BÜLENT GÜLER EVIDENCE FOR 'FLIGHT TO QUALITY' HYPOTHESIS WITHIN AN INFLATION UNCERTAINTY MODELLING Bilkent 2003

EVIDENCE FOR 'FLIGHT TO QUALITY' HYPOTHESIS WITHIN AN INFLATION UNCERTAINTY MODELLING

A Master's Thesis

by
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July 2003

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The Institute of Economics and Social Sciences
of
Bilkent University

by

BÜLENT GÜLER

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MASTER OF ARTS IN ECONOMICS

in

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ABSTRACT

EVIDENCE FOR 'FLIGHT TO QUALITY' HYPOTHESIS WITHIN AN INFLATION UNCERTAINTY MODELLING

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July 2003

There is a great literature devoted to link between inflation uncertainty and interest rates. However, there are opposing findings about the relationship between inflation uncertainty and interest rates. Some of the studies find a positive correlation between them, while some of them find a negative correlation. In this paper, we analyzed the link between inflation uncertainty and spreads among riskier and safer bonds within a model of a time-varying parameter model with an ARCH specification. We divided inflation uncertainty into two parts, structural uncertainty and impulse uncertainty, as indicated in Evans (1991), firstly. We estimated the relationship between these types of uncertainties and spreads among riskier and safer bonds, using USA data.

The results indicate us that both structural and impulse uncertainties have significant relationship with spreads between corporate bonds, the riskier bonds, and treasury bills, the safer bonds. Especially having a positive effect of impulse uncertainty on spreads shows an important evidence for *'Flight to Quality'* hypothesis.

Keywords: *'Flight to Quality'*, structural uncertainty, impulse uncertainty, spread, Kalman Filter

ÖZET

‘KALİTEYE KAÇIŞ’ HİPOTEZİNE ENFLASYON BELİRSİZLİĞİ MODELLEMESİYLE KANIT

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Master, Ekonomi Bölümü

Tez Yöneticisi: Yrd. Doç. Dr. Ümit Özlale

Temmuz 2003

Enflasyon belirsizliği ve faiz oranları arasındaki ilişkiyi inceleyen geniş bir literatür mevcuttur. Fakat, bu ilişki konusunda karşıt buluşlar bulunmaktadır. Bazı çalışmalar, enflasyon belirsizliği ve faiz oranları arasında pozitif bir ilişkinin varlığını gösterirken bazı çalışmalar da negatif bir ilişkiden söz etmektedirler. Bunların ötesinde, biz bu tezde, ARCH modellemesiyle birlikte zaman içerisinde değişen parametre modeli kullanarak enflasyon belirsizliği ile riskli ve güvenli bonolar arasındaki marj ilişkisini inceledik. Öncelikle enflasyon belirsizliğini, Evans (1991)’de belirtildiği gibi, *“yapısal belirsizlik”* ve *“ani belirsizlik”* diye iki kısma böldük. Ardından da A.B.D. verilerini kullanarak, bu iki belirsizliğin riskli ve güvenilir bono marjı üzerindeki etkilerini inceledik.

Sonuçta, *“yapısal belirsizlik”* ve *“ani belirsizlik”* in şirket tahvilleri, riskli tür bonolar, ile hazine bonoları, güvenilir tür bonolar, arasındaki marj üzerinde anlamlı bir etkisinin olduğunu bulduk. Özellikle *“ani belirsizlik”* in marjlar üzerinde pozitif bir etkisinin olması *‘Kaliteye Kaçış’* hipotezine önemli bir kanıt oluşturmaktadır.

Anahtar Kelimeler: *‘Kaliteye Kaçış’* hipotezi, yapısal belirsizlik, ani belirsizlik, marj, Kalman Filtresi.

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

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Director

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 Introduction

In all types of economies, permanent and/or temporary modifications, adjustments or variations can change the important dynamics in the economy. *'Flight to Quality'* hypothesis emerges as one of these consequences of changes or variations in monetary policy on real economic dynamics. This hypothesis proposes that sudden shocks to the economy, temporary or permanent, will lead investors to escape from "bad" investment options to "good" investment options. These two options vary by the type of investment. It can be "low quality" versus "high quality", or "short-term" versus "long-term", as well as "low-return" versus "high-return", or "riskier" versus "safer" etc.

1.1 Literature on *'Flight to Quality'* Hypothesis

There is an extensive literature devoted to the *'Flight to Quality'* effect in terms of lender-borrower relationship. Bernanke and Gertler (1989) shows in a model, where firms are financed by Townsend-style (1979) optimal debt contracts which allows converting i.i.d shocks into autoregressive movements in output[1], that when prospective agency costs of lending (in the form of bankruptcy risks) increase, lenders reduce the amount of credit extended to firms that require monitoring and invest a greater share of their savings in the safe alternative[2]. Bernanke and Gertler (1990) and Calomiris and Hubbard (1990) analyze a similar result such that a reallocation of credit in downturns from low-net-worth to high-net-worth borrowers occurs when costs of lending increase. Moreover Gertler (1992) exhibits qualitatively similar results to Bernanke and Gertler (1989) framework that emerge when

[1] Aghion and Bolton (1993) gives an extended analysis of dynamics in a related model
[2] Williamson (1989) finds a similar result of Bernanke and Gertler (1989).

borrowers and lenders contract for multiple periods. He finds that with multi-period relationships, expected future profits of the borrower can partially substitute for internal finance in reducing agency costs. Since an increase in the safe real interest rate reduces the present value of expected profits, Gertler's result reinforces the point that higher interest rates worsen the agency problem.

'Financial accelerator'[3] theory predicts a differential effect of an economic downturn on borrowers who are subject to severe agency problems in credit markets and borrowers who don't face serious agency problems; the difference arises because declines in net worth raise the agency costs of lending to the former but not the latter. Therefore, if financial accelerator is operative, at the beginning of a recession we should see a decline in the share of credit flowing to those borrowers more subject to agency costs (the flight to quality). As a result of their greater cost or difficulty in obtaining credit, these borrowers should reduce spending and production earlier and more sharply than do borrowers with greater access to credit markets. The consequences of monetary policy in generating a *'Flight to Quality'* effect have also been widely studied. In this manner Bernanke and Blinder (1988), and Kashyap and Stein (1994) state that recessions following a tightening of monetary policy involve *'Flight to Quality'*, because of the adverse effect of increased interest rates on balance sheets and because monetary tightening may reduce flows of credit through the banking system. Kashyap, Stein, and Wilcox (1993), Gertler and Gilchist (1993), and Oliner and Rudebusch (1993) show that after tightening of monetary policy there is a sharp increase in commercial paper issuance, while bank loans are flat, which is consistent with *'Flight to Quality'* hypothesis[4].

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[3] It means the amplification of initial shocks brought about by changes in credit-market conditions.
[4] Kashyap, Stein, and Wilcox (1993) explains this result by the limitation of the supply of bank credits by the tightening of monetary policy, whereas Gertler and Gilchist (1993), and Oliner and Rudebusch (1993) justify this result by the impact of monetary tightening on the quality mix of borrowers.

Lang and Nakamura (1992), on the other hand, finds that the share of the bank loans made above prime (i.e. loans to riskier or harder-to-monitor borrowers) drops in recessions. Additionally Morgan (1993) demonstrates that, following a tightening of monetary policy, firms without previously established lines of credit receive a smaller share of bank loans[5]. Finally, in the favour of the *'Flight to Quality'* hypothesis, Corcoran (1992), and Carey, Browse, Rea, and Udell (1993) suggest that private placements fall sharply relative to public bond issues during recessions and tight-money periods.

1.2 Literature on Inflation Uncertainty

As a different strand, in recent years, there is a growing interest on the inflation uncertainty, which affects real economic activities directly or indirectly. As Berument, Kilinc, and Ozlale (2002) states in a society with a high degree of inflation uncertainty, there will be serious errors in inflation forecasts, which will mislead the investors, who plan their future activities in the light of these inflation forecasts, by reducing the credibility of economic policies and causing high inflation risk premium. There can be observed many studies on the analysis of the inflation uncertainty over inflation, employment and output. Cukierman and Wachtel (1979), Cukierman and Meltzer (1986), Ball and Cecchetti (1990), Ball (1992), Evans and Wachtel (1993), and Holland (1993b and 1995) all find a positive relationship between inflation uncertainty and inflation. Hafer (1986) and Holland (1986) observe negative correlation between inflation uncertainty and employment. Friedman (1977), Froyen and Waud (1987), and Holland (1988) report a negative relationship between output and inflation uncertainty. Furthermore Berument, Kilinc, and Ozlale

[5] He also emphasizes that declines in noncommitment lending are highly correlated with increases in the share of the membership of the National Federation of Independent Business reporting that credit has become harder to obtain.

(2003) analyses the effect of inflation uncertainty on the long-short term interest rate spreads and finds a positive correlation between inflation uncertainty and the spread between several types of interest rates and the overnight interbank interest, which is the shortest term.

Routledge and Zin (2001) explores connection between uncertainty and liquidity. Their investigation depends on the two common features of various crises[6]. Firstly, times of crises are associated with a greater degree of uncertainty. Secondly, crises are accompanied by a severe lack of liquidity. Following the various recent international and domestic crises, liquidity disappeared. Bid-ask spreads increase, people have difficulty executing trades for existing financial securities, and new bond and equity offerings are postponed or canceled.

To explore the connection of uncertainty with liquidity, they specify a simple market where a monopolist financial intermediary makes a market for a propriety derivative security. The market-maker chooses bid and ask prices for the derivative, then, conditional on trade in this market, chooses an optimal portfolio and consumption. Within this framework, they find a positive relationship between bid-ask spread and uncertainty, and hence, a negative correlation between uncertainty and liquidity.

However, there is a missing literature on the consequence of inflation uncertainty on *'Flight to Quality'* hypothesis, in terms of escaping from riskier bonds to safer bonds. We expect variations in the yields of interest rates due to the volatility in the market, which causes uncertainty in decisions of agents. This fact can be seen by looking at financial options. There are two kinds of financial options: A *call* gives its holder the right but not the obligation to purchase a particular security at a given price (the

[6] Russian debt crisis in August 1998, Mexico, Thailand, Indonesia, South Korea, and Brazil crises during 1990s (analysed deeply in Summers (2000)), USA municipal bond crisis, various USA stock market crashes in 1929, 1987, and 1989 are typical crises in this manner

strike price); a *put* confers the right but not the obligation to sell at the strike price. This structure makes option prices very sensitive to market volatility.

In this paper we tried to connect the missing linkage between the inflation uncertainty and *'Flight to Quality'* hypothesis. For this purpose, we analyzed relationship between spreads of risky-safer bonds and different types of inflation uncertainty, as introduced by Evans (1991) and used in Berument (1999), and Berument, et al (2002 and 2003), and tried to see whether there is a flight to quality effect or not. As Evans (1991) introduced there may be an uncertainty about the structure of the inflation process, which is originated from the conditional variance of expected inflation and called "structural uncertainty". Also, uncertainty may occur due to the nature and magnitude of temporary shocks that hit the economy, which is originated from the conditional variance of given inflation and named as "impulse uncertainty". We used a time-varying parameter model with an Autoregressive Conditional Heteroscedasticity (ARCH) specification to measure the structural and impulse uncertainties. Furthermore we regressed these uncertainties on the spread between corporate bond (riskier bonds) and treasury bills (safer bonds) by using Least Square Estimation (LSE) technique while impulse uncertainty is found to have a positive effect on the interest rate spread, which is in favor of the *'Flight to Quality'* hypothesis, structural uncertainty seems to have a negative effect on the spread.

The plan of this paper is as follows: Section 2 explains the model used to measure two types of inflation uncertainty, structural uncertainty and impulse uncertainty and the motivation of using such a model. Section 3 begins with the definition of the data used in this paper and then demonstrates the estimation results for *'Flight to Quality'* hypothesis, and as a final point, checks for the robustness of the results. Finally Section 4 concludes the paper with a summary of the results.

2 The Model

2.1 Modeling Inflation Uncertainty

In the literature several methods for measuring inflation uncertainty are proposed. The first method is the survey-based approach, used by Hafer (1986), and Davis and Kanago (1996). They find a negative correlation between inflation uncertainty and real economic dynamics. However, as Bomberger (1996) states in his study, since survey-based approach could just measure the disagreement, and moreover results of the survey could be biased due to the fact that forecasters might try to avoid deviating from the others' forecasts, it cannot provide a true measure of inflation uncertainty.

Furthermore, it is crucial to mention that variability and uncertainty are not identical. Although a small volatility is observed in actual inflation ex post, agents may view the future with a great amount of uncertainty due to having very little information. On the other hand, there may be a great volatility in the behavior of inflation, but agents may view future with a very small amount of uncertainty due to having a good deal of advanced information. As a result, measuring inflation uncertainty depending solely on the variability or simple variance of actual inflation may be misleading. To avoid this problem, a second method that uses the conditional variance of period-to-period inflation as the main source of the uncertainty, (generalized as ARCH model) emerges to measure inflation uncertainty. In these types of models, changes in variability in ex post inflation are equated with changes in uncertainty when the time varying estimates of the conditional variance changes. Cukierman and Wachtel

(1979), and Mullineaux (1980) use the cross-sectional variance of the inflation forecasts, while Cukierman and Wachtel (1982) employs the mean squared error of the inflation forecast. Finally, Holland (1986) takes the root mean squared error of the inflation forecasts as a proxy for inflation uncertainty. All of these above-mentioned models make use of ARCH specification. However, since a raise in the conditional variance of next period's inflation rate may be unrelated to the precision, this method solely cannot capture all the economically relevant aspects of inflation uncertainty.

Furthermore another method, the Kalman Filter approach, is an extended form of the above method, and measures the uncertainty by estimating the time-varying conditional variance of the parameter estimates of a variable.

In this study, as in Evans (1991), we used a time-varying parameter model with an ARCH specification, by combining the last two methods emphasized above to measure structural and impulse uncertainties.

Let π_{t+1} stands for the inflation rate between t and $t+1$. With an aid of ARCH specification, the inflation uncertainty can be modeled as:

$$\pi_{t+1} = X_t \beta_{t+1} + e_{t+1} \qquad where \qquad e_{t+1} \sim N(0, h_t) \tag{1}$$

$$\beta_{t+1} = \beta_t + V_{t+1} \qquad where \qquad V_{t+1} \sim N(0, Q) \tag{2}$$

$$h_t = h + \sum_{i=0}^{m} \phi_i e_{t-i}^2 + \sum_{i=1}^{n} \gamma_i h_{t-i} \tag{3}$$

where X_t is a vector of explanatory variables for inflation, known at time *t*, β_{t+1} is a vector of parameters, e_{t+1} is the shock to inflation that cannot be forecasted with information at time *t*, and e_{t+1} is normally distributed with a time-varying conditional variance of h_t, which indicates the changes in uncertainty of the future inflation at time *t* and is specified as a linear function of current and past squared forecast errors. ϕ_i and γ_i are the time-varying parameters of h_t.

In this modeling, equations (1) and (3) represent a generic ARCH specification of inflation. Nevertheless, they are not sufficient to capture some important feature of the inflation process. As the dynamics of economy change over time, it is likely to have significant variations in the structure of inflation, which causes β to vary over time. This feature is obtained by equation (2), where V_{t+1} is a vector of normally distributed shocks to the parameter vector β_{t+1} with a homoskedastic covariance matrix Q. By this way, equations (1), (2), and (3) characterize a time-varying autoregressive process with an ARCH specification for shocks to inflation. However, now, h_t becomes a poor estimate for inflation uncertainty. Suppose that, at time *t*, it is announced that at time *t+1* the monetary policy will be changed. If the agents have perfect information about the structure of inflation, then the expected rate of inflation will be $E_t\pi_{t+1} = X_t\beta_{t+1}$, and the variance of inflation will be h_t. On the other hand, if the agents have poor information, then agents will expect the inflation to be represented as $E_t\pi_{t+1} = X_tE_t\beta_{t+1}$. Then, since h_t ignores the variations from the true value of β_{t+1}, it cannot represent the true value of the inflation uncertainty.

In order to see the effects of variations in the structure of inflation on uncertainty, we should include the Kalman Filter equations (see Chow (1984) for details):

$$\pi_{t+1} = X_t E_t \beta_{t+1} + \eta_{t+1}, \tag{4}$$

$$H_t = X_t \Omega_{t+1|t} X_t^T + h_t \tag{5}$$

$$E_{t+1}\beta_{t+2} = \beta_{t+1} + [\Omega_{t+1|t} X_t^T H_t^{-1}]\eta_{t+1} \tag{6}$$

$$\Omega_{t+2|t+1} = [I - \Omega_{t+1|t} X_t^T H_t^{-1} X_t]\Omega_{t+1|t} + Q \tag{7}$$

where $\Omega_{t+1|t}$ stands for the conditional covariance matrix of β_{t+1}, which represents the uncertainty about the structure of the inflation process. Since equation (4) indicates that innovations in the inflation rate, which is denoted by η_{t+1}, may come from both inflation shocks e_{t+1} and unanticipated changes in the structure of inflation V_{t+1}, the conditional variance of inflation H_t depends upon both h_t and the conditional variance of $X_t \beta_{t+1}$, which is $X_t \Omega_{t+1|t} X_t^T$, formulated in equation (5). If there is not any uncertainty about the vector of parameters, β_{t+1} ($\Omega_{t+1|t}$ is equal to the null matrix), then h_t will entirely govern the conditional variation of inflation. This means that the model covers the generic ARCH specification, formulated by equations (1) and (3). Otherwise, if there is uncertainty about the structure of inflation, then h_t will miscalculate the true conditional variance of inflation, H_t, since $X_t \Omega_{t+1|t} X_t^T > 0$. Equation (6) shows the innovations in updating the estimates of β_{t+1}, which is used for forecasting the future inflation. Finally equations (6) and (7) represent the updating of the conditional distribution of β_{t+1} over time in response to new information about actual inflation. As in Berument, et al (2002), we can refer to inflation uncertainty associated with randomness in β as "structural uncertainty", which is denoted by $X_t \Omega_{t+1|t} X_t^T$; while the uncertainty associated with the randomness in "e" is called "impulse uncertainty" and represented by the conditional variance of e_{t+1}, which is h_t.

