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DETERMINATION OF SWAP SPREADS: AN EMPIRICAL ANALYSIS

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ABSTRACT

This paper empirically examines the key determinants that influence the behavior of changes in swap spreads over time for the period June 1984 through September 1991. Our results show that contemporaneous as well as leading changes in variables such as the corporate default spreads, the level of Treasury rates, the slope of the Treasury yield curve, the interest rate volatility measure, and eurodollar rates have differential effects on the changes in swap spreads over time for interest rate swap contracts with different maturities.

1. Introduction

Since its inception in the early 80's, the interest rate swap contract has become one of the most popular corporate financing tools and its market has grown significantly. The outstanding notional principal was more than $4.6 trillion[1] by the end of 1990. Most of these swaps (more than two-thirds) represent the simple plain vanilla types of fixed/floating interest rate swaps denominated in a single currency.

Interest rate swaps have evolved from their original role for financial arbitrage to a general risk management tool (see the work of Smith, Smithson, and Wakeman (1986, 1988) and Smith, Smithson, and Wilford (1990).

Several theoretical papers have been written on the motivation for rational counterparties to enter into swap agreements. For example, based upon the theory of comparative advantages, Bicksler and Chen (1986) argue that swap counterparties can benefit from a fixed/floating interest rate swap if the lower credit party pays a fixed-rate and the higher credit party pays a floating rate in the swap contract. Turnbull (1987); however, argues that interest rate swaps are a zero sum game and both parties can not simultaneously benefit from the swap contract. Using differential expectations arguments; Arak, Estrella, Goodman, and Silver (1988) show that swaps are not redundant securities. They argue that a firm with a better expectation than the market of its future credit risk will have the economic incentive to borrow at a short-term rate and swap into the fixed-rate. This argument has recently been better articulated and extended by Titman (1992).

With one exception of the most recent paper by Sun, Sundaresan and Wang (1993), there has been no empirical investigation of the pricing behavior of interest rate swaps due mainly to the lack of comprehensive data on interest rate swaps. Sun, Sundaresan,

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[1] This figure was estimated by the International Swap Dealers Association (ISDA), see Swaps Monitor, vol. 6, No. 1, October 19, 1992.

and Wang (1993) examine the effect of dealers' credit ratings on swap quotations and on bid-offer spreads. Using two dealers, one single A rated and one AAA rated, their major finding is that the AAA offer rates are significantly higher than the single A offer rates while the AAA bid rates are significantly lower than single A bid rates. Evans and Bales (1991) have shown graphically some patterns of swap spreads of both short-dated and long-dated interest rate swaps for the period between late 1984 and mid 1987. Furthermore, Litzenberger (1992) in his AFA presidential address paper provides some interesting observations on the behavior of swaps.

The purpose of our study is to use statistical analysis to investigate the behavior of changes in swap spreads over time for the period June 1984 through September 1991. The major findings in this study are as follows:

1). For the long-dated swap spreads (5, 7, and 10 years) changes are explained by contemporaneous changes in the AA Minus AAA corporate spread. The A Minus AA as well as the BBB Minus A corporate spread do not have explanatory power once the AA Minus AAA spread is taken into account.

2). For the five-year swap spread, changes are additionally explained by changes in the treasury rate level and by changes in a term structure variable. This is not the case for any other swap spread.

3). For the 3 and 5-year swap spreads, changes in an interest rate volatility measure explains changes in swap spreads even after changes in default spreads are taken into account. This is not true for the 2, 7, and 10-year swap spread cases.

4). Changes in swap spreads can sometimes be explained by changes in future variables such as the single A Minus AA corporate spread. However, changes in swap spreads are never explained by changes in lagged variables.

5). Short-dated swap spreads are related, as expected, to eurodollar rates and not to treasuries and long-dated corporate default spreads.

2. Determinants of Swap Spreads and Empirical Hypotheses

Interest rate swap contracts are flexible and efficient alternatives to the traditional long-term and short-term debt instruments. Thus, factors influencing fixed rate and floating rate borrowing in the traditional debt markets are the primary determinants of swap spreads. Changes in the long-term swap spreads are likely to move over time within the range of corporate default spreads as suggested by financial arbitrage arguments. However, additional factors such as the level and shape of the Treasury yield curve, and the risk and expectation of future interest rates that influence the borrowing costs in the traditional debt markets, will also affect swap spreads. Short-term swap spreads; however, are determined largely by the Eurodollar futures market. In addition the cost of hedging swaps could also be important in determining swap spreads. In the following we shall first describe the bounds for swap spreads and then proceed to discuss our empirical hypotheses.

A. Bounds for Swap Spreads

In the following we will describe a plain vanilla fixed/floating interest rate swap and establish the bounds for swap spreads.

In a plain vanilla interest rate swap, one of the counterparties of the swap promises to pay a stipulated amount of interest calculated at a fixed rate of the "notional principal" and the other counterparty promises to pay a floating amount of interest on the notional principal calculated according to a floating-rate index, such as LIBOR. Both counterparties of a fixed/floating interest rate swap can create fixed-rate as well as floating-rate debt of their own. If a firm chooses to borrow at a long-term fixed rate, its cost stream can be expressed as,

$$R_{Li} = R_l + D_{li}, \quad i = 1, 2. \tag{1}$$

where R_l is the long-term default-free rate of interest (e.g., yields on U.S. Treasury Bonds) and D_{li} is the default premium for the ith firm. The cost stream is contractually fixed for all periods until the maturity date of the debt.

If a firm chooses to borrow at a short-term rate, rolling over for a desired number of periods, its cost stream will be

$$r_{ti} = r_{ft} + d_{ti}, \quad i = 1, 2. \tag{2}$$

where r_{ti} is the short-term risk-free rate of interest and d_{ti} is the default spread for the ith firm for each period. The interest costs for the short-term borrowers for each period are determined at the beginning of that period.

A fixed/floating interest rate swap allows the two counterparties to change the maturity structure of their debt. Let us assume that in a fixed/floating interest rate swap firm 1 agrees to pay to firm 2 the interest payments based upon a fixed rate which is equal to $(R_l + SS)$, where SS is commonly termed the swap spread, in exchange for receiving the interest payments indexed to a short-term rate of interest (r_{ft}).

The net effective cost of the synthetic fixed-rate debt to firm 1 can be derived as follows:

$$\begin{aligned} R_{S1} &= r_{ft} + d_{t1} + (R_l + SS) - r_{ft} \\ &= R_l + SS + d_{t1} \end{aligned} \tag{3}$$

A simple arbitrage argument will show that firm 1 will not enter into the swap agreement unless the cost of the synthetic fixed-rate debt is less than that of the direct fixed-rate debt. Thus we have the following inequality showing the condition for firm 1 to enter into a fixed/floating interest rate swap:

$$R_l + SS + d_{t1} < R_l + D_{l1},$$
$$\text{or} \quad SS < D_{l1} - d_{t1}. \tag{4}$$

The net effective cost of the synthetic floating-rate debt to firm 2 can be derived as follows:

$$\begin{aligned} r_{s2} &= R_l + D_{l2} + r_{ft} - (R_l + SS) \\ &= D_{l2} + r_{ft} - SS \end{aligned} \tag{5}$$

Similarly, firm 2 will not enter into a fixed/floating interest rate swap agreement unless the cost of its synthetic floating-rate debt is less than that of its direct floating-rate debt. Thus, we have the following inequality showing the condition for firm 2 to enter into a fixed/floating interest rate swap:

$$D_{l2} + r_{ft} - SS < r_{ft} + d_{t2},$$
$$\text{or,} \quad D_{l2} - d_{t2} < SS \tag{6}$$

From the results in (4) and (6), we have the following boundary conditions for the swap spread:

$$D_{l2} - d_{t2} < SS < D_{l1} - d_{t1}. \tag{7}$$

Thus, we can see that the bounds for swap spreads are determined by the counterparties' borrowing costs in alternative fixed- and floating-rate markets. The lower bound for the swap spread is the difference between firm 2's default premiums in the direct fixed-rate and floating-rate markets. The upper bound for the swap spread is the difference between firm 1's default premiums in the direct fixed-rate and floating-rate markets.

