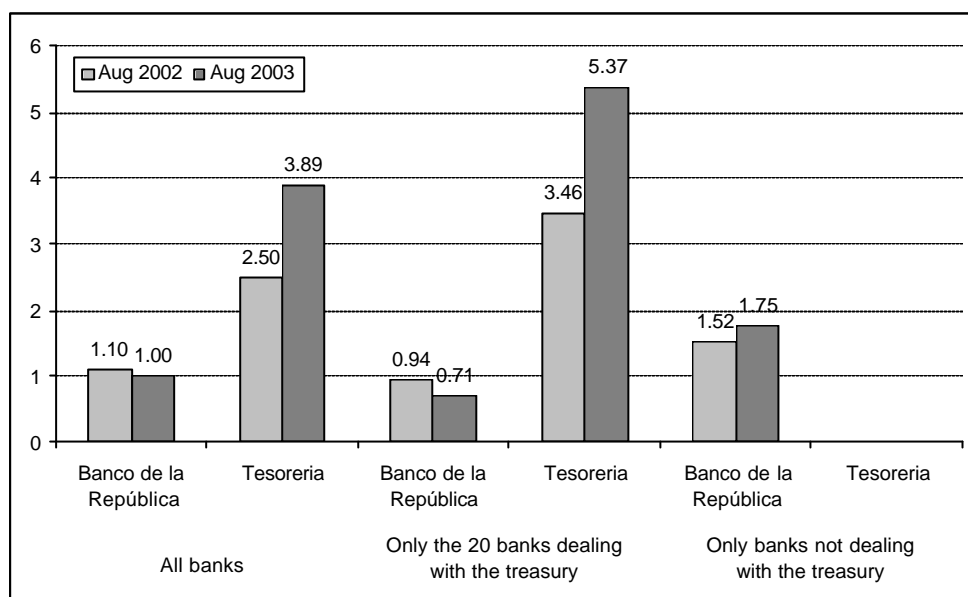
Source: Superintendencia Bancaria

Now we continue to study the changes in the composition of the banks' liabilities between August 2002 and August 2003. During this period the repo rate as well as the TIB increased by some 200 basis points while the DTF rate remained more or less constant. We have chosen to look at the changes over a full one-year period (i.e. August 2002 to August 2003) to avoid interference of seasonal changes in the liabilities. Figure 3.5 illustrates the changes in the different classes of liabilities. The volume of CDs, indeed, fell by 1.1 percentage points, while the volume of repos increased by the same amount. However, this change is too small to fully explain the large fall in the spread between the DTF rate and the repo rate. The other apparent change in the graph, the fact that investment titles fell by some 2.7 percentage points, and other liabilities increased with a similar amount, relates to a reclassification of a large account in one financial institution, Fogafin, so this did not account for any real change.

Repos are issued both by Banco de la República and by the *Tesorería*, the Treasury. The increase in repos observed earlier in figure 3.5 can, therefore be broken down in these two types of repos. As illustrated in figure 3.5 by the first two sets of bars, the increase in the banks' holdings of repos is explained by a significant increase in the volume of repos of the Treasury. However, only 20 banks deal with the Treasury, so we continue by dividing the banks into those dealing with the Treasury and those not dealing with the Treasury. If studying the banks dealing with the Treasury, it is apparent that their holdings of Treasury repos increased sharply, as expected. However, their holdings of repos with Banco de la República did not fall sharply. The banks not dealing with the treasury did, however, only increase their repo holdings marginally.