2.2 Justification of the Model

In this part we will explain the motivation for choosing a time-varying parameter model with an ARCH specification in a detailed form. Especially we will clarify the reason behind using both time-varying parameters and ARCH specification within a single model. Evans (1991) gives two reasons for this fact:

> … inflation shocks represent combinations of structural disturbances such as productivity, money supply, and price shocks. Over time it is unlikely that the actual or perceived frequency with which these structural disturbances occur remains constant. For example, the variance of monetary shocks is likely to be higher during periods of greater uncertainty about the future course of monetary policy. Similarly, the variance of price shocks probably rises around OPEC meetings.
>
> The Lucas critique provides another reason. Since the inflation process represents the result of a large number of price-setting decisions, shocks to the aggregate price level must in part depend upon how individual price setters respond to structural disturbances. For example, the pricing strategies of individual firms will determine the aggregate effects of a given nominal demand shock. Such pricing rules are subject to change. In particular the analysis in Ball, Mankiw, and Romer (1988), Evans (1989), and others suggest that the frequency of individual price changes should rise as the economy moves toward regimes of higher inflation so that the aggregate price level will respond more quickly to nominal shocks. Under these circumstances, a prolonged increase in the rate of inflation will induce a rise in the conditional variance of inflation independently of the perceived frequency of nominal shocks.

The reasons indicated above suggest that time-varying model with an ARCH specification captures the important features for the inflation process. Behavioral and policy changes in the economy will both persuade ARCH effects and time variation in the structure of inflation, which the above model already confines.

3 Results

3.1 Data Set

We employ monthly USA data from 1953:04 to 2002:11. Since most of the studies related to *'Flight to Quality'* hypothesis and inflation uncertainty take United States economy as the main observation, we will be able to compare our results with the existing literature.

Monthly inflation of USA is obtained from CPI (Consumer Price Index) data[7]. Structural uncertainty and impulse uncertainty are obtained using this inflation data in the equations (1) to (6)[8]. Interest rates used in the spreads are the AAA type corporate bond, treasury bill rate, BAA type corporate bond and secondary market treasury bill rate[9]. All these interest rates have equivalent maturity, which is 3 month. Interest rate spread is obtained by taking the difference between AAA type corporate bond and treasury bill rate (AAA-treasury)[10]. Also for robustness of the results, the spread is obtained by taking the difference between BAA type corporate bond and secondary market treasury bill rate (BAA-treasurysec), BAA type corporate bond and treasury bill rate (BAA-treasury), and finally, AAA type corporate bond and second market treasury bill rate (AAA-treasurysec)[11]. Figure 2 shows the behavior of spreads, and they are positive most of the time. Elton, Gruber, Agrawal, and Mann (2001) suggests three possible reasons for this fact:

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[7] See Figure 1 for the graph of the inflation.

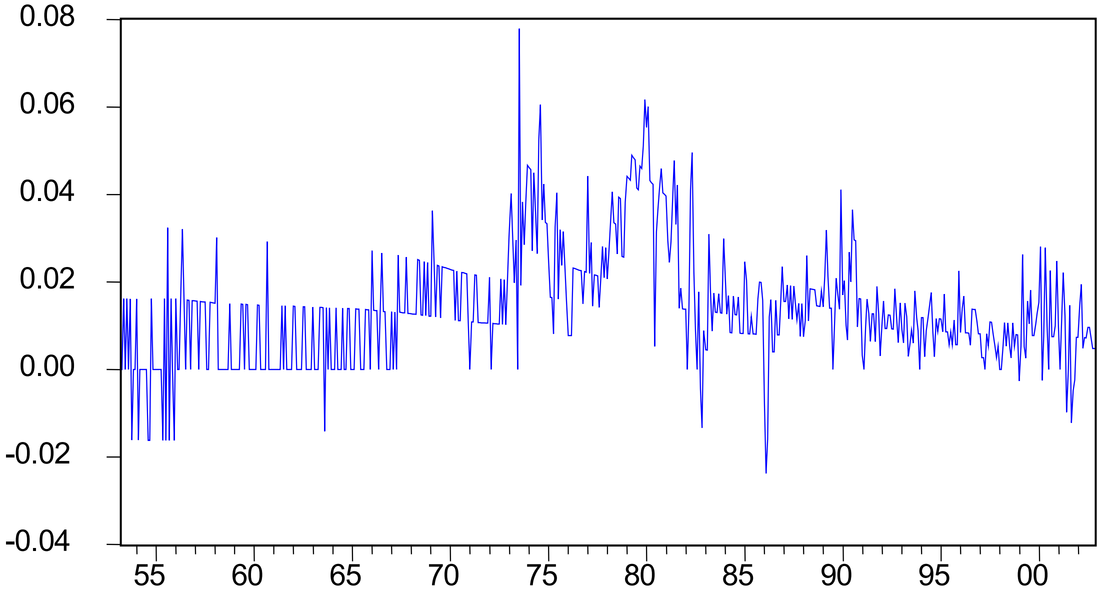
[8] The Matlab codes for obtaining the structural uncertainty and impulse uncertainty can be found in Appendix A. They are mostly written by James P. LeSage

[9] See Appendix B to see the data of all interest rates

[10] All kinds of interest rates and spreads are in the form of effective interest rates, where it is calculated using the following formula: $effspread_t = \frac{1 + spread_t}{1 + \pi_{t+1}}$

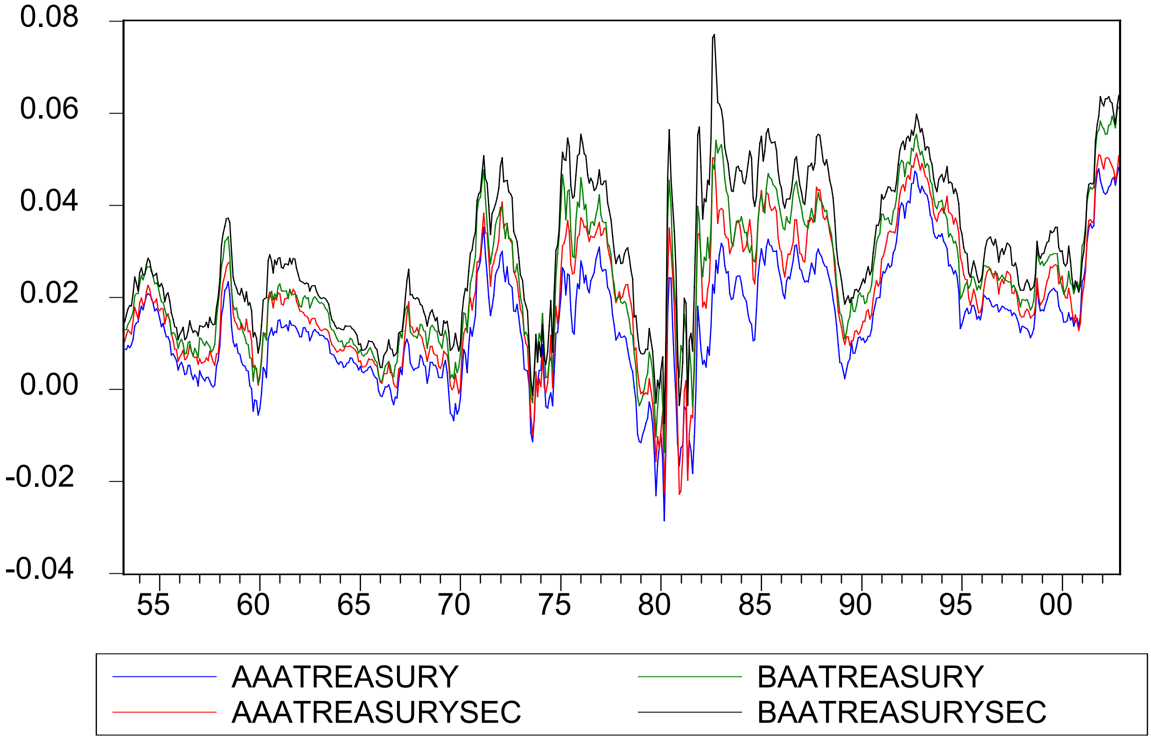
[11] See Platt and Platt (1992) for a detailed literature review on yield spreads

Figure 1



Note: The behaviour of monthly USA inflation from 1953:04 to 2002:11

Figure 2



Note: The behaviour of various interest rate spreads, each with 3-month maturity

1. Expected default loss –some corporate bonds will default and investors require a higher promised payment to compensate for the expected loss from defaults.
2. Tax premium –interest payments on corporate bonds are taxed at the state level whereas interest payments on government bonds are not.
3. Risk premium –the return on corporate bonds is riskier than the return on government bonds, and investors should require a premium for the higher risk. This occurs because a large part of the risk on corporate bonds is systematic rather than diversifiable.

After applying the monthly inflation data in the related equations above, we get the following Figure 3 and Figure 4 for the behaviors of the structural uncertainty and the impulse uncertainty, respectively[12]. As it can be seen from the figures, both structural and impulse uncertainties capture the unexpected changes in inflation and interest rates in USA economy, which would increase the uncertainties for future inflation. Especially, the big increases in both structural and impulse uncertainties in mid 1970s, beginning of 1980s, 1990s and 2000s are due to the big changes in the inflation rate in those years leading uncertainty for the expectation of future inflation.

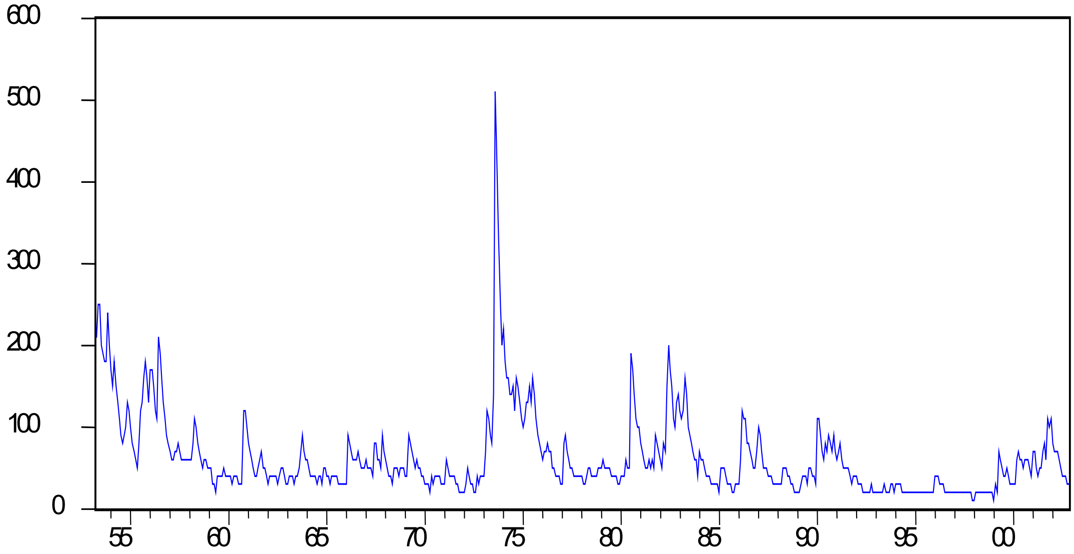
3.2 Estimation Results

We, firstly, analyzed the effects of both structural uncertainty and impulse uncertainty on various interest rates (AAA type corporate bond, BAA type corporate bond, treasury bill, and secondary market treasury bill). However, we couldn't solve the ambiguity of the relationship between the interest rate and types of inflation uncertainty. For the estimation procedure, we tested the following equation by using Least Square Estimation (LSE) method:

$$Bond_t = \lambda_0 + \lambda_1 h_t + \lambda_2 S_t + \eta_t \qquad (8)$$

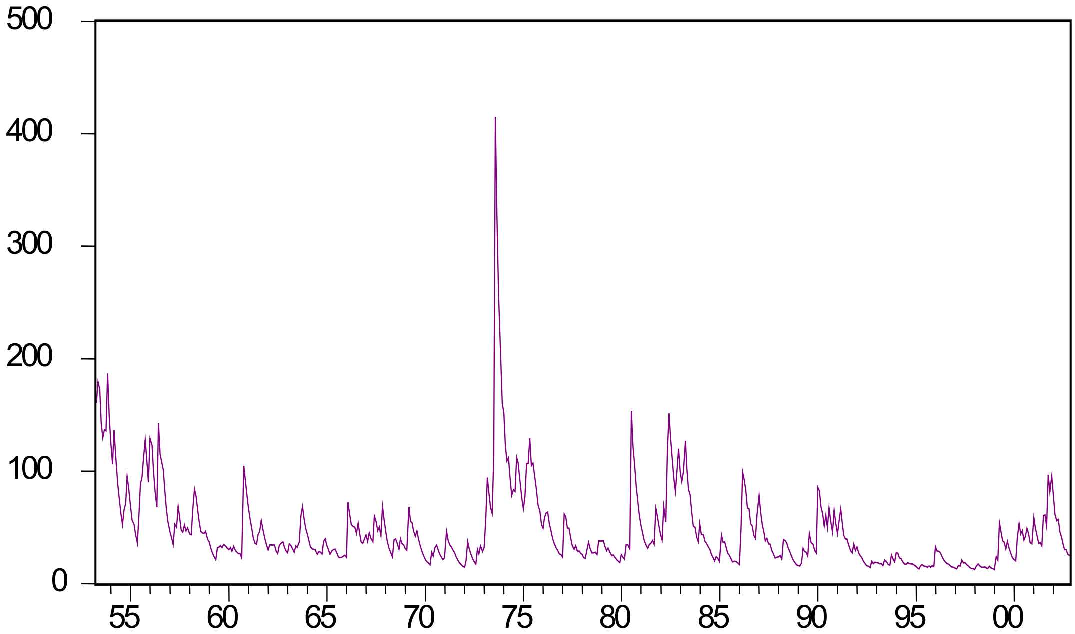
[12] See Appendix B for the whole data of both structural uncertainty and impulse uncertainty

Figure 3



Note: The behaviour of structural uncertainty from 1953:04 to 2002:11

Figure 4



Note: The behaviour of impulse uncertainty from 1953:04 to 2002:11

where, S_t is $X_t \Omega_{t+1|t} X_t^T$, the structural uncertainty, h_t is the impulse uncertainty as indicated before, and η_t is the disturbance term. In the above equation bond yields are in effective form.

Estimation results for equation (8) are reported in Table 1.

Table 1: Estimation Results for Various Bonds

	Constant	S_t	h_t
Treasury Bill	1.059212 (547.2715)	0.000510 (-2.965591)	-0.000674 (-2.929100)
Secondary Market Treasury Bill	1.052955 (578.0073)	0.000597 (-3.685392)	-0.000779 (-3.595294)
AAA corporate	1.076177 (587.0638)	-0.000096 (-0.588858)	0.0000769 (0.352512)
BAA corporate	1.084853 (527.9391)	-0.000167 (-0.912115)	0.000186 (0.762686)

Note: t-statistics are reported in parentheses.

As it can be seen from Table 1, treasury bills seem to be positively correlated with structural uncertainty, and negatively correlated with impulse uncertainty. However, results for corporate bonds are not significant. These results show us that, as the impulse uncertainty increases, volatility shocks to the economy rise, agents fly to the treasury bonds, and since the demand to these bonds increase, their prices decrease. Nevertheless, it is hard to make such an interpretation for corporate bonds due to the insignificant estimation results[13]. So by looking the effects of inflation uncertainty on the interest rates separately, it is difficult to say there is a flight to quality effect, but

[13] Also see the Figures 5 and 6 for the graphics of jointly behaviours of bonds, uncertainties.

we can test this effect by analysing the relationship between uncertainties and interest rate spreads.