Rearranging the inequalities in (7), we have the following

$$d_{t1} - d_{t2} < SS < D_{l1} - D_{l2} \qquad (8)$$

In other words, the lower bound for the swap spread is the difference between the two counterparties' default spreads in the floating-rate market; while the upper bound for the swap spread is the difference between their default premiums in the fixed-rate market. It should be noted from the boundary conditions for swap spreads shown above that the existence of a quality spread differential between the floating-rate and the fixed-rate markets is a necessary condition for a positive swap spread in a fixed/floating interest rate swap. As typically observed, the quality spread in the floating-rate market is less than the quality spread in the fixed-rate market. Furthermore, the boundary conditions suggest that an equilibrium swap spread should be set such that the lower-rated firm (firm 1) has an incentive to use the swap market to create a synthetic fixed-rate debt that is cheaper than its direct fixed-rate debt.

Knowing the bounds for swap spreads is important and useful. However, in order to investigate the predictability power of the major determinants of changes in swap spreads, our empirical analyses will focus on examining the changes in swap spreads over time rather than the swap spread itself.

B. Empirical Hypotheses

Interest rate swaps allow firms with different credit ratings to synthetically create fixed-rate and floating-rate debt and hence they are priced in relation to the existing instruments in the traditional money and capital markets. Thus, we might expect that the key determinants of swap spreads are the same as those that influence the prices of the instruments in the fixed-rate and floating-rate markets. The long-dated interest rate swaps are usually used for creating synthetic fixed-rate and floating-rate corporate borrowing, thus we expect corporate spreads to have close relations with the swap spreads. The short-dated interest rate swaps perform essentially the same function as Eurodollar futures contracts, thus we expect that the swap spreads are influenced by the Eurodollar rates. Furthermore, the interest rate volatility, which is closely linked with the business cycles in the economy, is another important factor that influences the yield spreads in financial markets. Thus, we have included the interest rate volatility as one of the key determinants in explaining changes in interest rate swap spreads. The following specific hypotheses are formulated and tested using the regression analysis:

Hypothesis 1: The variations in the levels of swap spreads are directly related with that in the corporate bond spreads. More specifically, long-dated swap spreads fluctuate over time within the bounds between the AAA and A corporate spreads.

Hypothesis 2: Changes in swap spreads are directly related with the changes in corporate spreads and interest rate volatility. [This is the main hypothesis of our study. We have used contemporaneous, leading and lagging regressions for the analysis.]

Hypothesis 3: Changes in swap spreads are influenced by the level and the shape of the U.S. Treasury yield curve. For example, the level could be a proxy for hedging costs which then affects the spread dealers are willing to consider.

Hypothesis 4: Changes in short-dated swap spreads are directly related with the changes in the Eurodollar rates.

3. Data and Empirical Methodology

The data used in this paper come from three different sources. Swap spreads come from three large dealers from three different time periods, and represent daily quotes. Constant maturity treasury rates and eurodollar rates come from the Atlanta Federal Reserve, and also represent daily quotes. We are primarily interested in the rates on every fourth Wednesday.[2] If data are not available for all needed rates for a particular Wednesday, we go ahead to Thursday, and if there are no data for Thursday, we go back to Tuesday. Swap spreads are available for 2, 3, 5, 7, and 10 years (i.e.; SS_t^2= The 2-year swap spread at time t). The treasury rates we use are 3, 6, and 9 months and 1, 2, 3, 5, 7 and 10 years (i.e.; TR_t^{6M} = the 6-month treasury rate a time t). The eurodollar rates we use are 1, 3, 6, 9 months and 1 year (i.e.; ER_t^{6M} = the 6-month eurodollar rate at time t).

For corporate rates we use weekly averages from Standard & Poors. The rates are for industrial bonds, representing a composite of 7 to 10-year bonds. We have available AAA, AA, A, and BBB rates as well as a 7 to 10-year composite treasury rate. Since these are weekly averages, they do not match swap rates perfectly. However, we treat the weekly average for a particular week as if it is the point estimate for Wednesday. Since we are focusing on every fourth Wednesday, we believe that using the averages for the week will not be too detrimental.

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[2] The middle of the week is chosen in order to avoid anomalies associated with the weekend effect.

The final variable used represents interest rate volatility. We calculate the volatility of the term premium of a 5-year to 10-year composite treasury return over a 6-month to 1 year composite return both from the Fama/Bliss files. We use an ARCH(12) process to describe volatility.

The period we use for all data is from Thursday, June 14, 1984 until Wednesday, September 4, 1991. Thus, since we use four-week intervals, we have 93 data points and thus 92 changes in these variables. We use primarily five regressions in our analysis. Each one is done in a step-wise fashion in order to see if variables that are initially significant become insignificant once other variables are added. We, however, show only the results for the full regression which includes all the variables. The regressions are as follows:

$$\Delta SS_t^M = a + B_0\,\Delta TR_t^M + B_1\,\Delta TS1_t^M + B_2\,\Delta MDS_t^{AAA} + B_3\,\Delta MDS_t^{AA} \qquad (9)$$
$$B_4\,\Delta MDS_t^{A} + B_5\,\Delta MDS_t^{BBB} + B_6\,\Delta V + \varepsilon$$

In this regression we are interested in what contemporaneous variables help us explain changes in swap spreads. It is done for M = 2, 3, 5, 7, and 10 years.

$\Delta SS_t^M = SS_t^M - SS_{t-1}^M$: (a).

SS_t^M = M Maturity swap spread at time t.

$\Delta TR_t^M = TR_t^M - TR_{t-1}^M$: (b).

TR_t^M = M Maturity treasury rate at time t.

$\Delta TS1_t^M = \Delta\left[TR_t^M - TR_t^{3M}\right]$ (c).

TR_t^{3M} = 3 month treasury rate at time t.

$\Delta MDS_t^{AAA} = MDS_t^{AAA} - MDS_{t-1}^{AAA}$: (d).

MDS_t^{AAA} = AAA corporate rate at time t minus composite (7-10 year) treasury rate at time t.

$\Delta MDS_t^{AA} = MDS_t^{AA} - MDS_{t-1}^{AA}$: (e).

MDS_t^{AA} = AA corporate rate at time t minus AAA corporate rate at time t.

$\Delta MDS_t^{A} = MDS_t^{A} - MDS_{t-1}^{A}$: (f).

MDS_t^{A} = Single A corporate rate at time t minus AA corporate rate at time t.

$\Delta MDS_t^{BBB} = MDS_t^{BBB} - MDS_{t-1}^{BBB}$: (g).