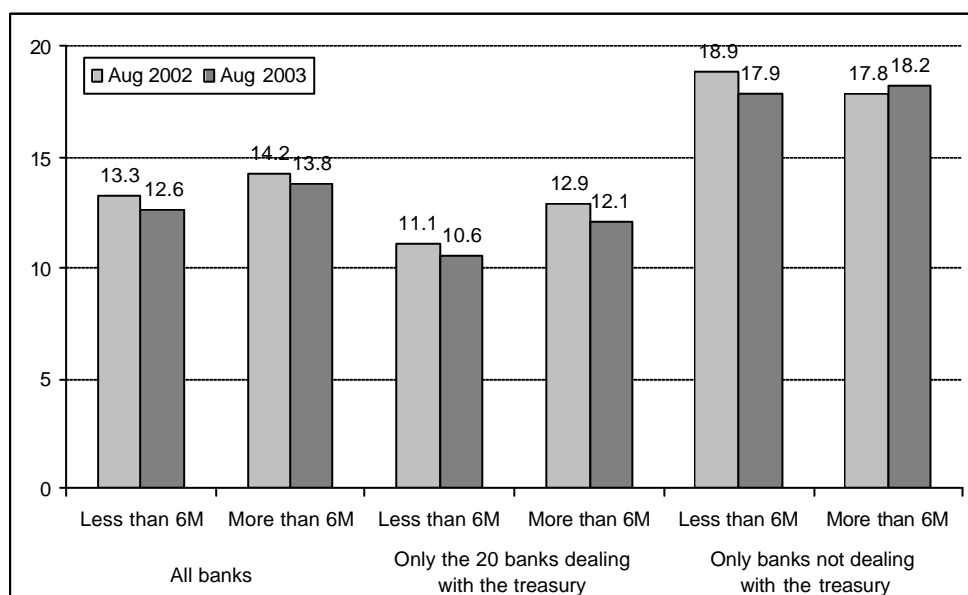


**Figure 3.6:** Changes in the banks' holdings of repos, August 2002 – August 2003



Source: Superintendencia Bancaria

**Figure 3.7:** Changes in the volume of CDs in the banking system, August 2002 – August 2003



Source: Superintendencia Bancaria

If we study the volume of CDs issued by the banks, this has decreased by 1.1 percentage points between August 2002 and August 2003, as discussed earlier. In figure 3.6, the volume of CDs has been broken down by maturity (CDs with a maturity of less than 6 months and CDs of longer maturities) as well as by banks that deal with the Treasury and those that do not. It is apparent from the figure that the total volume of short-term CDs decreased, which was also the case of longer term CDs. This pattern was only broken by banks not dealing with the treasury, which saw a slight increase in their volume of outstanding longer-term CDs.

We can consequently conclude that there was a change in the composition in the banks' liabilities between August 2002 and August 2003, but that these changes were relatively small. In particular, the changes were not large enough to explain the large fall in the spread between the overnight repo and inter-bank rates, and the DTF rate.

In a recent survey<sup>20</sup> made by the Superintendencia Bancaria, a number of banks have, nevertheless, stated that they have to some extent switched their emphasis from CDs to repos as a source of liquidity. This is due to the generous supply of liquidity from Banco de la República as well as from the Treasury. So this might, all the same, offer part of the explanation to why the DTF rate did not react to the increases in the repo rate, even if this is not clearly apparent in the data analysed in this section.

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<sup>20</sup> Not published.

### **3.5 The Overnight Rates Have Only Limited Impact on the Banks' Funding Cost**

In figure 3.4 in the previous section, we observed that repos accounted for some 5.2 percent of total liabilities in the banking system, and bank credit, of which some is overnight credit, accounted for some 6.5 percent. Even if their shares of the total liabilities of the banking system are not negligible, a change in the overnight rate has relatively limited impact on the banks' funding cost.

The transmission mechanism between the overnight rate and the 90-day DTF rate does, consequently, not work through the banks' funding cost, but rather through other mechanisms, such as arbitrage.