3.3 Testing the "Flight to Quality" Hypothesis

In order to test whether *'Flight to Quality'* hypothesis holds for spreads, we estimate the following equation by using least square estimation method:

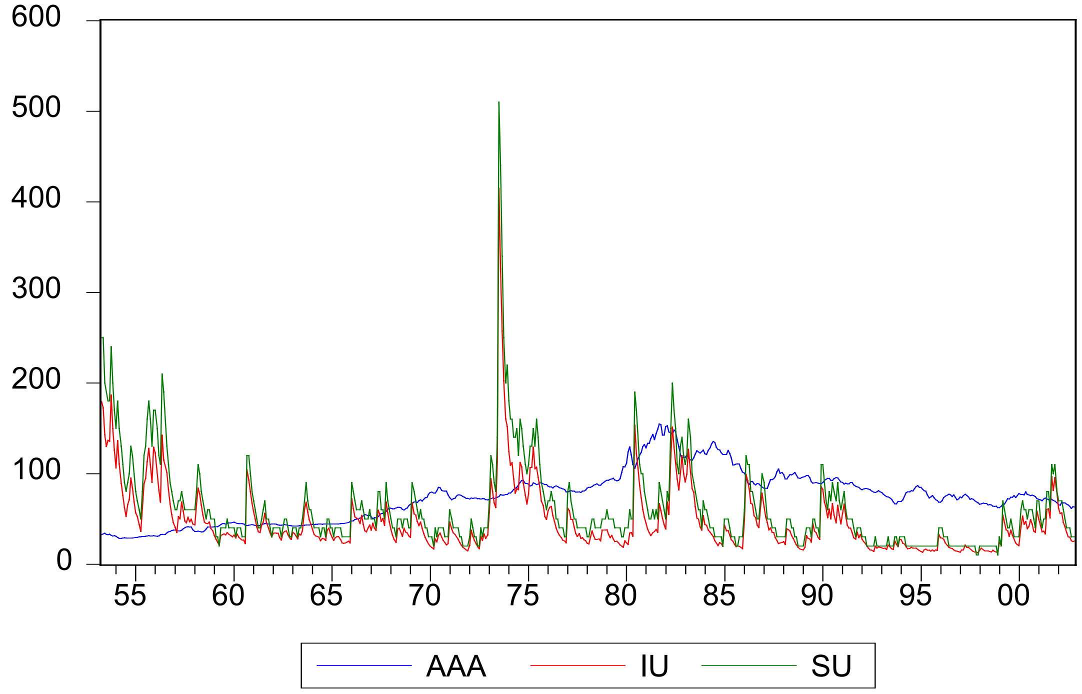
$$Spread_t = \alpha_0 + \alpha_1 h_t + \alpha_2 S_t + \varepsilon_t \tag{9}$$

The *'Flight to Quality'* hypothesis suggests that there has to be a positive relationship between impulse uncertainty and spreads[14]. As the impulse uncertainty increases, it means that there are sudden shocks that hit the economy, and this leads investors not to hold the risky bonds, corporate bonds, and prefer more safer bonds, such as treasury bills. By this way, the demand for corporate bonds decreases relatively to the demand for the treasury bills, which in turn causes the change in the value of corporate bonds to be higher than the change in the value of treasury bills.

The estimation results for equation (9) are reported in Table 2. Results show us that impulse uncertainty has a significantly positive effect on the spreads while structural uncertainty has a significantly negative effect on the spreads, which is in favour of *'Flight to Quality'* hypothesis. The reason for not having a positive relationship between structural uncertainty and spreads is that the spreads we analysed in this paper are all short-term bonds (all have 3 month maturity). Therefore the changes in

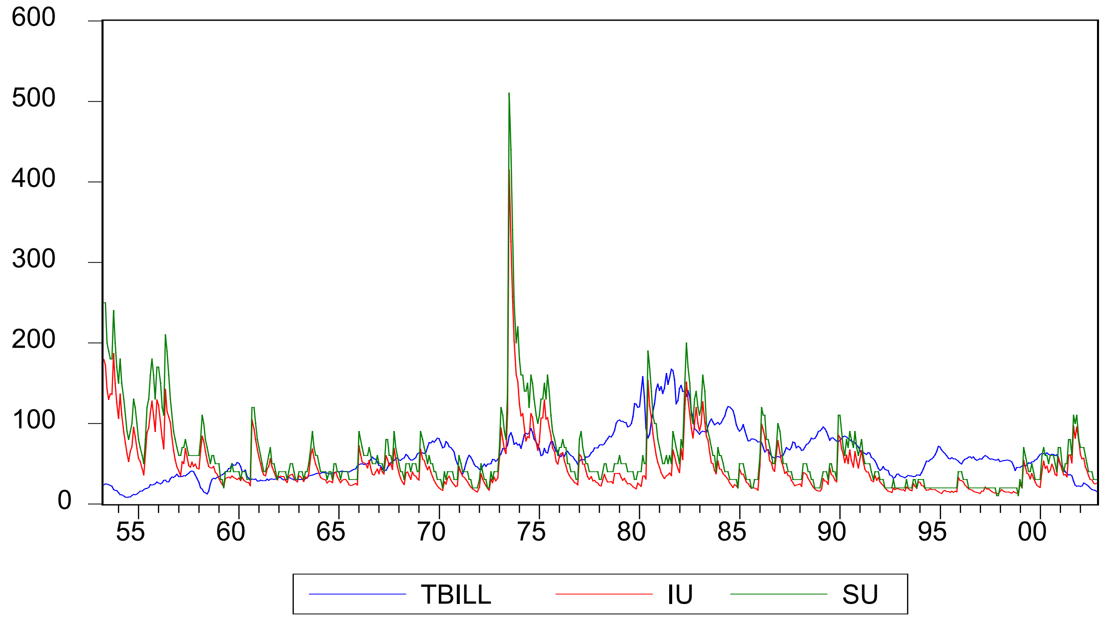
[14] See Fisher (1959) and Litterman and Iben (1991). Fisher (1959) suggests that there is a positive relationship between default risk and yield spreads, while Litterman and Iben (1991) suggests that risk premia increase with maturity.

Figure 5



Note: Jointly behaviors of corporate bonds, structural uncertainty and impulse uncertainty

Figure 6



Note: Jointly behaviours of treasury bill, structural uncertainty and impulse uncertainty the demand for these bonds will be mostly affected from the sudden shocks that hit the economy, impulse uncertainty, rather than the uncertainty of the structure of the economy.

3.4 Robustness of Estimation Results

As indicated above, BAA-treasury, BAA-treasurysec, and AAA-treasurysec spreads are used for testing the robustness of the results. Using equation (9), these spreads are regressed on structural uncertainty and impulse uncertainty, generated by using equations (1) through (7). Results are reported in Table 2. It can be easily seen from the table that coefficients of structural uncertainty in the estimation for all kinds of spreads are negative, as it is in the original case. Moreover, t-statistics, reported in the table show us that these coefficients are significant.

Furthermore, all the coefficients for impulse uncertainty are positive, and they are all significant. So, these findings clearly state that our results remain robust.

Table 2: Estimation Results for Various Spreads

	Constant	S_t	h_t
AAA-treasury	0.016965 (20.98814)	-0.000606 (-8.436335)	0.000751 (7.812959)
BAA-treasurysec	0.031898 (32.31313)	-0.000764 (-8.699619)	0.000966 (8.222303)
BAA-treasury	0.025642 (28.51066)	-0.000677 (-8.465972)	0.000861 (8.046029)
AAA-treasurysec	0.023222 (26.81198)	-0.000693 (-8.997980)	0.000856 (8.308233)

Note: t-statistics are reported in parentheses.

4 Conclusion

There is a great literature devoted to link between inflation uncertainty and interest rates. However, there are opposing findings about the relationship between inflation uncertainty and interest rates. Some of the studies find a positive correlation between these two variables, while some of them find a negative correlation. In this paper, we analyzed the link between inflation uncertainty and spreads among riskier and safer bonds within a model of a time-varying parameter model with an ARCH specification. We divided inflation uncertainty into two parts, structural uncertainty and impulse uncertainty, as indicated in Evans (1991), firstly. We estimated the relationship between these types of uncertainties and spreads among riskier and safer bonds, using USA data.

The results indicate us that both structural and impulse uncertainties have significant relationship with the spreads between corporate bonds, the riskier bonds, and treasury bills, the safer bonds. Impulse uncertainty has a positive effect on spreads, which is an evidence for *'Flight to Quality'* hypothesis. As the sudden shocks hit the economy, an indication of a rise in impulse uncertainty, people have more doubts for the returns of riskier bonds than the returns of safer bonds with short-term maturity, and this leads a more flight from the riskier bonds, compared to the flight from the safer bonds. So the spread between the riskier bonds and safer bonds increase, which supports *'Flight to Quality'* hypothesis. However, structural uncertainty does not have a positive effect on spreads. This is because of the short-term maturity of the bonds. All the interest rate spreads are generated by using 3-months maturity bonds. We expect a change in the demand of these bonds due to the sudden volatilities in the economy, rather than the structural modifications. Therefore, it is anticipated not to have a positive relationship between structural uncertainty and spreads.

BIBLIOGRAPHY

Aghion, P., and P. Bolton (1993), "A Theory of Trickle-Down Growth and Development with Debt Overhang," unpublished, Nuffield College (Oxford) and LSE.

Athanassakos, G., P. Carayannopoulos (2001), "An Empirical Analysis of the Relationship of Bond Yield Spreads and Macro-economic Factors," *Applied Financial Economics* 11, 197-207.

Ball, L. and S. Cecchetti (1990), "Inflation Uncertainty at Short and Long Horizons," *Brookings Papers on Economic Activity*, 215-254.

Ball, L. (1992), "Why does High Inflation Raise Inflation Uncertainty," *Journal of Monetary Economics* 1, 371-388.

Ball, L., N. G. Mankiw, and D. Romer (1988), "The New Keynesian Economics and the Output-Inflation Trade-off," *Brookings Papers on Economic Activity,* no.1, 1-65.

Bernanke, B. and A. Blinder (1988), "Credit, Money and Aggregate Demand," *American Economic Review* 98, 435-439.

Bernanke, B. and M. Gertler (1989), "Agency Costs, Net Worth and Business Fluctuations," *American Economic Review* 79, 14-31.

Bernanke, B. and M. Gertler (1990), "Financial Fragility and Economic Performance," *Quarterly Journal of Economics* 105, 87-114.

Berument, H. (1999), "The Impact of Inflation Uncertainty on Interest Rates in the UK," *Scottish Journal of Political Economy* 46, 207-218.

Berument, Hakan, Zubeyir Kilinc and Umit Ozlale (2002), "The Missing Link Between Inflation Uncertainty and Interest Rates," unpublished, Bilkent University (Ankara, Turkey).

Berument, Hakan, Zubeyir Kilinc and Umit Ozlale (2003), "Long-Short Interest Rate Spreads and Different Inflation Risk Premiums", unpublished, Bilkent University (Ankara, Turkey).

Blanchard, O. J. and S. Fischer (1989), *Lectures on Macroeconomics*, Cambridge, Mass.: MIT Press.

Bollersev, T. (1986), "Generalized Autoregressive Conditional Heteroskedasticity, " *Journal of Econometrics* 31, 307-327.

Bomberger, T. (1996), "Disagreement as a Measure of Uncertainty," *Journal of Money, Credit, and Banking* 23(3), 381-392.

Calomiris, C. and R. G. Hubbard (1990), “Imperfect Information, Multiple Loan Markets and Credit Rationing,” *Economic Journal* 100.

Carey, M., S. Browse, J. Rea, and G. Udell (1993), “The Economics of the Private Placement Market,” preliminary staff study, Board of Governors.

Chan, L. K. C. (1994), “Consumption, Inflation Risk, and Real Interest Rates: An Empirical Analysis,” *Journal of Business* 67, 69-96.

Chow, G. C. (1984), *Econometrics*, New York: McGraw-Hill.

Corcoran, P. (1992), “The Credit Slowdown of 1989-1991: The Role of Supply and Demand,” Federal Reserve Bank of Chicago, *Proceedings of the 28th Annual Conference on Bank Structure and Competition*.

Cukierman, A. and P. Wachtel (1979), “Differential inflationary expectations and the variability of the rate of inflation,” *American Economic Review* 69, 595-609.

Cukierman, A. and P. Wachtel (1982), “Relative Price Variability and Nonuniform Inflationary Expectations,” *Journal of Political Economy* 90, 146-157.

Cukierman, A., and A. Meltzer (1986), “A Theory of Ambiguity, Credibility, and Inflation Under Discretion and Asymmetric Information,” *Econometrica* 17, 1099-1128.

Darby, M. R. (1975), “The Financial and Tax Effects of Monetary Policy on Interest Rates,” *Economic Inquiry* 13, 266-276.

Davis, G., and B. Kanago (1996), “On Measuring the Effect of Inflation Uncertainty on Real GNP,” *Oxford Economic Papers* 48, 163-175.

Duffee, G. R. (1996), “Treasury Yields and Corporate Bond Yield Spreads: An Empirical Analysis,” unpublished, Federal Reserve Board.

Duffee, G. R. (1998), “The Relation Between Treasury Yields and Corporate Bond Yield Spreads,” *Journal of Finance* 53, 2225-2240.

Duffie, D. and K. Singleton (1997), “An econometric Model of the Term Structure of Interest Rate Swap Yields,” *Journal of Finance* 52, 1287-1322.

Eichengreen, B., G. Hale, A. Mody (2000), “Flight to Quality: Investor Risk Tolerance and the Spread of Emerging Market Crises,” working paper, World Bank.

Elton, E., M. J. Gruber, D. Agrawal, C. Mann (2001), “Explaining the Rate Spread on Corporate Bonds”, *The Journal of Finance* 56, 247-277.

Evans, M. (1989), “On the Changing Nature of the Output-Inflation Tradeoff”, Working Paper, Solomon Brothers Research Center, Stern School of Business, New York University.

Evans, M. (1991), "Discovering the Link Between Inflation Rates and Inflation Uncertainty," *Journal of Money, Credit, and Banking* 23, 169-184.

Evans, M. and P. Wachtel (1993), "Inflation Regimes and the Sources of Inflation Uncertainty," *Journal of Money, Credit, and Banking* 25, 475-511.

Fama, E. (1975), "Short Term Interest Rates as Predictor of Inflation," *American Economic Review* 65, 269-282.

Fama, E. and M. Gibbons (1982), "Inflation, Real Returns and Capital Investment," *Journal of Monetary Economics* 9, 297-323.

Fama, E., and K. French (1993), "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics* 33, 3-57.

Fisher, L. (1959), "Determinants of Risk Premiums on Corporate Bonds", *Journal of Political Economy* 67, 217-230.

Friedman, M. (1977), "Nobel Lecture: Inflation and Unemployment," *Journal of Political Economy* 85, 451-472.

Froyen, R. and R. Waud (1987), "An Examination of Aggregate Price Uncertainty in Four Countries and Some Implications for Real Output," *International Economic Review*, 353-373.

Gertler, M. (1992), "Financial Capacity and Output Fluctuations in an Economy with Multiperiod Financial Relationships," *Review of Economic Studies* 59, 455-472.

Gertler, M. and S. Gilchrist (1993), "The Role of Credit Market Imperfections in the Monetary Transmission Mechanism: Arguments and Evidence," *Scandinavian Journal of Economics*, 309-340.

Hafer, R. W. (1986), "Inflation Uncertainty and a Test of the Friedman Hypothesis," *Journal of Macroeconomics*, 365-372.

Holland, S. (1986). "Wage Indexation and the Effect of Inflation Uncertainty on Real GNP," *Journal of Business*, 473-484.

Holland, S. (1988), "Indexation and the Effect of Inflation Uncertainty on Employment: An Empirical Analysis," *American Economic Review*, 235-244.

Holland, S. (1993b), "Comment on Inflation Regimes and the Sources of Inflation Uncertainty," *Journal of Money, Credit, and Banking* 27, 514-520.

Holland, S. (1995), "Inflation and Uncertainty: Test for Temporal Ordering," *Journal of Money, Credit, and Banking* 27, 827-837.

Kashyap, A. and J. Stein (1994), "Monetary Policy and Bank Lending," in N. Gregory Mankiw (ed.), *Monetary Policy* (Chicago:University of Chicago Press for NBER).

Kashyap, A., J. Stein, and D. Wilcox (1993), "Monetary Policy, and Credit Conditions: Evidence from the Composition of External Finance," *American Economic Review* 83, 78-98.

Lang, W. and L. Nakamura (1992), "'Flight to Quality' in Bank Lending and Economic Activity," unpublished, Federal Reserve Bank of Philadelphia.

Litterman, R. and T. Iben (1991), "Corporate Bond Valuation and the Term Structure of Credit Spreads," *The Journal of Portfolio Management*, 52-64.

Morgan, D. (1993), "The Lending View of Monetary Policy and Bank Loan Commitments," unpublished, Federal Reserve Bank of Kansas City.

Mullineaux, D. J. (1980), "Unemployment, Industrial Production and Inflation Uncertainty in United States," *Review of Economics and Statistics* 2, 1-32.

Oliner, S., and G. Rudebusch (1993), "Is There a Bank Credit Channel to Monetary Policy," unpublished, Board of Governors.

Platt, H., and M. Platt (1992), "Credit Risk and Yield Differentials for High Yield Bonds," *Quarterly Journal of Business and Economics* 31, 51-68.

Rodrigues, A. P. (1997), "Term Structure and Volatility Shocks," unpublished, Federal Reserve Bank of New York.

Routledge, B. R., S. E. Zin (2001), "Model Uncertainty and Liquidity," NBER Working Paper.

Severn, A. K., and W. J. Stewart (1992), "The Corporate-Treasury Yield Spread and State Taxes," *Journal of Economics and Business* 44, 161-166.

Summers, L. H. (2000), "International Financial Crises: Causes, Prevention, and Cures," *American Economic Review –Papers and Proceedings* 90(2), 1-17.

Townsend, R. (1979), "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory* 21, 265-293.

Williamson, S. (1989), "Costly Monitoring, Optimal Contracts and Liquidity Constraints; An Empirical Investigation," *Journal of Political Economy* 97, 135-146.