MDS_t^{BBB} = BBB corporate rate at time t minus single A corporate rate at time t.

$\Delta V_t = V_t - V_{t-1}$ (h).

V_t = volatility of term structure premium

$$\Delta SS_t^M = a + B_o\,\Delta TR_{t-1}^M + B_1\,\Delta TS1_{t-1}^M + B_2\,\Delta MDS_{t-1}^{AAA} + B_3\,\Delta MDS_{t-1}^{AA} + B_4\,\Delta MDS_{t-1}^{A} + B_5\,\Delta MDS_{t-1}^{BBB} + B_6\,\Delta V_{t-1} + \varepsilon \tag{10}$$

This is the same as regression (1) except we are looking at past (lag of one period) instead of contemporaneous variables in order to explain swap spreads.

$$\Delta SS_t^M = a + B_o\,\Delta TR_{t+1}^M + B_1\,\Delta TS1_{t+1}^M + B_2\,\Delta MDS_{t+1}^{AAA} + B_3\,\Delta MDS_{t+1}^{AA} + B_4\,\Delta MDS_{t+1}^{A} + B_5\,\Delta MDS_{t+1}^{BBB} + B_6\,\Delta V_{t+1} + \varepsilon \tag{11}$$

This is the same as regressions (1) and (2) except we are looking at future (lead of one period) variables instead of contemporaneous or past variables to explain swap spreads. The idea here is that swap spreads tend to lead other variables, perhaps due to liquidity in swaps, and thus the future independent variables can be thought of as expected future variables when markets have perfect foresight.

$$\Delta SS_t^M = a + B_0\ \Delta ER_t^M + B_1\,\Delta TR_t^M + B_2\,\Delta MDS_t^{AAA} + B_3\,\Delta MDS_t^{AA} + B_4\,\Delta MDS_t^{A} + B_5\,\Delta MDS_t^{BBB} + \varepsilon \tag{12}$$

in which ER_t^M = The Eurodollar rate for maturity M.

This regression is only run for M = 2, 3 months. Since short dated swaps are believed to move mostly with euromarkets we would like to see if eurodollar rates are more important than treasury rates.

$$\Delta SS_t^M = a + B_0\,\Delta ER_t^M + B_1\,\Delta ETS_t^1 + B_2\,\Delta MDS_t^{AAA} + B_3\,\Delta MDS_t^{AA} + B_4\,\Delta MDS_t^{A} + B_5\,\Delta MDS_t^{BBB} + \varepsilon \tag{13}$$

This is similar to both regressions (1) and (4) in which

$$\Delta ETS_t^1 = ETS_t^1 - ETS_{t-1}^1 :$$
$$ETS_t^1 = ER_t^{1\,\text{year}} - ER_t^{1\,\text{month}}$$

4. Results

Before focusing on the regression results we focus on some qualitative evidence. As stated in Litzenberger (1992) and Evans and Bales (1991) swap spreads do not seem to be as cyclical as A-rated corporate spreads. As shown in Figures 1 through 3 this is clearly true for the 5, 7, and 10-year swap spreads. However, if we focus on the volatility of swap rates versus corporate rates we find a different story. Now, as shown in Figures 4 through 6, swap rates appear to be slightly more volatile than corporate rates. This reversal is clear evidence that we need to do a regression analysis to determine if default spreads drive swap spreads and if any, which ones drive changes in swap spreads.

Let us give an example of how we might achieve those qualitative results. Suppose first that swap spreads compete with corporate spreads. Thus there should be some relationship between swap spreads and corporate spreads. Second, let us suppose that treasury rates are more volatile than swap rates which are in turn more volatile than single-A corporate rates, all due to liquidity reasons. Then, it is quite possible for swap spreads to be less volatile then A rated corporate spreads while swap rates are more volatile than corporate rates. Again, we need to statistically determine what variables help explain changes in swap spreads. For example, does the spread of Single A over AA corporates help explain changes in swap spreads?

Before asking specific questions about short and long-term swap spreads, we first give a general view of our ability to explain changes in swap spreads with contemporaneous, lagged, and leading variables. Table 1 contains the results for regression 1, which shows how well contemporaneous variables explain changes in swap spreads. Our adjusted R^2s range from a low of .0214 for the 2-year swap spread to a high of .188 for the 5-year swap spread. The adjusted R^2's for the 7 and 10-year swap spreads are .090 and .139 respectively. We certainly expect the adjusted R^2 to be low for the 2-year and 3 swap spreads since as mentioned the 2 and 3-year swaps compete in the euromarkets and also because our default spreads are based on 7 to 10-year composites. We, however, are surprised that the R^2 is highest for the 5-year swap spread.[3]

Our lagged and leading variables do not explain changes in swap spreads nearly as well as do our contemporaneous variables. Table 2 provides the results for regression 2, in which lagged variables are used to explain changes in swap spreads. The highest adjusted R^2 is .053 for the seven-year case. Other adjusted R^2's are all less than .03. With the leading variables, we are able to do slightly better. As shown in Table 3, for regression 3 we are able to achieve an R^2 of .13 for the 3-year swap spread case.

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[3] A possible explanation is that the 5-year swap for much of our period was the most actively traded swap.

A. Long Term Swap Spreads: Explanation By Contemporaneous Variables

(1). Default Spreads

We are clearly interested in whether changes in corporate default spreads explain changes in interest rate swap spreads. We measure default spreads in terms of marginal spreads; AAA Minus treasuries, AA Minus AAA, single A Minus AA, and finally BBB Minus A. From the regressions in Table 1 (regression 1), we can see how changes in each of these independent variables explains changes in swap spreads.[4] We might expect from qualitative results such as Evans and Bales (1991) for the spread of the single A over the AA to be the key variable, since they find that the swap rate stays most of the time between the AA and single A corporate rates. We find that the spread of AA over AAA is the only marginal default spread which consistently has explanatory power for the 5, 7, and 10-year swap spread cases. This may be considered consistent with Evans and Bales (1991) if we assume that Standard & Poors" is slow to downgrade corporate bonds and thus the AA composite rate might be more indicative of the true single A composite rate. However, this effect would be most significant only in bad economic times.

For the 2 and 3-year swap spreads none of the marginal default spreads have significant coefficients. This does not surprise us for two reasons. First, and more importantly, the 2 and 3-year swap rates as discussed in Evans and Bales (1991) tend to compete in the euromarkets. Secondly, our default spreads are based on a 7-10 year composite. If we believe the 2 and 3-year default spreads to not be that much related to the 7 and 10-year default spreads, then we would not expect our default spreads to have significant coefficients for the 2 and 3-year cases.

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[4] When we look at changes in swap spreads on a weekly basis, we are unable to achieve significant results. There is too much noise in weekly swap quotes.

It is interesting to note that coefficients on the AA minus AAA spread for the 5, 7 and 10-year swap spreads are significantly less than one (Table 1). Thus, the swap spreads move less than one to one with this default spread. This is similar to qualitative results comparing swap spreads to single A default spreads.

Once this AAA Minus AA default spread is taken into account, no other default spreads matter statistically, except for one case. For changes in the 7-year swap spread, the coefficient is significant for the AAA Minus treasuries variable.