## **4 Other Factors that Make the DTF Rate Sticky**

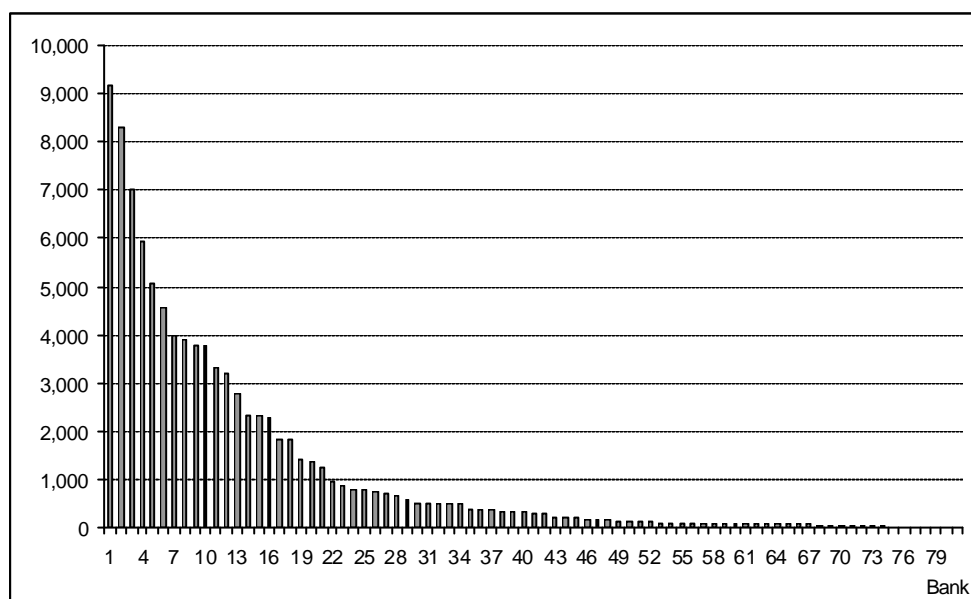
The DTF rate might, in fact, remain constant because it is sticky by its nature rather than because it is actively controlled by some market players. If the DTF rate is sticky, it might, indeed, remain constant only to change when it is significantly out of line with what it *should* be. In this chapter we will briefly discuss a number of factors that might make the DTF rate sticky. The low competition in the financial system is discussed in section 4.1; the fact that the DTF rate is not a free-market rate is discussed in section 4.2; the nature of the DTF rate as a very dominant benchmark is discussed in section 4.3; and, finally, the arbitrage mechanism between the DTF rate and other interest rates is examined in section 4.4.

### **4.1 Competition in the Financial System Is Very Low**

Competition within the financial system in Colombia is very low. This is not so much because the system is an oligopoly. Colombia has over 80 banks and financial institutions present, as illustrated by figure 4.1.

The reason for the low competition is rather that switching costs are high for the clients, with the exception of the largest clients that normally deal with several banks. The cause of the high switching cost is the problem of information present in any banking system. When a client has built up a relationship with his bank and proven that he is a good customer in the sense that he is able and willing to service his debt promptly, the bank will generally be able to offer him credit lines and loans at better terms. The bank's ability to assess a client's creditworthiness, therefore, increases over time. If the client decides to change banks, he will have to start all over again, and the process to build up a relationship with the new bank is normally both costly and time consuming. For this reason, most clients stay with their bank for a long time, and are reluctant to change to another bank, even if this would be significantly better.

**Figure 4.1:** Total assets of individual banks, August 2003 (COP billions)



*Source:* Superintendencia Bancaria

There is, nevertheless, some concentration in the Colombian financial sector. If studying the market for CDs, we can conclude that eight financial institutions are issuing more than 50 percent of all CDs.<sup>21</sup> This concentration is also apparent in figure 4.1, which graphs the total assets of the individual banks in the system.

The main explanation to the low competition in the CD market is, nevertheless, that very few clients choose to shop around, but instead prefer to invest the money with their traditional bank. Market concentration in itself is less of a problem.

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<sup>21</sup> Hernández (2004).

## **4.2 The DTF Rate Is Not a Free Market Rate**

The DTF rate is not an auction based free-market rate, but rather a rate that banks and financial institutions offer to their clients on 90-day Certificates of Deposits, i.e. a certain type of time deposits. To change this CD rate requires an explicit decision from the bank. Under such conditions, the DTF rate does not necessarily react to smaller changes in demand and supply conditions in the market, even if it will have to be adjusted if market conditions change significantly. An auction rate, on the other hand, does not suffer from this kind of shortcomings.

Most developed countries, such as the United States, use a free-market rate as a benchmark rate. In the case of the U.S., the most important benchmark is probably the one-year Treasury Bill rate, which is determined in the secondary market of traded T-Bills with a time to maturity of one year. This rate is published regularly.