APPENDIX A

(MATLAB CODES FOR THE MODEL)

FUNCTION 1

```
%---------------------------------------------------
% USAGE: tvp_garchd
%---------------------------------------------------

% State-Space Models with Regime Switching

load usinf.data;


y = usinf(:,1);
n = length(y);
x = [ones(n,1) usinf(:,2:13)];
% global y;
% global x;
[n k] = size(x);


% initial values
 parm = [1.924010
0.250715
0.084523
0.099977
0.044039
0.042374
0.067159
0.029956
0.089208
0.096543
0.099444
0.034634
-0.091534
4.773617
0.147682
0.807179
];

info.b0 = zeros(k+1,1); % relatively diffuse prior
info.v0 = eye(k+1)*50;
info.prt = 1; % turn on printing of some
            %intermediate optimization results
info.start = 11; % starting observation

result = tvp_garch(y,x,parm,info)

vnames =
strvcat('inflation','constant','inflation1','inflation2','inflation3','inflation4','inflation5','inflation6','inflatio
n7','inflation8','inflation9','inflation10','inflation11','inflation12')
```

FUNCTION 2

```
function result = tvp_garch(y,x,parm,info)
% PURPOSE: time-varying parameter estimation with garch(1,1) errors
%         y(t) = X(t)*B(t) + e(t), e(t) = N(0,h(t))
%         B(t) = B(t-1) + v(t),    v(t) = N(0,sigb^2)
%         h(t) = a0 + a1*e(t-1)^2 + a2*h(t-1) ARMA(1,1) error variances
% ---------------------------------------------------------------------
% USAGE:     result = tvp_garch(y,x,parm,info);
%       or: result = tvp_garch(y,x,parm); for default options
% where: y = dependent variable vector
%       x = explanatory variable matrix
%    parm = (k+3)x1 vector of starting values
%           parm(1:k,1)   = sigb vector
%           parm(k+1,1)   = a0
%           parm(k+2,1)   = a1
%           parm(k+3,1)   = a2
%   info = a structure variable containing optimization options
%   info.b0    = a (k+1) x 1 vector with initial b values (default: zeros(k+1,1))
%   info.v0    = a (k+1)x(k+1) matrix with prior for sigb
%              (default: eye(k+1)*1e+5, a diffuse prior)
%   info.prt   = 1 for printing some intermediate results
%              = 2 for printing detailed results (default = 0)
%   info.delta = Increment in numerical derivs              [.000001]
%   info.hess  = Hessian: ['dfp'], 'bfgs', 'gn', 'marq', 'sd'
%   info.maxit = Maximium iterations                        [500]
%   info.lamda = Minimum eigenvalue of Hessian for Marquardt      [.01]
%   info.cond  = Tolerance level for condition of Hessian       [1000]
%   info.btol  = Tolerance for convergence of parm vector       [1e-4]
%   info.ftol  = Tolerance for convergence of objective function [sqrt(eps)]
%   info.gtol  = Tolerance for convergence of gradient          [sqrt(eps)]
%   info.start = starting observation (default: 2*k+1)
% ---------------------------------------------------------------------
% RETURNS: a result structure
%       result.meth   = 'tvp_garch'
%       result.sigb   = a (kx1) vector of sig beta estimates
%       result.ahat   = a (3x1) vector with a0,a1,a2 estimates
%       result.vcov   = a (k+3)x(k+3) var-cov matrix for the parameters
%       result.tstat  = a (k+3) x 1 vector of t-stats based on vcov
%       result.stdhat = a (k+3) x 1 vector of estimated std deviations
%       result.beta   = a (start:n x k) matrix of time-varying beta hats
%       result.ferror = a (start:n x 1) vector of forecast errors
%       result.fvar   = a (start:n x 1) vector for conditional variances
%       result.sigt   = a (start:n x 1) vector of arch variances
%       result.rsqr   = R-squared
%       result.rbar   = R-bar squared
%       result.yhat   = predicted values
%       result.y      = actual values
%       result.like   = log likelihood (at solution values)
%       result.iter   = # of iterations taken
%       result.start  = # of starting observation
%       result.time   = time (in seconds) for solution
% ---------------------------------------------------------------------
% NOTES: 1) to generate tvp betas based on max-lik parm vector
%          [beta ferror] = tvp_garch_filter(parm,y,x,start,b0,v0);
%       2) tvp_garch calls garch_trans(), maxlik(), tvp_garch_like, tvp_garch_filter
% ---------------------------------------------------------------------
% SEE ALSO: prt(), plt(), tvp_garch_like, tvp_garch_filter
% ---------------------------------------------------------------------
```

```
 infoz.maxit = 500;
 [n k] = size(x);
 start = 2*k+1;
 priorv0 = eye(k+1)*1e+5;
 priorb0 = zeros(k+1,1);

if nargin == 4 % we need to reset optimization defaults
if ~isstruct(info)
  error('tvp_garch: optimization options should be in a structure variable');
end;
% parse options
fields = fieldnames(info);
nf = length(fields);
  for i=1:nf
    if strcmp(fields{i},'maxit')
        infoz.maxit = info.maxit;
    elseif strcmp(fields{i},'btol')
        infoz.btol = info.btol;
    elseif strcmp(fields{i},'ftol')
        infoz.ftol = info.ftol;
    elseif strcmp(fields{i},'gtol')
        infoz.gtol = info.gtol;
    elseif strcmp(fields{i},'hess')
        infoz.hess = info.hess;
    elseif strcmp(fields{i},'cond')
        infoz.cond = info.cond;
    elseif strcmp(fields{i},'prt')
        infoz.prt = info.prt;
    elseif strcmp(fields{i},'delta')
        infoz.delta = info.delta;
    elseif strcmp(fields{i},'lambda')
        infoz.lambda = info.lambda;
    elseif strcmp(fields{i},'start')
        start = info.start;
    elseif strcmp(fields{i},'v0')
        priorv0 = info.v0;
    elseif strcmp(fields{i},'b0')
        priorb0 = info.b0;
    end;
  end;
end;


% Do maximum likelihood estimation
oresult = maxlik('tvp_garch_like',parm,infoz,y,x,start,priorb0,priorv0);
parm1 = oresult.b;
% take absolute value of standard deviations
parm1(1:k,1) = abs(parm1(1:k,1));

niter = oresult.iter;
like = -oresult.f;
time = oresult.time;

% compute numerical hessian at the solution
cov0 = inv(fdhess('tvp_garch_like',parm1,y,x,start,priorb0,priorv0));
grad = fdjac('garch_trans',parm1);
vcov = grad*cov0*grad';
stdhat = sqrt(diag(vcov));
```

```
% produce tvp beta hats,
% prediction errors and variance of forecast error,
% and garch(1,1) variance estimates
[beta ferror fvar sigt] = tvp_garch_filter(parm1,y,x,start,priorb0,priorv0);


% transform a0,a1,a2
parm1 = garch_trans(parm1);

yhat = zeros(n-start+1,1);
for i=start:n;
yhat(i-start+1,1) = x(i,:)*beta(i-start+1,:)';
end;

resid = y(start:n,1) - yhat;
sigu = resid'*resid;
tstat = parm./stdhat;

ym = y(start:n,1) - mean(y(start:n,1));
rsqr1 = sigu;
rsqr2 = ym'*ym;
result.rsqr = 1.0 - rsqr1/rsqr2; % r-squared
rsqr1 = rsqr1/(n-start);
rsqr2 = rsqr2/(n-1.0);
result.rbar = 1 - (rsqr1/rsqr2); % rbar-squared

% return results structure information
result.sigb = parm1(1:k,1);
result.ahat = parm1(k+1:k+3,1);
result.beta = beta;
result.ferror = ferror;
result.fvar = fvar;
result.sigt = sigt;
result.vcov = vcov;
result.yhat = yhat;
result.y = y;
result.resid = resid;
result.like = like;
result.time = time;
result.tstat = tstat;
result.stdhat = stdhat;
result.nobs = n;
result.nvar = k;
result.iter = niter;
result.meth = 'tvp_garch';
result.start = start;
```

FUNCTION 3

```
function result = maxlik(func,b,info,varargin)
% PURPOSE: minimize a log likelihood function
% ---------------------------------------------------------------------
% USAGE:     result = maxlike(func,b,info,varargin)
%        or: result = maxlike(func,b,[],varargin) for default options
% Where: func    = function to be minimized
%        b       = parameter vector fed to func
```

```
%        info structure containing optimization options
%        .delta  = Increment in numerical derivs                  [.000001]
%        .hess   = Hessian method: ['dfp'], 'bfgs', 'gn', 'marq', 'sd'
%        .maxit  = Maximium iterations                            [100]
%        .lambda = Minimum eigenvalue of Hessian for Marquardt     [.01]
%        .cond   = Tolerance level for condition of Hessian        [1000]
%        .btol   = Tolerance for convergence of parm vector        [1e-4]
%        .ftol   = Tolerance for convergence of objective function [sqrt(eps)]
%        .gtol   = Tolerance for convergence of gradient           [sqrt(eps)]
%        .prt    = Printing: 0 = None, 1 = Most, 2 = All           [0]
%       varargin = arguments list passed to func
% ---------------------------------------------------------------
% RETURNS: results = a structure variable with fields:
%          .b     = parameter value at the optimum
%          .hess  = numerical hessian at the optimum
%          .bhist = history of b at each iteration
%          .f     = objective function value at the optimum
%          .g     = gradient at the optimum
%          .dg    = change in gradient
%          .db    = change in b parameters
%          .df    = change in objective function
%          .iter  = # of iterations taken
%          .meth  = 'dfp', 'bfgs', 'gn', 'marq', 'sd' (from input)
%          .time  = time (in seconds) needed to find solution
% ---------------------------------------------------------------


infoz.func = func;

% set defaults

infoz.maxit = 100;
infoz.hess = 'bfgs';
infoz.prt = 0;
infoz.cond = 1000;
infoz.btol = 1e-4;
infoz.gtol = sqrt(eps);
infoz.ftol = sqrt(eps);
infoz.lambda = 0.01;
infoz.H1 = 1;
infoz.delta = .000001;
infoz.call = 'other';
infoz.step = 'stepz';
infoz.grad='numz';
hessfile = 'hessz';


if length(info) > 0
  if ~isstruct(info)
    error('maxlik: options should be in a structure variable');
end;
% parse options
fields = fieldnames(info);
nf = length(fields); xcheck = 0; ycheck = 0;
 for i=1:nf
   if strcmp(fields{i},'maxit')
        infoz.maxit = info.maxit;
    elseif strcmp(fields{i},'btol')
        infoz.btol = info.btol;
    elseif strcmp(fields{i},'gtol')
```

```
        infoz.gtol = info.gtol;
    elseif strcmp(fields{i},'ftol')
        infoz.ftol = info.ftol;
    elseif strcmp(fields{i},'hess')
        infoz.hess = info.hess;
    elseif strcmp(fields{i},'cond')
        infoz.cond = info.cond;
    elseif strcmp(fields{i},'lambda')
        infoz.lambda = info.lambda;
    elseif strcmp(fields{i},'delta')
        infoz.delta = info.delta;
    elseif strcmp(fields{i},'prt')
        infoz.prt = info.prt;
    end;
end;
else
% rely on default options
end;


lvar = length(varargin);
stat.iter = 0;
k = rows(b);
if lvar > 0
n = rows(varargin{1});
end;
convcrit = ones(4,1);
stat.Hi = [];
stat.df = 1000;
stat.db = ones(k,1)*1000;
stat.dG = stat.db;
func = fcnchk(infoz.func,lvar+2);
grad = fcnchk(infoz.grad,lvar+1);
hess = fcnchk(hessfile,lvar+2);
step = fcnchk(infoz.step,lvar+2);

stat.f = feval(func,b,varargin{:});
stat.G = feval(grad,b,infoz,stat,varargin{:});
stat.star = ' ';
stat.Hcond = 0;

%=====================================================================
%   MINIMIZATION LOOP
%=====================================================================

if infoz.prt > 0
% set up row-column formatting for mprint of intermediate results
in0.fmt = strvcat('%5d','%16.8f','%16.8f');
% this is for infoz.prt = 1 (brief information)
in1.cnames = strvcat('iteration','function value','dfunc');
in1.fmt = strvcat('%5d','%16.8f','%16.8f');
% this is for infoz.prt = 2
Vname = 'Parameter';
 for i=1:k
 tmp = ['Parameter ',num2str(i)];
 Vname = strvcat(Vname,tmp);
 end;
in2.cnames = strvcat('Estimates','dEstimates','Gradient','dGradient');
in2.rnames = Vname;
in2.fmt = strvcat('%16.8f','%16.8f','%16.8f','%16.8f');
```

```
end


if infoz.prt == 1
mprint([stat.iter stat.f stat.df],in1);
end;
if infoz.prt == 2
mprint([stat.iter stat.f stat.df],in1);
mprint([b stat.db stat.G stat.dG],in2);
end;

t0 = clock;
while all(convcrit > 0)
 % Calculate grad, hess, direc, step to get new b
 stat.iter = stat.iter + 1;
 stat = feval(hess,b,infoz,stat,varargin{:});
  stat.direc = -stat.Hi*stat.G;
  alpha  = feval(step,b,infoz,stat,varargin{:});
  stat.db = alpha*stat.direc;
  b = b + stat.db;

 % Re-evaluate function, display current status
  f0 = stat.f;     G0 = stat.G;
if strcmp(infoz.call,'other'),
  stat.f = feval(func,b,varargin{:});
  stat.G = feval(grad,b,infoz,stat,varargin{:});
else
  stat.f = feval(func,b,infoz,stat,varargin{:});
  stat.G = feval(grad,b,infoz,stat,varargin{:});
end;

% Determine changes in func, grad, and parms
  if stat.f == 0
   stat.df = 0;
else
   stat.df = f0/stat.f - 1;
end
  stat.dG = stat.G-G0;
  dbcrit = any(abs(stat.db)>infoz.btol*ones(k,1));
  dgcrit = any(abs(stat.dG)>infoz.gtol*ones(k,1));
  convcrit = [(infoz.maxit-stat.iter); (stat.df-infoz.ftol);...
   dbcrit; dgcrit];
  if stat.df < 0, error('Objective Function Increased'); end
  X(stat.iter,:) = b';

% print intermediate results
if infoz.prt == 1
mprint([stat.iter stat.f stat.df],in1);
end;
if infoz.prt == 2
mprint([stat.iter stat.f stat.df],in1);
mprint([b stat.db stat.G stat.dG],in2);
end;

end
time = etime(clock,t0);


%======================================================================
%   FINISHING STUFF
```

```
%==========================================================================

% Write a message about why we stopped

if infoz.prt > 0
 if convcrit(1) <= 0
  critmsg = 'Maximum Iterations';
elseif convcrit(2) <= 0
  critmsg =  'Change in Objective Function';
elseif convcrit(3) <= 0
    critmsg = 'Change in Parameter Vector';
elseif convcrit(4) <= 0
    critmsg = 'Change in Gradient';
end
  disp(['  CONVERGENCE CRITERIA MET: ' critmsg])
  disp(' ')
end

% put together results structure information
result.bhist = X;
result.time = time;
result.b = b;
result.g = stat.G;
result.dg = stat.dG;
result.f = stat.f;
result.df = stat.df;
result.iter = stat.iter;
result.meth = infoz.hess;
% Calculate numerical hessian at the solution
result.hess = fdhess(func,b,varargin{:});
```

FUNCTION 4

```
function llik = tvp_garch_like(parm,y,x,start,priorb0,priorv0)
% PURPOSE: log likelihood for tvp_garch model
% ------------------------------------------------------
% USAGE: llike = tvp_garch_like(parm,y,x,start,priorb0,priorv0)
% where: parm = a vector of parmaeters
%        parm(1) = sig beta 1
%        parm(2) = sig beta 2
%        .
%        .
%        .
%        parm(k) = sig beta k
%        parm(k+1) = a0
%        parm(k+2) = a1
%        parm(k+3) = a2
%        start     = # of observation to start at
%                  (default: 2*k+1)
%        priorb0 = a (k+1)x1 vector with prior for b0
%              (default: zeros(k+1,1), a diffuse prior)
%        priorv0 = a (k+1)x(k+1) matrix with prior for sigb
%              (default: eye(k+1)*1e+5, a diffuse prior)
% ---------------------------------------------------
% RETURNS: -log likelihood function value (a scalar)
% ---------------------------------------------------
```

```
[n k] = size(x);

% transform parameters
parm = garch_trans(parm);
if nargin == 3
start = 2*k+1; % use initial observations for startup
priorv0 = eye(k+1)*1e+5;
priorb0 = zeros(k+1,1);
elseif nargin == 4
priorv0 = eye(k+1)*1e+5;
priorb0 = zeros(k+1,1);
elseif nargin == 6
% do nothing
else
error('tvp_garch_like: Wrong # of input arguments');
end;


sigb = zeros(k,1);
for i=1:k;
sigb(i,1) = parm(i,1)*parm(i,1);
end;
a0 = parm(k+1,1);
a1 = parm(k+2,1);
a2 = parm(k+3,1);

ivar = a0/(1-a1-a2); % initial variance

f = eye(k+1);
f(k+1,k+1) = 0;
g = eye(k+1);
cll = priorb0;
pll = priorv0; % initial var-cov for reg coef
pll(k+1,k+1) = ivar;
htl = ivar;


loglik = zeros(n,1);

for iter = 1:n;

h = [x(iter,:) 1];

ht = a0 + a1*(cll(k+1,1)*cll(k+1,1) + pll(k+1,k+1)) + a2*htl;

tmp = [sigb
       ht];

Q = diag(tmp);

ctl = f*cll;
ptl = f*pll*f' + g*Q*g';

vt = y(iter,1) - h*ctl; % prediction error
su = h*ptl*h';
ft = h*ptl*h'+ht;      % variance of forecast error

ctt = ctl + ptl*h'*(1/ft)*vt;
```

```
ptt = ptl - ptl*h'*(1/ft)*h*ptl;


lik = (1/sqrt(2*pi*abs(ft)))*exp(-0.5*vt'*(1/ft)*vt);

loglik(iter,1) = -log(lik);


cll = ctt;
pll = ptt;
htl = ht;

end;

llik = sum(loglik(start:n,1));
```