(2). Treasury Level

In a previous draft we reported that the changes in the treasury rate level explains changes in swap spreads even after changes in default spreads are taken into account. The intuition behind this result is that treasury levels proxy for the cost of hedging. Repo rates can also be used, but we do not have access to good repo data. This result was based on only the 1984 to 1988 time period. As we extend the results to late 1991, we find that the treasury level no longer explains changes in swap spreads. There is; however, one exception. Treasury rates help explain changes in 5-year swap spreads; over and above default spreads. This; however, may be explained by two reasons. First, the fact that our default spreads are based on a 7 to 10-year composite and thus the treasury level is partially proxying for the true 5-year default spreads which in turn are not fully proxied by the 7 to 10-year composite default spreads. Second, five-year swaps are the most actively traded and thus the most related to hedging costs.

(3). Term Structure

The term structure variable does not come in as a significant variable except for the case of five-year swap spreads. We even try three different term structure variables in which for each case we subtract a short rate from the analogous long rate of the swap. The example presented in Table 1 is for a six-month short rate, but we also use a 3-month and 2-year short rate. The results are basically the same. This result may be explained, just as the treasury level result for the 5-year swap spread is explained, by the term structure proxying for the true 5-year default spread.

(4). Volatility

The change in volatility comes in as a significant variable in both the 3 and 5-year swap spread cases, but not in the 7 and 10-year swap spread cases. There are two possible explanations besides the explanation that volatility matters over and above default spreads for the 5 and 7-year swap spread cases. Firstly, the volatility variable is already taken into account in the 7 and 10-year swap spread cases through the default spread variables which are based on a 7 to 10-year composite. This composite might not fully reflect the true 5-year default spreads and thus volatility could be proxying for the 5-year default spreads. Secondly, the volatilities we use are for the return premium of a 5 to 10-year treasury composite over a 6-month to 1-year treasury composite. If the composite series of the long rate is dominated by the five-year notes, we would expect our volatility number to be more appropriate for the 5-year swap spread. However, we clearly would expect the change in the 5-year rate volatility to be related to changes in the 7 and 10-year rate volatilities.

B. Long Term Swaps: Explanation by Past Variables

Table 2 contains the results for explaining swap spreads with past variables (The same variables used in regression 1). Not one variable has a significant coefficient for any of the regressions. Also, the highest adjusted R^2 is a mere .05 (for the 7-year swap spread case).

C. Long Term Swaps: Explanation by Leading Variables

Unlike the lagged variable case, there are some leading variables which are significant. Furthermore, when the analogous contemporaneous variables are added to the regressions, these variables remain significant (Table 3). Changes in the future single A Minus AA corporate spread helps explain changes in current swap spreads in the case of the 7-year swap spread. For the 3-year swap spread, its current changes can be explained by three significant variables; future changes in the term structure, in the AAA Minus treasury spread, and the AA Minus AAA default spread. The highest adjusted R^2 is .13 for the 3-year swap spread case.

If we split the period in half, we find that during the early years when the swap market was first developing, future changes in the single A Minus AA spread as well as the BBB Minus A spread help explain current changes both in the 7 and 10-year swap spreads.

D. Explaining Short Swap Spreads

As discussed in Evans and Bales (1991), short dated swap spreads tend to follow the euromarkets. We provide further evidence of this in Tables 4 and 5. Table 5 can be directly compared to Table 1. The regression presented in Table 5 (regression 5) differs from the regression presented in Table 1 (regression 1) by replacing two independent variables. First, instead of using the change in the treasury rate, in regression 5 we use the change in the one-year eurorate. Second, instead of using a term structure variable based on treasuries, we use a term structure based on eurorates. Also, the volatility variable is left out. For changes in the two-year swap spread we only get an adjusted R^2 of .036 and there are no significant variables. For the 3-year swap spread, the adjusted R^2 is .214 and there are two significant variables. The term structure variable and the AA Minus AAA default spread are significant.[5] The significance of the default spread variable; however, should not be taken seriously because it is no longer significant once we include the volatility variable.

In Table 4 (regression 4), we analyze the effect of using both the changes in the treasury rate and changes in the eurodollar rate. For changes in the two-year swap spread,

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[5] If we split the time period in half, we find that for the early years these variables are significant as well for changes in the 2-year swap spread.

the eurodollar variable is significant while the treasury variable is not. The adjusted R^2 is .059. For changes in the three-year swap spread, both the eurodollar rate and the treasury rate are significant. However, once the volatility variable is added, only the eurodollar rate remains significant. Thus, eurodollar rates are important relative to treasury rates, in explaining changes in short-dated swap spreads.

5. Conclusions:

We have shown that contemporaneous changes in a few key variables explain changes in interest rate swap spreads. The AA minus AAA corporate spread is the major factor explaining changes in swap spreads for the 5-, 7-, and 10-year maturity contracts. Our volatility measure helps explain swap spreads for only the 3- and 5-year maturity contracts. The empirical results also show that both the level of the Treasury and the slope of the Treasury yield curve help explain changes in the swap spreads for the 5-year contracts. This could be due to the fact that the 5-year swap contracts are the most actively traded ones, and thus swap dealers usually take positions and hedge them.

Our results also show that changes in Eurodollar rates play the major role in explaining swap spreads for short-term swaps (maturities with two and three years). Finally, expectations of future variables do explain in some cases contemporaneous changes in swap spreads.