The DTF rate will, by its very nature, be more sticky than a rate determined by a traded market. An auction-based rate is another type of free market rate. The 90-day TES could in this aspect act as a better benchmark than the DTF rate. However, the 90-day TES rate suffers from other shortcomings. The relatively small volumes issued of 90-day TES have lead to a large volatility of this rate, as illustrated earlier in figure 2.12. The volumes issued have, nevertheless, recently been increased, and the total outstanding volume of 90-day TES is today around half of that of outstanding 90-day CDs. The TES rate does, however, suffer from another shortcoming. As a primary market rate, it is influenced by the fact that many of the players buy TES just to sell them on to their clients for a profit. A secondary market rate that does not suffer from this bias is normally better as a benchmark. The secondary market for TES is, however, far from liquid enough to act as a source for a benchmark.

### **4.3 The DTF Is a Dominant Benchmark**

The DTF rate is, indeed, by far the most important benchmark rate in Colombia. As such an important benchmark, other rates tend to follow it. As we discussed in section 3.2 earlier, both the 61-to-89-day CD rate and the 91-to-119-day CD rate reacted to the 200-basis-point increase in the repo rate, while the DTF rate remained constant. However, the increase in these two rates were only 13 and 23 basis points respectively, and these increases could, indeed, have been expected to be larger. However, the influence that the DTF rate has as a benchmark on the other interest rates of similar maturities should be significant, and this is probably the main explanation to why we did not see a larger increase.

There is no other important benchmark rate in the short end (less than one year) of the Colombian yield curve. For this reason, the markets have a problem to correctly price short-term fixed-income assets. Even if the DTF rate is out of line, nobody really knows what the 90-day rate should be. Many players in the market, therefore, continue to price assets out of the DTF rate, even if this might be misleading. Therefore, if the DTF rate does not react to an increase in the repo rate, no other short-term rate will react significantly either.

#### 4.4 Arbitrage with Other Interest Rates Too Expensive

Generally, a change in the short-term interest rate, such as the overnight rate, should induce changes in the longer-term interest rates, since such a change should generate a change in interest-rate expectations. The longer-term interest rates,  $i_{t+n}$ , should, indeed, be an average of expected interest rates according to:<sup>22</sup>

$$i_{t+n} = \frac{i_t + i_{t+1}^e + i_{t+2}^e + \dots + i_{t+n-1}^e}{n} \quad (4.1)$$

where  $t$  is the present time,  $n$  is the time to maturity of the interest rate,  $i_{t+n}$ , and  $1, 2, \dots, n-1$  are the times to maturity of the shorter interest rates. An  $e$  indicates an expected interest rate. This relationship generates a smooth yield curve that under normal circumstances has a positive slope.<sup>23</sup> That this relationship holds is guaranteed by arbitrage.

However, the 0.4 percent transaction tax<sup>24</sup> present in Colombia simply hinders arbitrage at the short end of the yield curve. For a bank or another financial institution to fund itself with 90-day CDs and to reinvest those titles is not viable, since the transaction tax in annual terms will take 1.6 percentage points off the yield. The transactions tax has, therefore, effectively stopped all arbitrage at the short end of the curve.<sup>25</sup>

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<sup>22</sup> See also Hernández (2004).

<sup>23</sup> A yield curve can under some circumstances have a negative slope, and is then referred to as being inverted. However, a discussion on this is outside the scope of this paper. See, for example, Fabozzi (2001) for a discussion on yield curves and their properties.

<sup>24</sup> Referred to as the *cuatro por mil*.

<sup>25</sup> See also Reveis (2002a).



## 5 Conclusion

Since mid-July 2002, the 90-day DTF interest rate has remained more or less constant at around 7.8 percent. Most importantly, it did not react to two 100-basis-point increases in the overnight repo rate in January and May 2003. This is highly unsatisfactory, since it has rendered the repo rate as an important monetary policy tool rather inefficient.

This paper has studied the DTF rate and its development over time, and it has provided a number of explanations to why the DTF rate has stayed constant since July 2002. The paper has also shown that the pass-through from the overnight rate to DTF rate, that was present before July 2002, has completely vanished. Before July 2002 a change in the overnight inter-bank rate (TIB) was partially passed through to the DTF rate with a pass-through coefficient reaching 0.48 after 12 weeks. After July 2002 this coefficient only reached 0.02 after 12 weeks.