FUNCTION 5

```
function cc1=garch_trans(cc0)
% PURPOSE: function to transform garch(1,1) a0,a1,a2 garch parameters
% ---------------------------------------------------
% USAGE: out = garch_trans(in);
% where: in is a 3x1 vector with a0,a1,a2 parameters
% ---------------------------------------------------
 % RETURNS: a 3x1 vector with:
 % a0=a0^2;
 % a1=exp(a0)/(1 + exp(a1) + exp(a2));
 % a2=exp(a0)/(1 + exp(a1) + exp(a2));
% ---------------------------------------------------


ka = length(cc0)-3;
   cc1=cc0;

    cc1(ka+1,1)=(cc0(ka+1,1))^2;
    cc1(ka+2,1)=exp(cc0(ka+2,1))/(1 + exp(cc0(ka+2,1)) + exp(cc0(ka+2,1)));
    cc1(ka+3,1)=exp(cc0(ka+3,1))/(1 + exp(cc0(ka+3,1)) + exp(cc0(ka+3,1)));
```

FUNCTION 6

```
function mprint(y,info)
% PURPOSE: print an (nobs x nvar) matrix in formatted form
%---------------------------------------------------
% USAGE:     mprint(x,info)
% where: x         = (nobs x nvar) matrix (or vector) to be printed
%        info      = a structure containing printing options
%        info.begr = beginning row to print,    (default = 1)
%        info.endr = ending row to print,       (default = nobs)
%        info.begc = beginning column to print, (default = 1
%        info.endc = ending column to print,    (default = nvar)
```

```
%       info.cnames = an (nvar x 1) string vector of names for columns (optional)
%                   e.g. info.cnames = strvcat('col1','col2');
%                   (default = no column headings)
%       info.rnames = an (nobs+1 x 1) string vector of names for rows (optional)
%                   e.g. info.rnames = strvcat('Rows','row1','row2');
%                   (default = no row labels)
%       info.fmt    = a format string, e.g., '%12.6f' or '%12d' (default = %10.4f)
%                   or an (nvar x 1) string containing formats
%                   e.g., info.fmt=strvcat('%12.6f','%12.2f','%12d'); for nvar = 3
%       info.fid    = file-id for printing results to a file
%                   (defaults to the MATLAB command window)
%                   e.g. fid = fopen('file.out','w');
%       info.rflag  = 1 for row #'s printed, 0 for no row #'s (default = 0)
%       info.width  = # of columns before wrapping occurs (default = 80)
%---------------------------------------------------
% e.g.   in.cnames = strvcat('col1','col2');
%       in.rnames = strvcat('rowlabel','row1','row2');
%       mprint(y,in), prints entire matrix, column and row headings
%       in2.endc = 3; in2.cnames = strvcat('col1','col2','col3');
%    or: mprint(y,in2), prints 3 columns of the matrix, just column headings
%    or: mprint(y), prints entire matrix, no column headings or row labels
% NOTES: - defaults are used for info-elements not specified
%       - default wrapping occurs at 80 columns, which varies depending on the
%         format you use, e.g. %10.2f will wrap after 8 columns
%---------------------------------------------------
% SEE ALSO: tsprint, mprint_d, lprint
%---------------------------------------------------


% setup defaults
fid = 1; rflag = 0; cflag = 0; rnum = 0; nfmts = 1; cwidth = 80;
[nobs nvars] = size(y);
begr = 1; endr = nobs; begc = 1; endc = nvars; fmt = '%10.4f';
if nargin == 1
% rely on defaults
elseif nargin == 2
  if ~isstruct(info)
    error('mprint: you must supply the options as a structure variable');
  end;
fields = fieldnames(info);
nf = length(fields);
for i=1:nf
    if strcmp(fields{i},'fmt')
        fmts = info.fmt;
  [nfmts junk] = size(fmts);
  if nfmts == nvars
   fmt = fmts;
  elseif nfmts == 1
   fmt = fmts;
  else
   error('mprint: wrong # of formats in string -- need nvar');
  end;
    elseif strcmp(fields{i},'fid')
        fid = info.fid;
    elseif strcmp(fields{i},'begc');
        begc = info.begc;
    elseif strcmp(fields{i},'begr');
        begr = info.begr;
    elseif strcmp(fields{i},'endc');
        endc = info.endc;
```

```
    elseif strcmp(fields{i},'endr');
        endr = info.endr;
    elseif strcmp(fields{i},'width');
      cwidth = info.width;
    elseif strcmp(fields{i},'cnames');
        cnames = info.cnames;
        cflag = 1;
    elseif strcmp(fields{i},'rnames');
        rnames = info.rnames;
        rflag = 1;
    elseif strcmp(fields{i},'rflag');
        rnum = info.rflag;
    end;
end;

else
error('Wrong # of arguments to mprint');

end; % end of if-elseif input checking


% see if the user supplied row names and set rnum
% correct her mistake if she did this
if rflag == 1
rnum = 0;
end;

% parse formats
if nfmts == 1
   f1 = strtok(fmt,'%');
   f2 = strtok(f1,'.');
    if strcmp(f1,f2)
     f2 = strtok(f2,'d');
     dflag = 1;
     fflag = 0;
    else
     tmp1 = strtok(fmt,'f');
     tmp2 = strtok(tmp1,'.');
     tmp1 = tmp1(2:length(tmp1));
     tmp2 = tmp2(2:length(tmp2));
     opoint = num2str(str2num(tmp1) - str2num(tmp2));
     decimal = opoint(1,length(opoint));
     f2 = strtok(f2,'f');
     fflag = 1;
     dflag = 0;
    end;
   f2 = str2num(f2);
   nwide = floor(cwidth/f2); % 80 columns divided by format
   nvar = endc-begc+1;
   nsets = ceil(nvar/nwide);
else %  wrapping in this case is based on widest format in the list
nwidev = zeros(nfmts,1);
nsetsv = zeros(nfmts,1);
f2v = zeros(nfmts,1);
dflagv = zeros(nfmts,1);
fflagv = zeros(nfmts,1);
decimalv = zeros(nfmts,1);
   for ii=1:nfmts;
   f1 = strtok(fmt(ii,:),'%');
   f2 = strtok(f1,'.');
```

```
   if strcmp(f1,f2)
    f2 = strtok(f2,'d');
    dflagv(ii,1) = 1;
    fflagv(ii,1) = 0;
   else
    tmp1 = strtok(fmt(ii,:),'f');
    tmp2 = strtok(tmp1,'.');
    tmp1 = tmp1(2:length(tmp1));
    tmp2 = tmp2(2:length(tmp2));
    opoint = num2str(str2num(tmp1) - str2num(tmp2));
    decimalv(ii,1) = opoint(1,length(opoint));
    f2 = strtok(f2,'f');
    fflagv(ii,1) = 1;
    dflagv(ii,1) = 0;
   end;
  f2v(ii,1) = str2num(f2);
  nwidev(ii,1) = floor(cwidth/f2v(ii,1)); % cwidth columns divided by format
  nvar = endc-begc+1;
  nsetsv(ii,1) = ceil(nvar/nwidev(ii,1));
end;
nsets = min(nsetsv);
nwide = max(nwidev);
end;

% if we have row and column labels
% adjust variable labels and column heading strings
% to match the width of the printing format

if rnum == 1
dstr = 'Obs#';
end;

if cflag == 1 % we have column headings
 [vsize nsize] = size(cnames); % error check cnames argument
 if vsize ~= nvars; error('Wrong # cnames in mprint'); end;
 if nfmts == 1 % case of only 1 format string
  nmax = max(f2,nsize); % build format strings
                    % based on widest format
  sfmt = ['%', num2str(nmax)];
  sfmt = [sfmt,'s '];
  ffmt = ['%', num2str(nmax)];
   if dflag == 1
   ffmt = [ffmt,'d '];
   elseif fflag == 1
   ffmt = [ffmt,'.'];
   ffmt = [ffmt,decimal];
   ffmt = [ffmt,'f '];
   end;
 else % we have multiple format strings, process each
 sfmtv = []; fmtv = [];
  for ii=1:nfmts % find and parse multiple formats
  nmax = max(f2v(ii,:),nsize); % build format strings
                    % based on widest format
  sfmtv{ii} = ['%', num2str(nmax)];
  sfmtv{ii} = [sfmtv{ii},'s '];
  ffmtv{ii} = ['%', num2str(nmax)];
   if dflagv(ii,1) == 1
   ffmtv{ii} = [ffmtv{ii},'d '];
   elseif fflagv(ii,1) == 1
   ffmtv{ii} = [ffmtv{ii},'.'];
```

```
   ffmtv{ii} = [ffmtv{ii},decimalv(ii,1)];
   ffmtv{ii} = [ffmtv{ii},'f '];
   end;
  end; % end of for ii loop
 end; % end of if-else
elseif cflag == 0 % we have no column headings
 if nfmts == 1 % case of only 1 format string
  nmax = f2; % augment format string with a space (the hard way)
  ffmt = ['%', num2str(nmax)];
   if dflag == 1
   ffmt = [ffmt,'d '];
   elseif fflag == 1
   ffmt = [ffmt,'.'];
   ffmt = [ffmt,decimal];
   ffmt = [ffmt,'f '];
   end;
 else % we have multiple format strings, process each
 sfmtv = []; fmtv = [];
  for ii=1:nfmts % find and parse multiple formats
  nmax = f2v(ii,:); % augment format strings with a space
  ffmtv{ii} = ['%', num2str(nmax)];
   if dflagv(ii,1) == 1
   ffmtv{ii} = [ffmtv{ii},'d '];
   elseif fflagv(ii,1) == 1
   ffmtv{ii} = [ffmtv{ii},'.'];
   ffmtv{ii} = [ffmtv{ii},decimalv(ii,1)];
   ffmtv{ii} = [ffmtv{ii},'f '];
   end;
  end; % end of for ii loop
 end; % end of if-else
end; % end of if-elseif cflag == 0,1

if rflag == 1 % we have row labels
 [vsize nsize] = size(rnames); % error check cnames argument
 if vsize ~= nobs+1; error('Wrong # rnames in mprint'); end;
 rfmt = ['%', num2str(nsize)];
 rfmt = [rfmt,'s '];
end; % end of if rflag == 1

if (rflag == 0 & cflag == 0)
    ffmt = fmt;
end;

% print matrix
for j=1:nsets;
 if nfmts == 1 % print row header and column headers
 if rnum == 1;fprintf(fid,'%5s ',dstr);
     elseif rflag == 1
  fprintf(fid,rfmt,rnames(1,:));
     end;
     if cflag == 1
    for i = (j-1)*nwide+begc:j*nwide+begc-1
  if i <= endc
% find version #;
  %[version,junk] = version; vers = str2num(version);
   %if vers == 5.2
   fprintf(fid,sfmt,strjust(cnames(i,:),'right'));
   %else
   %fprintf(fid,sfmt,strjust(cnames(i,:)));
   %end;
```

```
  end;
 end;
     end;
  fprintf(fid,'\n');
 else % we have multiple formats
 if rnum == 1;fprintf(fid,'%5s ',dstr);
    elseif rflag == 1
 fprintf(fid,rfmt,rnames(1,:));
    end;
    if cflag == 1
   for i = (j-1)*nwide+begc:j*nwide+begc-1
  if i <= endc
% find version #;
  %[version,junk] = version; vers = str2num(version);
   %if vers == 5.2
   fprintf(fid,sfmtv{i},strjust(cnames(i,:),'right'));
   %else
   %fprintf(fid,sfmtv{i},strjust(cnames(i,:)));
   %end;
  end;
   end;
    end;
 fprintf(fid,'\n');
 end; % end of if-else nfmts
 for k = begr:endr; % print row labels and numbers in matrix
  if rnum == 1; fprintf(fid,'%5d ',k);
       elseif rflag == 1
  fprintf(fid,rfmt,rnames(k+1,:));
       end;
  for l = (j-1)*nwide+begc:j*nwide+begc-1
   if l <= endc
    if nfmts == 1
    fprintf(fid,ffmt,y(k,l));
    else
    fprintf(fid,ffmtv{l},y(k,l));
    end;
   end;
  end; % end of for l
  fprintf(fid,'\n');
 end; % end of for k
fprintf(fid,'\n');
end; % end of for j
```

FUNCTION 7

```
function H = fdhess(f,x,varargin)
% PURPOSE: Computes finite difference Hessian
% -------------------------------------------------------
% Usage:  H = fdhess(func,x,varargin)
% Where: func = function name, fval = func(x,varargin)
%           x = vector of parameters (n x 1)
%    varargin = optional arguments passed to the function
% -------------------------------------------------------
% RETURNS:
%           H = finite differnce hessian
% -------------------------------------------------------
```

```
eps = 1e-5;

n = size(x,1);
fx = feval(f,x,varargin{:});

% Compute the stepsize (h)
h = eps.^(1/3)*max(abs(x),1e-2);
xh = x+h;
h = xh-x;
ee = sparse(1:n,1:n,h,n,n);

% Compute forward step
g = zeros(n,1);
for i=1:n
  g(i) = feval(f,x+ee(:,i),varargin{:});
end

H=h*h';
% Compute "double" forward step
for i=1:n
for j=i:n
  H(i,j) = (feval(f,x+ee(:,i)+ee(:,j),varargin{:})-g(i)-g(j)+fx)/H(i,j);
  H(j,i) = H(i,j);
end
end
```

FUNCTION 8

```
function [betao, ferroro, fvaro, sigto] = tvp_garch_filter(parm,y,x,start,priorb0,priorv0)
% PURPOSE: generate tvp_garch model betas, forecast errors, forecast variance
%         and garch(1,1) sigmas over time given maximum likelihood estimates
% -----------------------------------------------------------
% USAGE: [beta ferror fvar sigt ] = tvp_garch_filter(parm,y,x,start,priorb0,priorv0)
% where: parm = a vector of maximum likelihood estimates
%       y = data vector
%       x = data matrix
%    start = # of observation to start the filter
%          (default = 1)
%    priorb0 = a (k+1) x 1 vector with prior for b0
%    priorv0 = a (k+1)x(k+1) matrix with prior for sigb
%          (default: eye(k+1)*1e+5, a diffuse prior)
% -----------------------------------------------------------
% RETURNS:   beta = (Txk) matrix of tvp beta estimates
%         ferror = (Tx1) vector with forecast error and
%
%          fvar = (Tx1) vector with conditional variance
%          sigt = (Tx1) vector with garch variances
% -----------------------------------------------------------


[n k] = size(x);

% transform parameters
parm = garch_trans(parm);
```

```
if nargin == 3
start = 1;
priorb0 = zeros(k+1,1);
priorv0 = eye(k+1)*1e+5;
elseif nargin == 4
priorb0 = zeros(k+1,1);
priorv0 = eye(k+1)*1e+5;
elseif nargin == 6
% do nothing
else
error('tvp_garch_filter: Wrong # of input arguments');
end;

beta = zeros(n,k);
ferror = zeros(n,1);
fvar = zeros(n,1);
sigt = zeros(n,1);

sigb = zeros(k,1);
for i=1:k;
sigb(i,1) = parm(i,1)*parm(i,1);
end;

a0 = parm(k+1,1);
a1 = parm(k+2,1);
a2 = parm(k+3,1);
ivar = a0/(1-a1-a2);
r=0;
f = eye(k+1);
f(k+1,k+1) = 0;
g = eye(k+1);

cll = priorb0;
pll = priorv0;
pll(k+1,k+1) = ivar;
htl = ivar;


for iter = 1:n;

h = [x(iter,:) 1];

ht = a0 + a1*(cll(k+1,1)^2 + pll(14,14)) + a2*htl;

tmp = [sigb
      ht];

Q = diag(tmp);

ctl = f*cll;
ptl = f*pll*f' + g*Q*g';

vt = y(iter,1) - h*ctl; % prediction error
su = h*ptl*h';
ft = h*ptl*h' +ht;      % variance of forecast error

ctt = ctl + ptl*h'*(1/ft)*vt;
ptt = ptl - ptl*h'*(1/ft)*h*ptl;
```

```
beta(iter,:) = ctl(1:k,1)';
ferror(iter,1) = vt;
fvar(iter,1) = su;
sigt(iter,1) = ht;

cll = ctt;
pll = ptt;
htl = ht;

end;

betao = beta(start:n,:);
ferroro = ferror(start:n,1);
fvaro = fvar(start:n,1);
sigto = sigt(start:n,1);
```