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Figure 1

5 Yr Swap Spread versus A Ind Spread

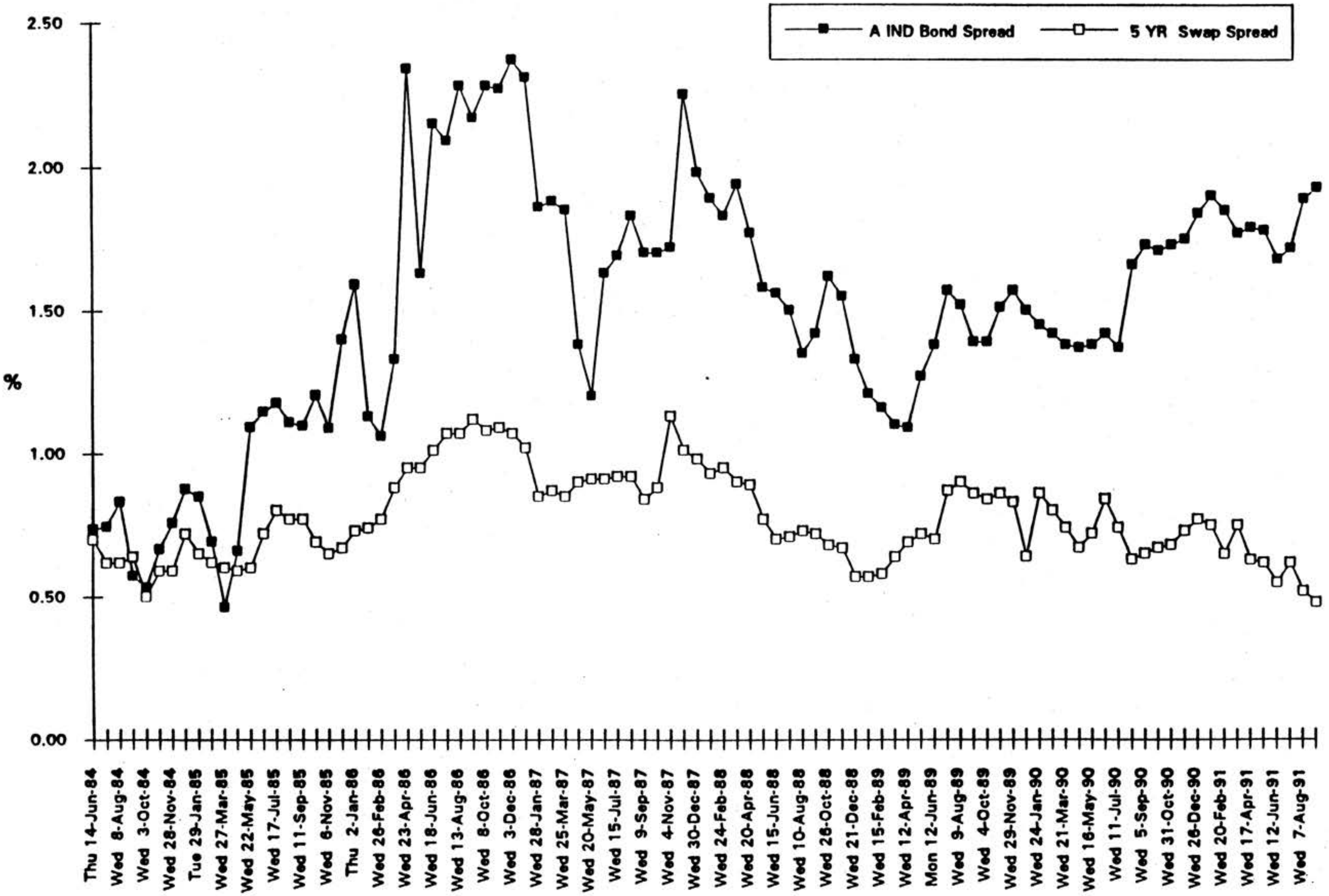

Figure 2

7 Yr Swap Spread versus A Ind Spread

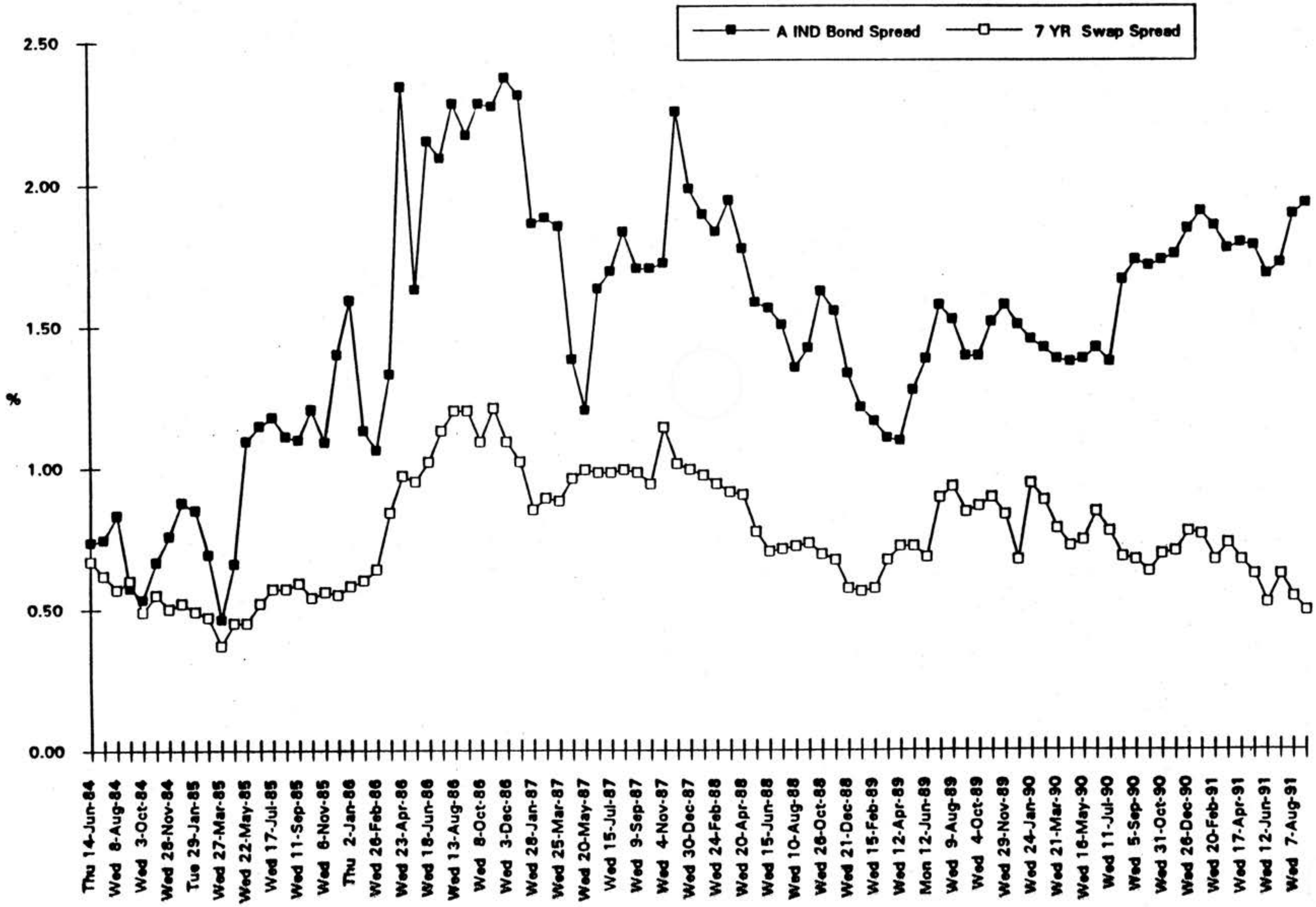

Figure 3

10 Yr Swap Spread versus A Ind Spread