The paper has provided a number of explanations to why the DTF rate has remained constant:

- *The real overnight interest rates have been negative.* In June 2003, the repo rate was lowered to 4.25 percent, with the overnight inter-bank rate promptly following suit. With inflation running at around 7 percent, this resulted in clearly negative interest rates. The overnight rates at this time seem to have been much more out of the market than the DTF rate. Only with the two large 100-basis-point increases in the repo rate in January and May 2003 the real overnight interest rates were brought into positive territory again. In this sense, the two 100-basis-point increases might have been exceptions, and the breakdown of the transfer mechanism between the over-night rates and the longer rates might, in fact, have been temporary.
- *The implicit forward rates have been high.* Between October 2003 and September 2004 the average DTF rate was 7.83 percent, the average 180-day CD rate was 8.49 percent, which yielded an average 90-to-180-day implicit forward rate of 8.97 percent. A fall in the DTF rate without a corresponding fall in the 180-day CD rate would imply a rise in the forward rate, which would be unrealistic. A fall in the longer rates of the yield curve might not be plausible since this end of the curve is held up by large amounts of government borrowing.

- *That the banks would actively keep the DTF rate constant is not a plausible assumption.* We have shown that the volatility of the DTF rate influences the level of the minimum capital requirements that banks must fulfil. A low volatility of the DTF rate reduces such capital requirements, and this might give the banks an incentive to try to reduce this volatility. We have shown that even if the DTF rate did not react to the two 100-basis-point increases in the repo rate, CD rates of similar maturities (i.e. maturities between 61 and 89 days as well as maturities between 91 and 119 days) did, indeed, react to these changes. However, the volatility measure used to calculate the banks' capital requirements is based on the DTF rate from 1984 up until present, so keeping the DTF rate constant for the last two years or so would only have a very limited impact on the capital requirements. The capital requirements have, furthermore, not been a binding condition in the banking system. This is, therefore, not a plausible explanation to the recent behaviour of the DTF rate.
- *Competition in the financial system is low.* We have discussed the fact that competitions in the financial system is low not because it is an oligopoly – there are in fact over 80 banks and other financial institutions present in Colombia – but because switching costs are high. Low competition tend to take the pressure off the agents to actively and constantly adjust their prices, and prices in such a system will, therefore, tend to be more sticky.
- *The DTF rate is not a free market rate.* The DTF rate is not an auction-based free-market rate, but rather a deposit rate offered by banks to their clients on their 90-day CDs. To change this rate normally requires an explicit decision from the bank, and the rate does, therefore, not necessarily react to smaller changes in market conditions.
- *The DTF rate is a dominant benchmark.* The DTF rate is by far the most important benchmark rate in Colombia, and as such other interest rates tend to follow it. Even if CD rates of similar maturities to the DTF rate reacted to the rises in the repo rate, these reactions were relatively modest (the reaction of the rates of CDs of a maturity of between 61 and 89 days to the two 100-basis-point increases in the repo rate was only 13 basis points, and that of CDs of a maturity between 91 and 119 days was only 23 basis points).
- *Banks' funding cost has not influenced the DTF rate.* We have shown that the structure of the banks' liabilities did not change significantly during the 12-month period (August 2002 to August 2003), which included the two 100-basis-point increases in the repo rate. Banks do, nevertheless, claim that they rely less on CDs as a source of funding due to the generous supply of liquidity in the form of overnight repos from Banco de la República as well as from the Treasury, so this might still offer a part of the explanation to why the DTF rate did not react to the hikes in the repo rate.

The low competition in the financial system, the fact that the DTF rate is not a free-market rate and that it is a dominant benchmark are nothing new. These structural characteristics were present long before the significant change in the behaviour of the DTF rate in mid-2002. However, the economic environment is very different today from some years ago. Colombia is today experiencing a low-inflation environment with low nominal interest rates. From 1998 to 2003, consumer-price inflation fell from 19.4 percent to 7.1 percent, and interest rates followed suit, with the DTF rate falling from 32.6 percent to 7.8 percent. While the inherent stickiness of the DTF rate did not matter much before when interest rates were high and very volatile, it has come to play a much more important part since mid-2002, in the current low-inflation environment.

A question is then what Colombia should do about the situation. In the long run, the Country should aim to define another benchmark. This should ideally be based on secondary market prices of traded TES at a certain maturity (e.g. 90 days or 1 year). This does, however, require an active creation of such a market and a commitment by the Government to issue enough TES at this maturity to keep the market liquid.

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