FUNCTION 9

```
function stat=hessz(b,infoz,stat,varargin)
% PURPOSE: Calculate/update Inverse Hessian
% -----------------------------------------------------
% USAGE: stat=hessz(b,infoz,stat,varargin)
% Where: b          = parameter vector fed to func
%        infoz      = structure from MINZ
%        stat       = status structure from MINZ
%        varargin   = arguments list passed to func
% -----------------------------------------------------
% RETURNS: stat = updated status structure with new
%          inverse Hessian
% -----------------------------------------------------
% NOTES: Supports the following search direction algorithms:
%        *  Steepest Descent (SD)
%        *  Gauss-Newton (GN)
%        *  Levenberg-Marquardt (MARQ)
%        *  Davidon-Fletcher-Powell (DFP)
%        *  Broyden-Fletcher-Goldfarb-Shano (BFGS)
%
%=====================================================================
%   INITIALIZATIONS
%=====================================================================

k = rows(b);
lvar = length(varargin);

if strcmp(infoz.call,'gmm') | strcmp(infoz.call,'ls')
  if strcmp(infoz.call,'gmm'), wdum = 1;
  else, wdum=0; end;
  momt = fcnchk(infoz.momt,3+(lvar-1)+wdum);
  jake = fcnchk(infoz.jake,3+(lvar-1)+wdum); % was lvar + 2
  m = feval(momt,b,infoz,stat,varargin{1:lvar-wdum});
  M = feval(jake,b,infoz,stat,varargin{1:lvar-wdum});
  if strcmp(infoz.call,'gmm')
    W = varargin{lvar};
  else
    W = eye(rows(M));
  end
```

```
  gnbase = M'*W*M;
else
  gnbase = eye(k);           % Could replace with some other pd matrix
end

dG = stat.dG; db = stat.db; Hi0 = stat.Hi;

%===================================================================
%   UPDATE INVERSE HESSIAN BY CASE
%===================================================================

switch infoz.hess

case 'sd'                      % Steepest Descent
  Hi = eye(k);

case {'gn','marq'}                % GN/Marq directions
  H = gnbase;
  if strcmp(infoz.hess,'marq')      % Marquardt
%    lambda = max(infoz.lambda,min(eig(gnbase)));  % alternate criteria
    lambda = infoz.lambda;
    Hcond = cond(gnbase);
    while Hcond > infoz.cond
      H = gnbase + lambda*eye(k);
      Hcond=cond(H);
      lambda = lambda*2;           % may be a better factor for increases
    end
  end
  Hi = H\eye(k);

case {'dfp','bfgs'}              % DFP/BFGS
  if isempty(stat.Hi)
    if infoz.H1 == 1, Hi = eye(k); % Initial Hessian
    else, Hi = gnbase\eye(k); end
  else
    if db'*dG > sqrt(eps*(db'*db)*(dG'*dG))

% ------- Based on update of inverse given in Num. Recipes, p. 420 -------
      a = db*db'/(db'*dG);
      b = -Hi0*dG*dG'*Hi0'/(dG'*Hi0*dG);
      if strcmp(infoz.hess,'bfgs')            % c = [0] for DFP
        c = db/(db'*dG) - Hi0*dG/(dG'*Hi0*dG);
        c = dG'*Hi0*dG*c*c';
      else
        c=zeros(k);
      end
      Hi = Hi0 + a + b + c;
    else
      Hi = stat.Hi;
    end
  end

otherwise
  error('UNKNOWN HESSIAN TYPE')
end


%===================================================================
%   CHECK CONDITIONING AND RETURN RESULT
%===================================================================
```

```
stat.Hcond = cond(Hi);
if stat.Hcond > infoz.cond,  stat.star = '*';
else,  stat.star = ' '; end
stat.Hi = Hi;
```

FUNCTION 10

```
function fjac = fdjac(f,x,varargin)
% PURPOSE: Computes two-sided finite difference Jacobian
% -------------------------------------------------------
% Usage: fjac = fdjac(func,x,varargin)
% Where: func = name of function of form fval = func(x)
%           x = vector of parameters (n x 1)
%    varargin = optional arguments passed to the function
% -------------------------------------------------------
% RETURNS:
%        fjac = finite differnce Jacobian
% -------------------------------------------------------
% See also: fdhess, hessian
% -------------------------------------------------------

eps = 1e-5;

h = eps^(1/3)*max(abs(x),1);
for j=1:length(x);
   x1 = x; x1(j) = x(j) + h(j);
   x0 = x; x0(j) = x(j) - h(j);
   fjac(:,j) = (feval(f,x1,varargin{:})-feval(f,x0,varargin{:}))/(x1(j)-x0(j));
end
```

FUNCTION 11

```
function  G=numz(b,infoz,stat,varargin)
% PURPOSE: Evaluate numerical derivs in MINZ package
%-----------------------------------------------------------------
% USAGE:  G=numz(b,infoz,stat,varargin)
% Where
%   b:        k-vector of parms
%   infoz:    structure variable with options for MINZ
%   stat:     structure variable with status for MINZ
%   varargin: variable number of arguments needed by function
%             being differentiated (infoz.func or infoz.momt)
%-----------------------------------------------------------------

if ~isfield(infoz,'delta')
  dh=.000001;             % Sets precision of Numerical Derivs
else
  dh = infoz.delta;
```

```
end

if (strcmp(infoz.call,'ls') | strcmp(infoz.call,'gmm'))
  func = fcnchk(infoz.momt,length(varargin)+3);
  T = cols(varargin{1})*cols(varargin{3});
else
  func = fcnchk(infoz.func,length(varargin)+3);
  T = 1;
end;

k=rows(b);
e=eye(k); b0=b;
G=zeros(T,k);
for i = 1:k
  if strcmp(infoz.call,'other');
  b = b0 + e(:,i)*dh; gplus=feval(func,b,varargin{:});
  b = b0 - e(:,i)*dh; gminus=feval(func,b,varargin{:});
  else,
  b = b0 + e(:,i)*dh; gplus=feval(func,b,infoz,stat,varargin{:});
  b = b0 - e(:,i)*dh; gminus=feval(func,b,infoz,stat,varargin{:});
  end;
  G(:,i)=(gplus-gminus)/(2*dh);
end

if ~(strcmp(infoz.call,'ls') | strcmp(infoz.call,'gmm'))
  G = G';
end;
```

FUNCTION 12

```
function r = rows(x)
% PURPOSE: return rows in a matrix x
% -----------------------------------------
% USAGE: r = rows(x)
% where: x = input matrix
% -----------------------------------------
% RETURNS: r = # of rows in x
% -----------------------------------------

[r,c] = size(x);
```

FUNCTION 13

```
function alpha=step(b,infoz,stat,varargin)
% PURPOSE: Determine step size in NUMZ package
%-----------------------------------------------------------------
% USAGE: alpha=step(b,infoz,stat,varargin)
%  Where
%  b         vector of model parameters
```

```
% infoz     structure variable with settings for MINZ0
% stat      structure variable with minimization status
% varargin  Variable list of arguments passed to func
%
% RETURNS:   alpha     scalar step size
%----------------------------------------------------------------

direc = stat.direc;
alf=infoz.ftol;
fold = stat.f;
maxalpha = 10;
alpha=1;
tmpalpha=1;
go=1;
lvar = length(varargin);
func = fcnchk(infoz.func,lvar);

% I don't use this step from  Num. Recipes; it causes trouble
%sumx = sqrt(direc'*direc)
%if sumx > maxalpha
%  direc = direc*maxalpha/sumx
%end

slope = stat.G'*direc;
temp=abs(direc)./max(abs(b),1);
temp=max(temp);
test=max(temp,eps);         % Added to avoid /0 error
minalpha = infoz.btol/test;
b0 = b;

%==================================================================
%  FIND MINIMIZING STEP SIZE
%==================================================================

while go == 1
  b = b0 + alpha*direc;
  if strcmp(infoz.call,'other'),
  f = feval(func,b,varargin{:});
  else,
  f = feval(func,b,infoz,stat,varargin{:});
  end;
  if alpha < minalpha
    b = b0;
    go = 0;
    alpha = 0;
  elseif f < fold + alpha*slope*alf
    go = 0;
  else
    if alpha == 1
      tmpalpha = -slope/(2*(f-fold-slope));
    else
      rhs1 = f - fold - alpha*slope;
      rhs2 = f2 - fold2 - alpha2*slope;
      a = (rhs1/alpha^2 - rhs2/alpha2^2)/(alpha-alpha2);
      b = (-alpha2*rhs1/alpha^2 + alpha*rhs2/alpha2^2)/(alpha-alpha2);
      if a == 0
        tmpalpha = -slope/(2*b);
      else
        disc = b^2 - 3*a*slope;
        if disc < 0
```

```
          disp('Round off problem in STEP');
          disc = 0;
        end
        tmpalpha = (-b+sqrt(disc))/(3*a);
      end
      if tmpalpha > .5*alpha, tmpalpha = .5*alpha; end
    end
  end
  alpha2 = alpha;
  f2 = f;
  fold2 = fold;
  if go ~= 0, alpha = max(tmpalpha,.1*alpha); end
end
```

APPENDIX B

(DATA OF INFLATION AND RELATED INTEREST RATES)

Date	INF	SU	IU	Treasury	AAA	TreasurySec	BAA	AAA-Tre	BAA-Tres	AAA-Tres	BAA-Tre
1953.04	0.00000	250	179.5232	1.023433842	1.03213243	1.021734118	1.036331748	0.008698588	0.01459763	0.010398312	0.012897906
1953.05	0.01624	250	172.4724	1.0248	1.0334	1.0216	1.0378	0.0086	0.0162	0.0118	0.013
1953.06	0.00000	200	142.5797	1.024334315	1.033832779	1.020934865	1.038432035	0.009498464	0.01749717	0.012897914	0.01409772
1953.07	0.01617	190	129.8522	1.0238	1.0328	1.0204	1.0386	0.009	0.0182	0.0124	0.0148
1953.08	0.00000	180	136.6735	1.022635204	1.032233657	1.020235591	1.038332674	0.009598453	0.018097084	0.011998067	0.01569747
1953.09	0.01611	180	135.7876	1.02216472	1.033066477	1.018064059	1.038967428	0.010901757	0.020903369	0.015002418	0.016802708
1953.10	-0.01611	240	186.7862	1.0179	1.0316	1.0138	1.0382	0.0137	0.0244	0.0178	0.0203
1953.11	0.00000	200	149.3637	1.0167	1.0311	1.0144	1.0375	0.0144	0.0231	0.0167	0.0208
1953.12	0.00000	170	125.5305	1.016436203	1.031133834	1.0158363	1.037232852	0.014697631	0.021396552	0.015297535	0.020796649
1954.01	0.01611	150	106.2001	1.014263447	1.030766106	1.011963076	1.037267154	0.016502659	0.025304078	0.01880303	0.023003707
1954.02	-0.01611	180	136.4879	1.0114	1.0295	1.0097	1.0361	0.0181	0.0264	0.0198	0.0247
1954.03	0.00000	150	110.5274	1.0113	1.0286	1.0103	1.0351	0.0173	0.0248	0.0183	0.0238
1954.04	0.00000	130	88.9832	1.0096	1.0285	1.0097	1.0347	0.0189	0.025	0.0188	0.0251
1954.05	0.00000	110	75.5059	1.0085	1.0288	1.0076	1.0347	0.0203	0.0271	0.0212	0.0262
1954.06	0.00000	90	62.3666	1.0082	1.029	1.0064	1.0349	0.0208	0.0285	0.0226	0.0267
1954.07	0.00000	80	52.5333	1.008563134	1.02906645	1.00736294	1.035167437	0.020503316	0.027804497	0.021703511	0.026604303
1954.08	-0.01617	90	65.6136	1.008963809	1.02886704	1.009363874	1.035068047	0.019903231	0.025704173	0.019503166	0.026104238
1954.09	-0.01624	100	71.1926	1.010136001	1.028732982	1.009936034	1.03453204	0.018596981	0.024596007	0.018796948	0.024396039
1954.10	0.01624	130	95.3155	1.0117	1.0287	1.0098	1.0346	0.017	0.0248	0.0189	0.0229
1954.11	0.00000	120	84.2042	1.0114	1.0289	1.0093	1.0345	0.0175	0.0252	0.0196	0.0231
1954.12	0.00000	100	68.8174	1.0121	1.029	1.0115	1.0345	0.0169	0.023	0.0175	0.0224
1955.01	0.00000	80	56.4688	1.0139	1.0293	1.0122	1.0345	0.0154	0.0223	0.0171	0.0206
1955.02	0.00000	70	52.6739	1.0157	1.0293	1.0117	1.0347	0.0136	0.023	0.0176	0.019
1955.03	0.00000	60	43.4949	1.0159	1.0302	1.0128	1.0348	0.0143	0.022	0.0174	0.0189
1955.04	0.00000	50	36.106	1.017665221	1.030267267	1.016064961	1.035068047	0.012602046	0.019003085	0.014202306	0.017402825
1955.05	-0.01624	80	61.7181	1.018834589	1.030232738	1.014335319	1.034831992	0.011398149	0.020496672	0.015897419	0.015997403
1955.06	0.01624	120	88.2845	1.019265481	1.030667332	1.014264669	1.035268079	0.011401851	0.02100341	0.016402663	0.016002598

1955.07	-0.01624	130	94.6653	1.019869458	1.030266089	1.015670819	1.034864598	0.01039663	0.019193779	0.01459527	0.01499514
1955.08	0.03241	160	112.8419	1.023865609	1.031266806	1.019164848	1.035767534	0.007401197	0.016602685	0.012101957	0.011901925
1955.09	-0.01617	180	127.9018	1.023434461	1.031133216	1.02053493	1.035732472	0.007698755	0.015197542	0.010598286	0.012298011
1955.10	0.01617	160	109.7238	1.0239	1.031	1.0223	1.0359	0.0071	0.0136	0.0087	0.012
1955.11	0.00000	130	89.9263	1.024965787	1.03116679	1.022565399	1.035967566	0.006201003	0.013402168	0.008601391	0.01100178
1955.12	-0.01617	170	129.0479	1.027133863	1.031333183	1.02523417	1.036032423	0.004199321	0.010798253	0.006099013	0.008898561
1956.01	0.01617	170	122.8767	1.0258	1.0311	1.0241	1.036	0.0053	0.0119	0.007	0.0102
1956.02	0.00000	150	99.5235	1.0249	1.0308	1.0232	1.0358	0.0059	0.0126	0.0076	0.0109
1956.03	0.00000	120	81.6396	1.025934672	1.030833883	1.022335252	1.035833077	0.00489921	0.013497825	0.00849863	0.009898405
1956.04	0.01611	110	68.2564	1.028870233	1.032069207	1.025671258	1.036467798	0.003198975	0.01079654	0.006397949	0.007597565
1956.05	0.03205	210	142.2905	1.029235966	1.032635424	1.025936492	1.037134707	0.003399458	0.011198215	0.006698932	0.007898741
1956.06	0.01594	190	114.9929	1.0274	1.0326	1.0249	1.0376	0.0052	0.0127	0.0077	0.0102
1956.07	0.00000	160	108.1946	1.027436852	1.032636026	1.022937566	1.037835201	0.005199174	0.014897634	0.00969846	0.010398349
1956.08	0.01588	130	101.2394	1.030836908	1.034136386	1.025837699	1.039135595	0.003299478	0.013297896	0.008298687	0.008298687
1956.09	0.01582	110	82.1292	1.0335	1.0356	1.0284	1.0407	0.0021	0.0123	0.0072	0.0072
1956.10	0.00000	90	66.659	1.032637216	1.035736728	1.028837815	1.041535814	0.003099511	0.012697998	0.006898912	0.008898597
1956.11	0.01576	80	54.8899	1.034237554	1.036737161	1.02973826	1.042236297	0.002499607	0.012498037	0.006998901	0.007998744
1956.12	0.01571	70	45.7965	1.036637763	1.037337654	1.031938499	1.043536684	0.00069989	0.011598185	0.005399155	0.00689892
1957.01	0.01565	60	40.7641	1.033538829	1.037538206	1.030939235	1.044737083	0.003999376	0.013797848	0.006598971	0.011198254
1957.02	0.01559	60	34.6225	1.0338	1.0367	1.031	1.0447	0.0029	0.0137	0.0057	0.0109
1957.03	0.00000	70	52.4616	1.034039328	1.036438955	1.030639856	1.044137759	0.002399627	0.013497903	0.005799099	0.010098431
1957.04	0.01554	70	49.9132	1.034739792	1.036539514	1.030540443	1.044238322	0.001799721	0.013697879	0.005999071	0.009498529
1957.05	0.01548	80	68.5516	1.034640377	1.037239976	1.030441025	1.045038773	0.002599599	0.014597748	0.006798951	0.010398396
1957.06	0.01543	70	58.668	1.036340681	1.038940281	1.032741234	1.046139174	0.0025996	0.01339794	0.006199047	0.009798494
1957.07	0.01537	60	47.5769	1.0381	1.0399	1.0316	1.0473	0.0018	0.0157	0.0083	0.0092
1957.08	0.00000	60	45.6732	1.0401	1.041	1.0337	1.0482	0.0009	0.0145	0.0073	0.0081
1957.09	0.00000	60	51.8313	1.040540599	1.041040523	1.035141426	1.049139282	0.000499923	0.013997856	0.005899096	0.008598683
1957.10	0.01532	60	46.6491	1.039941251	1.040841114	1.035641907	1.049739755	0.000899863	0.014097848	0.005199206	0.009798504
1957.11	0.01527	60	49.5184	1.035542476	1.0406417	1.032942872	1.050740164	0.005099224	0.017797293	0.007698829	0.015197688
1957.12	0.01521	60	44.0924	1.031643617	1.037942662	1.030243829	1.050140813	0.006299045	0.019896984	0.007698833	0.018497196
1958.01	0.01516	60	43.3314	1.026190506	1.035687642	1.02409114	1.047983934	0.009497136	0.023892794	0.011596503	0.021793427
1958.02	0.03016	80	65.4642	1.0199	1.0359	1.0153	1.0466	0.016	0.0313	0.0206	0.0267
1958.03	0.00000	110	83.9123	1.0184	1.0363	1.013	1.0468	0.0179	0.0338	0.0233	0.0284
1958.04	0.00000	100	77.5489	1.0145	1.036	1.0113	1.0467	0.0215	0.0354	0.0247	0.0322