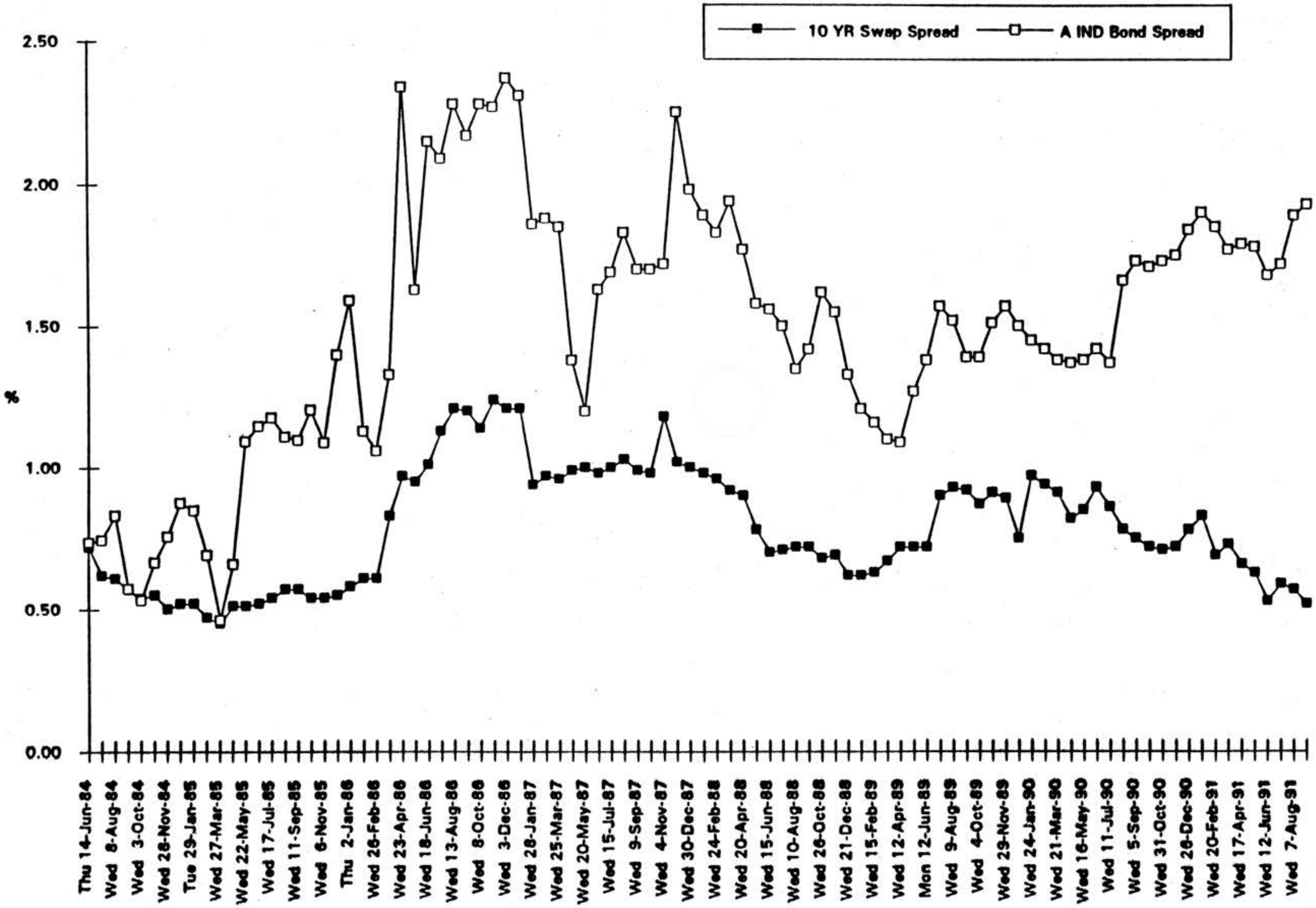

Figure 4
5 Yr Swap Rate versus A Ind Rate

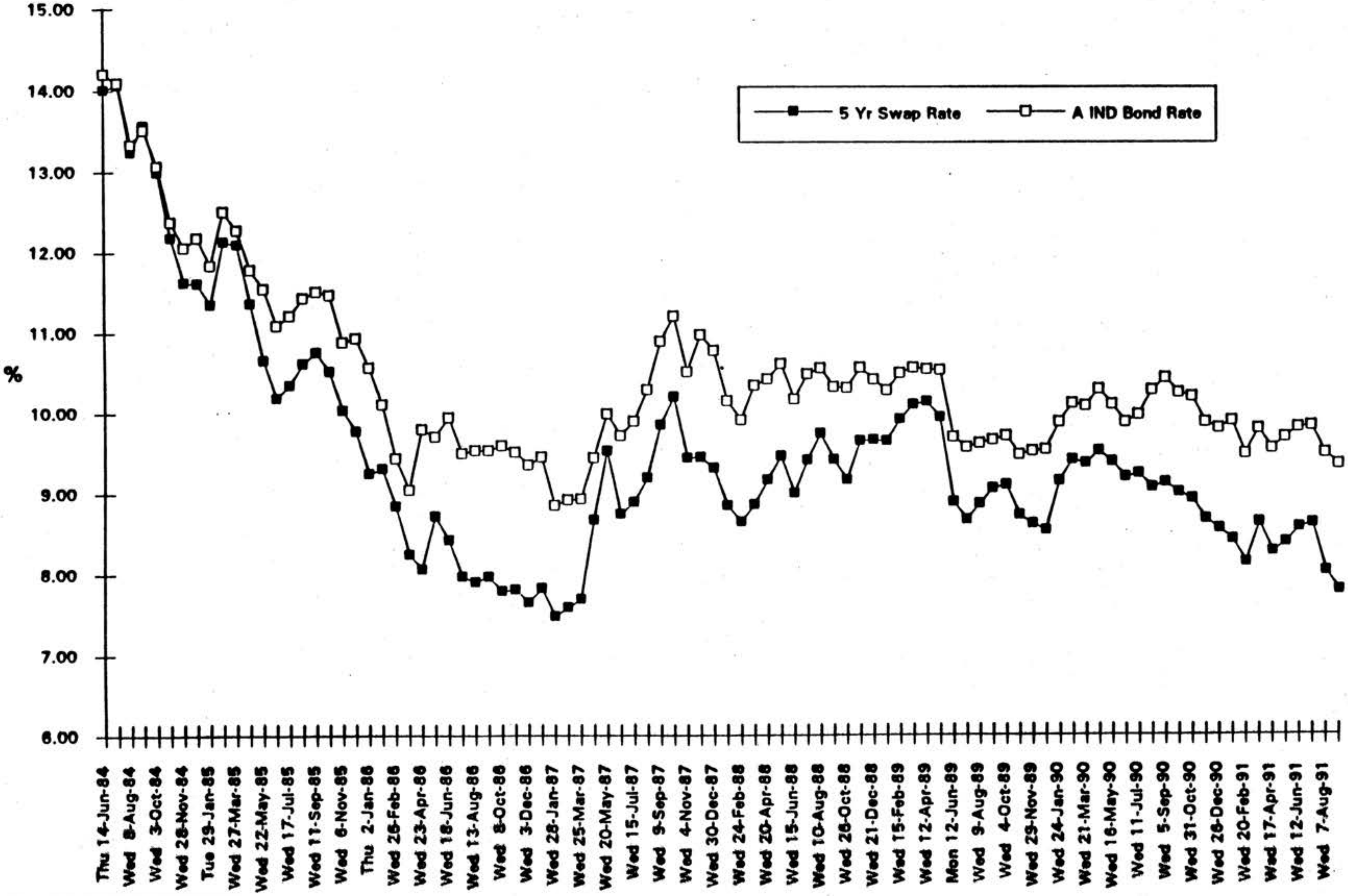

Figure 5

7 Yr Swap Rate versus A Ind Rate

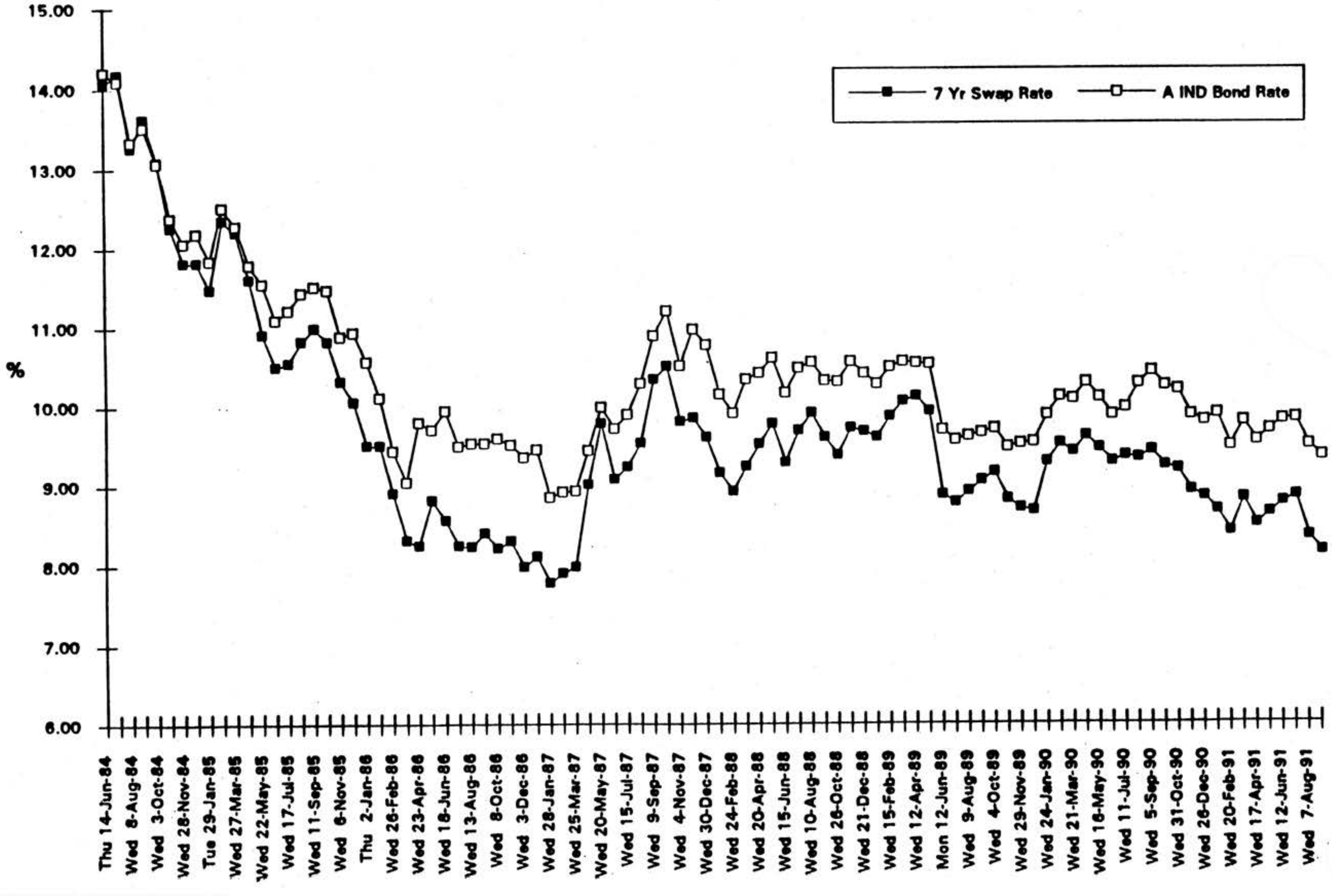

Figure 6

10 Yr Swap Rate versus A Ind Rate

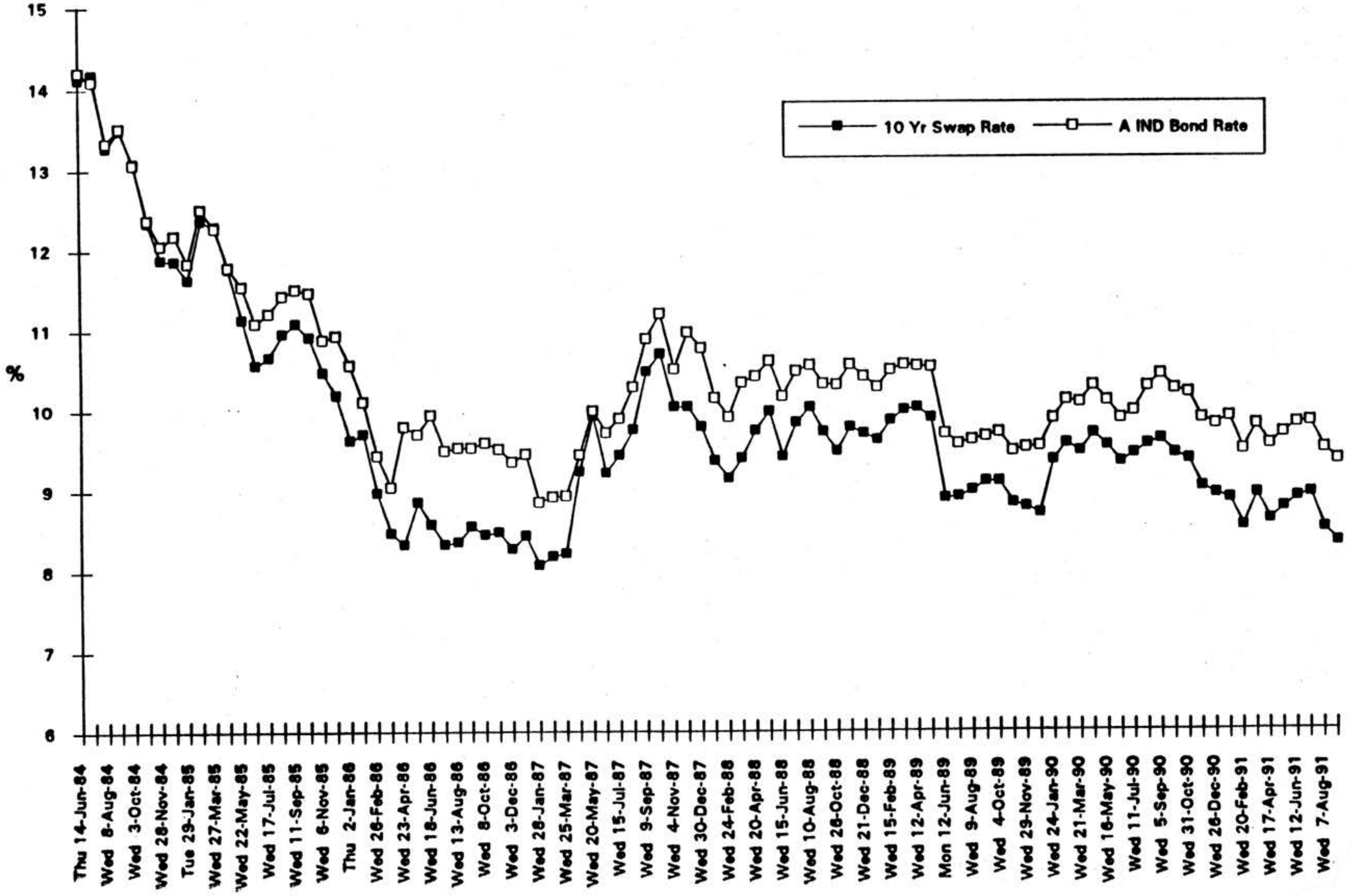

TABLE 1

OLS REGRESSIONS FOR CHANGES IN SWAP SPREADS (CONTEMPORANEOUS VARIABLES)

JUNE 14, 1984 through SEPTEMBER 4, 1991 (N = 92)

$$\Delta SS_t^M = a + B_0 \Delta TR_t^M + B_1 \Delta TS1_t^M + B_2 \Delta MDS_t^{AAA} + B_3 \Delta MDS_t^{AA} + B_4 \Delta MDS_t^{A} + B_5 \Delta MDS_t^{BBB} + B_6 \Delta V + \varepsilon$$