1958.05	0.00000	80	65.3035	1.0137	1.0357	1.0091	1.0462	0.022	0.0371	0.0266	0.0325
1958.06	0.00000	70	54.0888	1.0123	1.0357	1.0083	1.0455	0.0234	0.0372	0.0274	0.0332
1958.07	0.00000	60	46.157	1.0161	1.0367	1.0091	1.0453	0.0206	0.0362	0.0276	0.0292
1958.08	0.00000	50	44.8595	1.025	1.0385	1.0169	1.0467	0.0135	0.0298	0.0216	0.0217
1958.09	0.00000	60	44.6249	1.030345432	1.040743872	1.024246347	1.048542702	0.01039844	0.024296355	0.016497525	0.01819727
1958.10	0.01500	60	46.4075	1.0319	1.0411	1.0263	1.0492	0.0092	0.0229	0.0148	0.0173
1958.11	0.00000	50	39.3324	1.031	1.0409	1.0267	1.0487	0.0099	0.022	0.0142	0.0177
1958.12	0.00000	50	36.7613	1.0329	1.0408	1.0277	1.0485	0.0079	0.0208	0.0131	0.0156
1959.01	0.00000	50	31.4926	1.0336	1.0412	1.0282	1.0487	0.0076	0.0205	0.013	0.0151
1959.02	0.00000	30	27.3361	1.0354	1.0414	1.027	1.0489	0.006	0.0219	0.0144	0.0135
1959.03	0.00000	30	24.1165	1.0361	1.0413	1.028	1.0485	0.0052	0.0205	0.0133	0.0124
1959.04	0.00000	20	20.9666	1.037044963	1.0421442	1.029346114	1.048443259	0.005099238	0.019097145	0.012798087	0.011398296
1959.05	0.01495	40	31.7433	1.039445137	1.043544526	1.028246805	1.049443647	0.004099389	0.021196842	0.015297721	0.00999851
1959.06	0.01490	40	32.2924	1.0407	1.0446	1.0321	1.0504	0.0039	0.0183	0.0125	0.0097
1959.07	0.00000	40	33.4463	1.043745028	1.044544909	1.031846795	1.050644004	0.000799881	0.018797209	0.012698115	0.006898976
1959.08	0.01485	40	31.9555	1.044045512	1.044145497	1.03364705	1.05074452	9.99852E-05	0.01709747	0.010498447	0.006699009
1959.09	0.01480	50	34.7079	1.05	1.0452	1.0404	1.0518	-0.0048	0.0114	0.0048	0.0018
1959.10	0.00000	40	32.9098	1.048	1.0457	1.0405	1.0528	-0.0023	0.0123	0.0052	0.0048
1959.11	0.00000	40	31.3296	1.0481	1.0456	1.0415	1.0526	-0.0025	0.0111	0.0041	0.0045
1959.12	0.00000	40	29.9873	1.0514	1.0458	1.0449	1.0528	-0.0056	0.0079	0.0009	0.0014
1960.01	0.00000	40	32.0367	1.0503	1.0461	1.0435	1.0534	-0.0042	0.0099	0.0026	0.0031
1960.02	0.00000	30	28.6701	1.046445682	1.04544583	1.039446714	1.05324468	-0.000999853	0.013797965	0.005999115	0.006798997
1960.03	0.01475	40	33.0909	1.040047145	1.044746454	1.032948188	1.052345337	0.004699309	0.019397149	0.011798266	0.012298193
1960.04	0.01470	40	29.5925	1.0404	1.0445	1.0323	1.052	0.0041	0.0197	0.0122	0.0116
1960.05	0.00000	40	27.8189	1.0421	1.0446	1.0329	1.0528	0.0025	0.0199	0.0117	0.0107
1960.06	0.00000	30	26.5349	1.0336	1.0445	1.0246	1.0526	0.0109	0.028	0.0199	0.019
1960.07	0.00000	30	26.485	1.032	1.0441	1.023	1.0522	0.0121	0.0292	0.0211	0.0202
1960.08	0.00000	30	22.6655	1.029199005	1.042495117	1.022700906	1.050492778	0.013296111	0.027791872	0.019794211	0.021293773
1960.09	0.02925	120	104.5679	1.0307	1.0425	1.0248	1.0501	0.0118	0.0253	0.0177	0.0194
1960.10	0.00000	120	92.8884	1.0304	1.043	1.023	1.0511	0.0126	0.0281	0.02	0.0207
1960.11	0.00000	100	79.6734	1.0308	1.0431	1.0237	1.0508	0.0123	0.0271	0.0194	0.02
1960.12	0.00000	80	67.311	1.0286	1.0435	1.0225	1.051	0.0149	0.0285	0.021	0.0224
1961.01	0.00000	70	57.6434	1.0281	1.0432	1.0224	1.051	0.0151	0.0286	0.0208	0.0229
1961.02	0.00000	60	49.8322	1.0293	1.0427	1.0242	1.0507	0.0134	0.0265	0.0185	0.0214

1961.03	0.00000	50	40.7984	1.0288	1.0422	1.0239	1.0502	0.0134	0.0263	0.0183	0.0214
1961.04	0.00000	40	35.6544	1.0288	1.0425	1.0229	1.0501	0.0137	0.0272	0.0196	0.0213
1961.05	0.00000	40	34.8475	1.028550354	1.042548317	1.022751197	1.049947241	0.013997963	0.027196043	0.01979712	0.021396887
1961.06	0.01455	50	43.3954	1.0306	1.0433	1.0233	1.0503	0.0127	0.027	0.02	0.0197
1961.07	0.00000	60	46.1707	1.029050781	1.043948621	1.022251767	1.050747635	0.01489784	0.028495868	0.021696854	0.021696854
1961.08	0.01450	70	56.0481	1.0306	1.0445	1.0239	1.0511	0.0139	0.0272	0.0206	0.0205
1961.09	0.00000	50	46.1119	1.0306	1.0445	1.0228	1.0512	0.0139	0.0284	0.0217	0.0206
1961.10	0.00000	50	39.5375	1.0305	1.0442	1.023	1.0513	0.0137	0.0283	0.0212	0.0208
1961.11	0.00000	40	34.2209	1.0307	1.0439	1.0248	1.0511	0.0132	0.0263	0.0191	0.0204
1961.12	0.00000	30	29.6688	1.031650902	1.04404911	1.02585174	1.050848127	0.012398208	0.024996387	0.01819737	0.019197226
1962.01	0.01445	40	34.1754	1.032651252	1.04404961	1.027052059	1.05064866	0.011398358	0.023596601	0.016997552	0.017997408
1962.02	0.01440	40	34.2196	1.0328	1.0442	1.0273	1.0507	0.0114	0.0234	0.0169	0.0179
1962.03	0.00000	40	34.1849	1.0306	1.0439	1.0272	1.0504	0.0133	0.0232	0.0167	0.0198
1962.04	0.00000	40	34.1106	1.0299	1.0433	1.0273	1.0502	0.0134	0.0229	0.016	0.0203
1962.05	0.00000	40	28.9725	1.0303	1.0428	1.0269	1.05	0.0125	0.0231	0.0159	0.0197
1962.06	0.00000	30	26.4508	1.030152103	1.042650308	1.027152533	1.050049246	0.012498206	0.022896713	0.015497775	0.019897143
1962.07	0.01436	40	33.951	1.032752218	1.043250716	1.029052747	1.0503497	0.010498498	0.021296953	0.014197968	0.017597482
1962.08	0.01431	50	36.1633	1.032	1.0435	1.0282	1.0506	0.0115	0.0224	0.0153	0.0186
1962.09	0.00000	50	36.7987	1.0306	1.0432	1.0278	1.0503	0.0126	0.0225	0.0154	0.0197
1962.10	0.00000	40	32.1399	1.0298	1.0428	1.0274	1.0499	0.013	0.0225	0.0154	0.0201
1962.11	0.00000	30	28.9909	1.03	1.0425	1.0283	1.0496	0.0125	0.0213	0.0142	0.0196
1962.12	0.00000	30	27.2692	1.029953102	1.042251348	1.028553302	1.049050379	0.012298246	0.020497077	0.013698046	0.019097276
1963.01	0.01426	40	35.1325	1.0304	1.0421	1.0291	1.0491	0.0117	0.02	0.013	0.0187
1963.02	0.00000	40	33.874	1.0301	1.0419	1.0292	1.0489	0.0118	0.0197	0.0127	0.0188
1963.03	0.00000	40	31.0711	1.0303	1.0419	1.0289	1.0488	0.0116	0.0199	0.013	0.0185
1963.04	0.00000	30	27.7792	1.030953441	1.041951877	1.028853739	1.048550939	0.010998436	0.0196972	0.013098138	0.017597498
1963.05	0.01422	40	33.2636	1.031053905	1.042052346	1.029154174	1.048351454	0.010998442	0.01919728	0.012898172	0.017297549
1963.06	0.01417	40	32.1616	1.031854267	1.042152812	1.029754564	1.048251951	0.010298545	0.018497388	0.012398249	0.016397684
1963.07	0.01412	50	36.8193	1.03494617	1.042747271	1.031945746	1.048548091	0.007801102	0.016602345	0.010801526	0.013601921
1963.08	-0.01412	70	60.2709	1.035153801	1.042752728	1.033054098	1.048151965	0.007598927	0.015097868	0.00969863	0.012998164
1963.09	0.01412	90	68.272	1.0357	1.0431	1.0338	1.0484	0.0074	0.0146	0.0093	0.0127
1963.10	0.00000	70	57.4122	1.03625412	1.043053163	1.034354387	1.048152445	0.006799043	0.013798058	0.008698775	0.011898325
1963.11	0.01408	60	48.9452	1.0374	1.0433	1.0352	1.0484	0.0059	0.0132	0.0081	0.011
1963.12	0.00000	60	43.9932	1.0381	1.0435	1.0352	1.0485	0.0054	0.0133	0.0083	0.0104

1964.01	0.00000	50	38.2194	1.0379	1.0439	1.0352	1.0483	0.006	0.0131	0.0087	0.0104
1964.02	0.00000	40	32.8029	1.037654395	1.043453581	1.035154746	1.048152922	0.005799186	0.012998176	0.008298835	0.010498527
1964.03	0.01403	40	30.9661	1.0391	1.0438	1.0354	1.0483	0.0047	0.0129	0.0084	0.0092
1964.04	0.00000	40	30.3001	1.0391	1.044	1.0347	1.0485	0.0049	0.0138	0.0093	0.0094
1964.05	0.00000	40	29.8712	1.0384	1.0441	1.0348	1.0485	0.0057	0.0137	0.0093	0.0101
1964.06	0.00000	30	25.7725	1.038154794	1.043953983	1.034655283	1.048353367	0.005799189	0.013698084	0.009298699	0.010198574
1964.07	0.01399	40	28.3683	1.0372	1.044	1.0346	1.0483	0.0068	0.0137	0.0094	0.0111
1964.08	0.00000	40	27.7318	1.0374	1.0441	1.035	1.0482	0.0067	0.0132	0.0091	0.0108
1964.09	0.00000	30	26.1895	1.038255246	1.044054437	1.035155678	1.04805388	0.005799191	0.012898202	0.008898759	0.009798634
1964.10	0.01394	50	37.5028	1.038455681	1.044054903	1.035556084	1.047954361	0.005599222	0.012398277	0.008498819	0.00949868
1964.11	0.01390	50	39.5295	1.0391	1.0443	1.0364	1.0481	0.0052	0.0117	0.0079	0.009
1964.12	0.00000	40	33.8023	1.0402	1.0444	1.0384	1.0481	0.0042	0.0097	0.006	0.0079
1965.01	0.00000	40	29.8914	1.0394	1.0443	1.0381	1.048	0.0049	0.0099	0.0062	0.0086
1965.02	0.00000	30	26.021	1.040155906	1.04395538	1.039156045	1.047654867	0.003799474	0.008498823	0.004799335	0.007498961
1965.03	0.01385	40	28.9763	1.040456323	1.044055826	1.039156502	1.047655329	0.003599503	0.008498826	0.004899323	0.007199006
1965.04	0.01381	40	30.0179	1.040256806	1.044156269	1.039156957	1.04785576	0.003899463	0.008698803	0.004999312	0.007598954
1965.05	0.01377	40	30.4509	1.0403	1.0444	1.0389	1.0481	0.0041	0.0092	0.0055	0.0078
1965.06	0.00000	40	26.9881	1.0399	1.0446	1.038	1.0485	0.0047	0.0105	0.0066	0.0086
1965.07	0.00000	30	23.4826	1.0398	1.0448	1.0384	1.0488	0.005	0.0104	0.0064	0.009
1965.08	0.00000	30	22.8654	1.040557217	1.044756641	1.038257532	1.048656106	0.004199424	0.010398573	0.006499108	0.008098889
1965.09	0.01372	30	23.0737	1.041857489	1.045057051	1.039057872	1.048956518	0.003199562	0.009898646	0.005999179	0.007099029
1965.10	0.01368	30	24.3016	1.0428578	1.045457445	1.040158168	1.049156941	0.002599646	0.008998773	0.005299277	0.006299141
1965.11	0.01364	30	25.1986	1.0437	1.046	1.0409	1.0495	0.0023	0.0086	0.0051	0.0058
1965.12	0.00000	30	23.0528	1.04691583	1.046515939	1.043516753	1.049915016	-0.000399891	0.006398263	0.002999186	0.002999186
1966.01	0.02714	90	72.3637	1.048658343	1.047258532	1.045758735	1.0504581	-0.001399811	0.004699365	0.001499797	0.001799757
1966.02	0.01351	80	61.3508	1.049258702	1.047658917	1.046359092	1.051058459	-0.001599785	0.004699367	0.001299825	0.001799758
1966.03	0.01347	70	52.1314	1.049559098	1.049059165	1.045759608	1.053058628	-0.000499933	0.00729902	0.003299557	0.00349953
1966.04	0.01342	60	50.8006	1.049	1.0496	1.0462	1.0541	0.0006	0.0079	0.0034	0.0051
1966.05	0.00000	60	49.899	1.049159586	1.049659519	1.046259974	1.05465885	0.000499933	0.008398876	0.003399545	0.005499264
1966.06	0.01338	60	44.6125	1.049420393	1.050420127	1.044721645	1.055518768	0.000999734	0.010797123	0.005698482	0.006098375
1966.07	0.02664	70	53.629	1.051560553	1.051460567	1.047861044	1.056659877	-9.99867E-05	0.008798833	0.003599523	0.005099324
1966.08	0.01326	60	43.8076	1.055260489	1.052960793	1.049461256	1.058160105	-0.002299696	0.00869885	0.003499537	0.002899617
1966.09	0.01322	50	36.6786	1.0582	1.0549	1.0537	1.0609	-0.0033	0.0072	0.0012	0.0027
1966.10	0.00000	50	35.6419	1.0558	1.0541	1.0535	1.061	-0.0017	0.0075	0.0006	0.0052

1966.11	0.00000	50	39.618	1.0554	1.0535	1.0532	1.0613	-0.0019	0.0081	0.0003	0.0059
1966.12	0.00000	60	43.2097	1.05186136	1.05376111	1.049461677	1.061660069	0.00189975	0.012198392	0.004299433	0.009798708
1967.01	0.01318	50	37.3307	1.0475	1.052	1.0472	1.0597	0.0045	0.0125	0.0048	0.0122
1967.02	0.00000	50	45.0942	1.046962423	1.050162003	1.045462621	1.058060965	0.00319958	0.012598345	0.004699382	0.011098542
1967.03	0.01314	50	39.7505	1.0435	1.0513	1.0426	1.0585	0.0078	0.0159	0.0087	0.015
1967.04	0.00000	40	37.0474	1.040827695	1.050825079	1.038128401	1.058023196	0.009997384	0.019894795	0.012696678	0.017195501
1967.05	0.02616	80	59.7891	1.04136439	1.052262971	1.035865106	1.059462033	0.010898581	0.023596927	0.016397865	0.018097643
1967.06	0.01302	80	55.0762	1.044664367	1.054263121	1.035265587	1.061362199	0.009598754	0.026096612	0.018997533	0.016697832
1967.07	0.01298	60	47.1278	1.049964085	1.055663348	1.041965121	1.062462467	0.005699262	0.020497347	0.013698227	0.012498382
1967.08	0.01294	60	50.4131	1.051164334	1.056063702	1.042565444	1.063162786	0.004899368	0.020597342	0.013498258	0.011998451
1967.09	0.01291	50	42.5912	1.052129624	1.056228571	1.043931731	1.063726644	0.004098947	0.019794913	0.01229684	0.01159702
1967.10	0.02570	90	68.6013	1.053565226	1.05806465	1.045466262	1.065063755	0.004499424	0.019597493	0.012598388	0.011498529
1967.11	0.01279	70	56.775	1.055965316	1.060564729	1.047166438	1.0670639	0.004599413	0.019897462	0.013398291	0.011098584
1967.12	0.01275	60	46.4947	1.056965583	1.061764972	1.049566524	1.069164032	0.00479939	0.019597508	0.012198449	0.012198449
1968.01	0.01272	50	38.1801	1.05416633	1.061565392	1.049866875	1.068264543	0.007399062	0.018397667	0.011698517	0.014098212
1968.02	0.01268	40	31.7031	1.053966745	1.060865872	1.049667288	1.067864987	0.006899128	0.018197699	0.011198584	0.013898243
1968.03	0.01264	40	27.2569	1.055666917	1.060966249	1.051567434	1.068365316	0.005299332	0.016797882	0.009398815	0.012698399
1968.04	0.01261	30	23.8141	1.056834694	1.061833439	1.053535523	1.069431532	0.004998745	0.015896009	0.008297917	0.012596838
1968.05	0.02510	50	38.6786	1.061135146	1.062434821	1.056336344	1.070032925	0.001299676	0.013696581	0.006098478	0.008897779
1968.06	0.02496	50	39.4865	1.059668324	1.062667951	1.055068895	1.070566969	0.002999627	0.015498074	0.007599056	0.010898646
1968.07	0.01243	50	35.0983	1.056369108	1.062268377	1.052969529	1.06966746	0.005899269	0.016697931	0.009298848	0.013298352
1968.08	0.01239	40	30.439	1.054039906	1.059938451	1.050640745	1.067936477	0.005898544	0.017295732	0.009297706	0.013896571
1968.09	0.02468	50	39.7904	1.054370465	1.059569826	1.051770784	1.067768819	0.005199361	0.015998035	0.007799042	0.013398354
1968.10	0.01229	50	35.4915	1.055441761	1.060640489	1.053242299	1.068138655	0.005198728	0.014896355	0.00739819	0.012696893
1968.11	0.02447	50	34.3335	1.057371189	1.061770653	1.054371555	1.069969654	0.004399464	0.0155981	0.007399099	0.012598465
1968.12	0.01218	40	31.1324	1.061771015	1.064370699	1.059471294	1.072169752	0.002599684	0.012698457	0.004899405	0.010398737
1969.01	0.01215	40	29.3998	1.063014745	1.065513839	1.061015469	1.072811194	0.002499094	0.011795725	0.00449837	0.00979645
1969.02	0.03624	90	68.0626	1.063844739	1.066344139	1.060945434	1.072742604	0.0024994	0.011797169	0.005398705	0.008897865
1969.03	0.02399	80	55.3001	1.063272965	1.068372355	1.060073347	1.074971567	0.005099391	0.01489822	0.008299008	0.011698602
1969.04	0.01195	70	53.9539	1.062347193	1.068645694	1.06084755	1.075144148	0.006298501	0.014296598	0.007798144	0.012796955
1969.05	0.02380	60	46.8471	1.063948192	1.067647316	1.060149091	1.074945589	0.003699125	0.014796498	0.007498225	0.010997397
1969.06	0.02367	50	42.1564	1.070273863	1.069673934	1.06427457	1.076873085	-0.000599929	0.012598515	0.005399364	0.006599222
1969.07	0.01179	60	46.7094	1.075747464	1.070548684	1.069748872	1.0781469	-0.00519878	0.008398029	0.000799812	0.002399437
1969.08	0.02348	50	39.6793	1.075148961	1.069450292	1.069550268	1.078348214	-0.005698669	0.008797946	-9.99767E-05	0.003199253