M = MATURITY	a	B_0	B_1	B_2	B_3	B_4	B_5	B_6	Adj. R^2
2	.001	.052	.116	.085	.061	-.12	-.087	2.84	.014
	(.017)	(.065)	(.082)	(.134)	(.223)	(.15)	(.108)	(2.40)	
3	-.003	.031	.076	.004	.101	-.092	-.083	2.51*	.068
	(.009)	(.036)	(.042)	(.071)	(.115)	(.079)	(.058)	(1.28)	
5	-.001	-.059*	.067*	.061	.224*	-.013	-.051	2.27*	.188
	(.007)	(.030)	(.032)	(.059)	(.097)	(.085)	(.048)	(1.05)	
7	-.000	-.028	.038	.124*	.252*	-.034	-.046	1.04	.090
	(.008)	(.035)	(.035)	(.085)	(.110)	(.074)	(.055)	(1.20)	
10	-.002	-.042	.053	.106	.290*	.029	-.023	1.206	.139
	(.008)	(.032)	(.031)	(.057)	(.098)	(.066)	(.048)	(1.077)	

a Standard errors are in parentheses.
b Changes in variables are for every four weeks.
* The coefficient is significant at a 5% significance level.

TABLE 2

OLS REGRESSIONS FOR CHANGES IN SWAP SPREADS (LAGGED INDEPENDENT VARIABLES)

JUNE 14, 1984 through SEPTEMBER 4, 1991 (N = 91)

$$\Delta SS^{M}_{t} = a + B_0\Delta TR^{M}_{t-1} + B_1\Delta TS1^{M}_{t-1} + B_2\Delta MDS^{AAA}_{t-1} + B_3\Delta MDS^{AA}_{t-1} + B_4\Delta MDS^{A}_{t-1} + B_5\Delta MDS^{BBB}_{t-1} + B_6\Delta V_{t-1} + \varepsilon$$

M = MATURITY	a	B_0	B_1	B_2	B_3	B_4	B_5	B_6	Adj. R^2
2	-.003	.033	-.148	-.192	-.081	-.014	.008	-1.40	-.011
	(.017)	(.067)	(.083)	(.137)	(.232)	(.155)	(.116)	(2.44)	
3	-.002	.015	-.076	-.091	-.130	.024	-.015	-.635	-.003
	(.009)	(.036)	(.043)	(.073)	(.123)	(.083)	(.062)	(1.30)	
5	-.001	-.020	-.040	-.025	-.037	.064	.058	.073	.001
	(.008)	(.033)	(.036)	(.065)	(.110)	(.074)	(.056)	(1.16)	
7	-.000	-.020	-.049	-.029	-.014	.072	.091	1.06	.053
	(.009)	(.036)	(.036)	(.067)	(.116)	(.077)	(.059)	(1.23)	
10	.000	.002	-.063	.016	.017	.046	.081	-.072	.025
	(.008)	(.033)	(.033)	(.061)	(.107)	(.071)	(.054)	(1.14)	

a Standard errors are in parentheses.
b Changes in variables are for every four weeks.

TABLE 3

OLS REGRESSIONS FOR CHANGES IN SWAP SPREADS (LEADING INDEPENDENT VARIABLES)

JUNE 14, 1984 through SEPTEMBER 4, 1991 (N = 91)

$$\Delta SS^{M}_{t} = a + B_0 \Delta TR^{M}_{t+1} + B_1 \Delta TS1^{M}_{t+1} + B_2 \Delta MDS^{AAA}_{t+1} + B_3 \Delta MDS^{AA}_{t+1} + B_4 \Delta MDS^{A}_{t+1} + B_5 \Delta MDS^{BBB}_{t+1} + B_6 \Delta V_{t+1} + \varepsilon$$

M = MATURITY	a	B_0	B_1	B_2	B_3	B_4	B_5	B_6	Adj. R^2
2	.001	.067	.096	.091	.090	.046	-.025	2.41	-.02
	(.018)	(.068)	(.084)	(.138)	(.229)	(.158)	(.116)	(2.45)	
3	-.001	.040	.110*	.180*	.269*	.135	.039	.397	.13
	(.009)	(.035)	(.041)	(.069)	(.115)	(.079)	(.058)	(1.24)	
5	.000	-.006	.065	.067	.137	.131	.028	-.035	.01
	(.008)	(.033)	(.036)	(.065)	(.108)	(.074)	(.055)	(1.17)	
7	.001	-.002	.060	.051	.077	.162*	.011	-.069	.03
	(.009)	(.036)	(.036)	(.067)	(.114)	(.078)	(.059)	(1.24)	
10	.001	.008	.038	.058	.054	.078	-.045	.028	.01
	(.008)	(.034)	(.033)	(.062)	(.106)	(.073)	(.054)	(1.16)	

a Standard errors are in parentheses.
b Changes in variables are for every four weeks.
* The coefficient is significant at a 5% level.

TABLE 4

OLS REGRESSIONS FOR CHANGES IN SHORT SWAP SPREADS (CONTEMPORANEOUS INDEPENDENT VARIABLES)

<u>JUNE 14, 1984</u> through <u>SEPTEMBER 4, 1991</u> (N = 92)

$$\Delta SS_t^M = a + B_0\Delta ER_t^M + B_1\Delta TR_t^M + B_2\Delta MDS_t^{AAA} + B_3\Delta MDS_t^{AA} + B_4\Delta MDS_t^{A} + B_5\Delta MDS_t^{BBB} + \varepsilon$$

M = MATURITY	a	B_0	B_1	B_2	B_3	B_4	B_5	Adj. R^2
2	-.007	.296*	-.284	-.040	-.050	-.121	-.110	.059
	(.0178)	(.125)	(.163)	(.143)	(.233)	(.156)	(.118)	
3	-.008	.121*	-.163*	-.042	.078	-.096	-.092	.053
	(.010)	(.059)	(.078)	(.077)	(.126)	(.084)	(.064)	

a Standard errors are in parentheses.
b Changes in variables are for every four weeks.
* The coefficient is significant at a 5% level.

TABLE 5

OLS REGRESSIONS FOR CHANGES IN SHORT SWAP SPREADS (CONTEMPORANEOUS INDEPENDENT VARIABLES)

<u>JUNE 14, 1984</u> through <u>SEPTEMBER 4, 1991</u> (N = 92)

$$\Delta SS_t^M = a + B_0 \Delta ER_t^M + B_1 ETS_t^1 + B_2 \Delta MDS_t^{AAA} + B_3 \Delta MDS_t^{AA} + B_4 \Delta MDS_t^{A} + B_5 \Delta MDS_t^{BBB} + \varepsilon$$

M = MATURITY	a	B_0	B_1	B_2	B_3	B_4	B_5	Adj. R^2
2	-.004	.089	.073	.104	.115	-.091	-.0579	.036
	(.018)	(.047)	(.085)	(.130)	(.235)	(.164)	.1215	
3	-.006	-.034	.141*	.083	.280*	-.005	-.01638	.214
	(.009)	(.023)	(.032)	(.064)	(.115)	(.080)	(.060)	

a Standard errors are in parentheses.
b Changes in variables are for every four weeks.
* The coefficient is significant at a 5% level.

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