1969.09	0.02335	50	33.8741	1.077949653	1.071151232	1.070651348	1.080249119	-0.006798421	0.009597771	0.000499884	0.002299466
1969.10	0.02322	40	29.1526	1.0761514	1.073052116	1.069752878	1.081950061	-0.003099284	0.012197182	0.003299238	0.00579866
1969.11	0.02310	40	25.3378	1.078652141	1.073253381	1.072153634	1.082251314	-0.005398759	0.01009768	0.001099747	0.003599173
1969.12	0.02298	30	22.1817	1.081452805	1.076953834	1.077953605	1.086251708	-0.004498972	0.008298103	-0.000999771	0.004798903
1970.01	0.02286	30	19.9631	1.080754258	1.07885469	1.078454781	1.088352531	-0.001899568	0.009897749	0.000399909	0.007598272
1970.02	0.02274	30	18.3099	1.075656691	1.079055922	1.071057732	1.087554	0.003399231	0.016496269	0.007998191	0.011897309
1970.03	0.02262	20	16.6267	1.069579504	1.078278524	1.066179887	1.086177634	0.00869902	0.019997747	0.012098637	0.01659813
1970.04	0.01127	40	27.8112	1.070359766	1.078058038	1.064861	1.086756086	0.007698272	0.021895086	0.013197038	0.01639632
1970.05	0.02244	30	24.5338	1.077379562	1.08097916	1.06828058	1.089678188	0.003599598	0.021397608	0.01269858	0.012298625
1970.06	0.01118	40	31.7535	1.075380095	1.084679058	1.066681064	1.092378199	0.009298963	0.025697135	0.017997993	0.016998105
1970.07	0.01115	40	34.2196	1.070762134	1.084159158	1.064263578	1.093757026	0.013397024	0.029493448	0.01989558	0.022994892
1970.08	0.02221	40	29.8298	1.06956361	1.081061069	1.063864869	1.094158174	0.011497459	0.030293305	0.017196199	0.024594564
1970.09	0.02210	40	26.2279	1.067065356	1.080662366	1.060966697	1.093659508	0.01359701	0.032692811	0.019695669	0.026594152
1970.10	0.02199	30	23.8362	1.064067194	1.080063694	1.058868332	1.093060851	0.0159965	0.034192519	0.021195363	0.028993657
1970.11	0.02188	30	21.2557	1.054985025	1.080382257	1.052685276	1.093680808	0.025397232	0.040995532	0.027696982	0.038695783
1970.12	0.01090	30	22.5515	1.05	1.0764	1.0487	1.0912	0.0264	0.0425	0.0277	0.0412
1971.01	0.00000	60	46.4558	1.045586335	1.073483302	1.044286476	1.087281802	0.027896967	0.042995326	0.029196826	0.041695467
1971.02	0.01087	50	38.5051	1.038787356	1.070683897	1.036887562	1.083782477	0.031896541	0.046894915	0.033796335	0.044995121
1971.03	0.01084	40	34.3648	1.036676008	1.071868404	1.033576678	1.084365704	0.035192396	0.050789026	0.038291726	0.047689696
1971.04	0.02161	40	32.5724	1.042775806	1.072269465	1.038376751	1.084266885	0.029493659	0.045890134	0.033892713	0.04149108
1971.05	0.02150	40	30.0348	1.050287513	1.075184847	1.041288477	1.086083679	0.024897333	0.044795202	0.03389637	0.035796166
1971.06	0.01071	40	27.4917	1.056287149	1.076285012	1.0473881	1.087383827	0.019997863	0.039995727	0.028896913	0.031096678
1971.07	0.01068	30	23.7186	1.060287	1.076285294	1.053887682	1.087484101	0.015998295	0.033596419	0.022397613	0.027197101
1971.08	0.01066	30	20.8765	1.057887531	1.075785628	1.049288445	1.087484385	0.017898097	0.038195939	0.026497183	0.029596853
1971.09	0.01063	20	18.4675	1.053988219	1.074286067	1.046788983	1.085784847	0.020297847	0.038995864	0.027497084	0.031796628
1971.10	0.01061	20	17.1365	1.048989021	1.073786397	1.044489497	1.084685244	0.024797377	0.040195747	0.0292969	0.035696223
1971.11	0.01058	20	15.6023	1.046589544	1.07248681	1.042090018	1.083685628	0.025897267	0.04159561	0.030396792	0.037096085
1971.12	0.01055	20	14.4843	1.045780059	1.072274487	1.0398813	1.083572111	0.026494428	0.043690811	0.032393187	0.037792052
1972.01	0.02103	30	20.5055	1.0428	1.0719	1.0338	1.0823	0.0291	0.0485	0.0381	0.0395
1972.02	0.00000	50	37.1779	1.042590762	1.072587619	1.031891883	1.082186613	0.029996857	0.05029473	0.040695736	0.039595851
1972.03	0.01048	40	30.8796	1.046590607	1.072287921	1.037191589	1.082286876	0.025697314	0.045095286	0.035096332	0.035696269
1972.04	0.01045	30	26.2429	1.049490567	1.072888127	1.03699187	1.082287147	0.02339756	0.045295277	0.035896257	0.03279658
1972.05	0.01043	30	22.3935	1.046291162	1.072888395	1.03679215	1.082187428	0.026597233	0.045395278	0.036096245	0.035896266
1972.06	0.01040	20	19.2484	1.049191121	1.072188735	1.03899218	1.081887728	0.022997613	0.042895549	0.033196555	0.032696607

1972.07	0.01038	20	17.0583	1.04938298	1.071878328	1.039585006	1.082076219	0.022495348	0.042491213	0.032293322	0.032693239
1972.08	0.02068	40	30.6456	1.049691844	1.071789568	1.040092834	1.081788537	0.022097723	0.041695704	0.031696734	0.032096693
1972.09	0.01030	30	26.3089	1.054983369	1.071979879	1.046385135	1.080678093	0.01699651	0.034292958	0.025594744	0.025694724
1972.10	0.02053	40	33.3504	1.055092056	1.071990328	1.047292854	1.080489458	0.016898271	0.033196604	0.024697473	0.025397402
1972.11	0.01023	40	28.321	1.052485404	1.070981633	1.047586403	1.079679859	0.018496229	0.032093456	0.02339523	0.027194455
1972.12	0.02039	40	32.1336	1.054879255	1.070474514	1.050380623	1.07897193	0.015595258	0.028591307	0.02009389	0.024092674
1973.01	0.03041	70	57.1835	1.058474358	1.071069294	1.053676288	1.078566279	0.012594935	0.024889991	0.017393006	0.02009192
1973.02	0.04021	120	94.2659	1.061582406	1.071879325	1.05568417	1.079377082	0.010296919	0.023692912	0.016195155	0.017794676
1973.03	0.02992	110	80.0879	1.06828815	1.072687277	1.060689656	1.08008581	0.004399128	0.019396154	0.011997621	0.01179766
1973.04	0.01983	90	67.5327	1.068184058	1.072282846	1.062285803	1.080580391	0.004098788	0.018294589	0.009997043	0.012396333
1973.05	0.02958	80	62.483	1.0689	1.0729	1.0636	1.0806	0.004	0.017	0.0093	0.0117
1973.06	0.00000	140	112.985	1.07226468	1.072864213	1.071065614	1.080458297	0.000599533	0.009392683	0.001798599	0.008193617
1973.07	0.07790	510	414.987	1.08369129	1.0742931	1.079892021	1.082191578	-0.00939819	0.002299557	-0.005598922	-0.001499711
1973.08	0.01926	440	325.7043	1.08778377	1.07638813	1.086284343	1.084884879	-0.01139564	-0.001399465	-0.009896213	-0.002898891
1973.09	0.03826	340	257.2751	1.082791638	1.075993574	1.082591695	1.085990727	-0.006798064	0.003399032	-0.006598121	0.003199089
1973.10	0.02848	250	202.3855	1.073595436	1.075594683	1.071796114	1.083691632	0.001999247	0.011895517	0.003798569	0.010096195
1973.11	0.03768	200	160.5112	1.075198435	1.076197968	1.077797222	1.083694471	0.000999534	0.005897249	-0.001599254	0.008496037
1973.12	0.04665	220	151.9294	1.072205146	1.076303255	1.074004316	1.084299565	0.004098109	0.010295248	0.002298939	0.012094418
1974.01	0.04615	180	124.0749	1.073709663	1.077807791	1.077208065	1.084304824	0.004098128	0.007096759	0.000599726	0.010595161
1974.02	0.04567	160	109.0751	1.068509667	1.078207032	1.070909015	1.085005185	0.009697365	0.01409617	0.007298017	0.016495518
1974.03	0.02717	160	111.8766	1.077116246	1.079615124	1.079115348	1.085712386	0.002498878	0.006597037	0.000499776	0.008596139
1974.04	0.04491	140	93.9236	1.085813471	1.082114788	1.082914503	1.088312581	-0.003698683	0.005398078	-0.000799715	0.00249911
1974.05	0.03560	140	78.222	1.087511718	1.083412805	1.082013176	1.090211003	-0.004098913	0.008197827	0.001399629	0.002699284
1974.06	0.02651	150	83.4698	1.086129388	1.084130438	1.078433431	1.092126238	-0.00199895	0.013692806	0.005697007	0.005996849
1974.07	0.05254	120	81.9238	1.087342161	1.086542645	1.074849719	1.09413805	-0.000799516	0.019288331	0.011692926	0.006795889
1974.08	0.06050	160	112.3178	1.093226154	1.089627385	1.089227521	1.097324752	-0.003598769	0.008097231	0.000399863	0.004098598
1974.09	0.03420	150	107.4369	1.088238907	1.09193734	1.080142338	1.101333359	0.003698433	0.021191021	0.011795002	0.013094452
1974.10	0.04237	130	89.713	1.08013706	1.092332962	1.074239042	1.104428898	0.012195902	0.030189856	0.01809392	0.024291838
1974.11	0.03360	110	76.1804	1.076241146	1.088537046	1.074341779	1.105631346	0.0122959	0.031289567	0.014195267	0.0293902
1974.12	0.03334	100	66.3872	1.072833502	1.088629578	1.0712339	1.106025257	0.015796076	0.034791358	0.017395679	0.033191755
1975.01	0.02484	110	77.6259	1.068123954	1.088120658	1.062424893	1.107917395	0.019996704	0.045492502	0.025695765	0.039793441
1975.02	0.01648	130	106.4169	1.059626015	1.086021681	1.054826803	1.106318348	0.026395666	0.051491545	0.031194878	0.046692333
1975.03	0.01642	130	106.8311	1.06101314	1.086611044	1.054813648	1.104709563	0.025597904	0.049895915	0.031797397	0.043696423
1975.04	0.00819	150	129.0016	1.068651699	1.089145019	1.055755902	1.105439708	0.020493321	0.049683807	0.033389118	0.03678801

1975.05	0.03259	130	104.9415	1.06347036	1.088560224	1.051875045	1.106452995	0.025089864	0.054577951	0.036685179	0.042982635
1975.06	0.04040	160	106.9652	1.062729376	1.087525395	1.053230901	1.106022425	0.024796019	0.052791524	0.034294494	0.043293049
1975.07	0.01606	140	95.9693	1.070758069	1.088052546	1.060961197	1.105147087	0.017294477	0.04418589	0.027091349	0.034389018
1975.08	0.03193	110	84.9911	1.076743767	1.089240793	1.064146765	1.105636891	0.012497026	0.041490127	0.025094028	0.028893124
1975.09	0.02380	90	69.5983	1.077160394	1.089156612	1.063864586	1.10575138	0.011996218	0.041886794	0.025292026	0.028590986
1975.10	0.03153	80	64.6863	1.069248763	1.088344276	1.059351088	1.105940142	0.019095513	0.046589053	0.028993188	0.036691379
1975.11	0.02350	70	52.4031	1.064733965	1.087630394	1.054635539	1.105427619	0.02289643	0.050792079	0.032994855	0.040693654
1975.12	0.01559	60	49.291	1.065917113	1.087815411	1.054318015	1.105514034	0.021898297	0.051196019	0.033497395	0.039596921
1976.01	0.00778	70	58.6665	1.058017875	1.085915709	1.048618604	1.104014304	0.027897835	0.0553957	0.037297105	0.04599643
1976.02	0.00776	70	62.5616	1.059017944	1.085415898	1.048718742	1.102314589	0.026397955	0.053595847	0.036697157	0.043296645
1976.03	0.00775	80	63.5402	1.061854049	1.0849487	1.049756851	1.100944994	0.023094651	0.051188144	0.035191849	0.039090946
1976.04	0.02316	70	53.3424	1.058956021	1.083750309	1.048358463	1.099146762	0.024794288	0.050788299	0.035391846	0.04019074
1976.05	0.02304	70	47.1802	1.063756209	1.085551214	1.051758958	1.098348281	0.021795005	0.046589323	0.033792256	0.034592072
1976.06	0.02292	50	39.9391	1.064957215	1.085952428	1.053859745	1.098649534	0.020995214	0.044789789	0.032092684	0.033692319
1976.07	0.02280	50	35.3862	1.061759208	1.085353857	1.052061407	1.097951	0.023594649	0.045889593	0.03329245	0.036191792
1976.08	0.02268	40	32.0583	1.059760909	1.084255383	1.051162849	1.096152699	0.024494474	0.04498985	0.033092534	0.03639179
1976.09	0.02256	40	29.1674	1.058241521	1.083637718	1.050642659	1.093836191	0.025396197	0.043193531	0.032995059	0.035594669
1976.10	0.01498	40	26.0799	1.054764079	1.082957773	1.048965376	1.092655604	0.028193694	0.043690228	0.033992397	0.037891525
1976.11	0.02237	30	25.5565	1.052665755	1.08225917	1.047266956	1.09205699	0.029593415	0.044790033	0.034992213	0.039391234
1976.12	0.02225	30	23.4716	1.048436948	1.079323307	1.043039332	1.090718274	0.030886359	0.047678942	0.036283975	0.042281326
1977.01	0.04417	80	61.7305	1.052669301	1.07936345	1.045970769	1.090560996	0.02669415	0.044590228	0.033392682	0.037891696
1977.02	0.02192	90	59.0482	1.0543937	1.080086236	1.046396023	1.090883099	0.025692536	0.044487077	0.033690213	0.0364894
1977.03	0.02905	70	49.2934	1.054847549	1.080843792	1.04584885	1.091042318	0.025996243	0.045193468	0.034994942	0.036194769
1977.04	0.01445	60	49.0917	1.054172416	1.080166805	1.045174359	1.090464581	0.025994388	0.045290222	0.034992446	0.036292165
1977.05	0.02159	50	40.8495	1.058172683	1.080267936	1.049374573	1.089865875	0.022095253	0.040491302	0.030893363	0.031693192
1977.06	0.02148	50	33.7977	1.057773887	1.079269292	1.049975554	1.08886724	0.021495405	0.038891686	0.029293738	0.031093353
1977.07	0.02138	40	30.2917	1.059249664	1.079246826	1.051750729	1.088545507	0.019997162	0.036794778	0.027496098	0.029295842
1977.08	0.01419	40	33.5698	1.063474518	1.079571105	1.054676384	1.087969325	0.016096587	0.033292941	0.024894722	0.024494807
1977.09	0.02120	40	28.3284	1.065000631	1.078896725	1.057802654	1.087694252	0.013896094	0.029891598	0.021094071	0.022693621
1977.10	0.02811	40	29.0216	1.0694758	1.080173557	1.061377497	1.088671776	0.010697757	0.027294278	0.01879606	0.019195976
1977.11	0.02096	40	26.7321	1.069202816	1.080499676	1.060705178	1.089197258	0.01129686	0.028492081	0.019794498	0.019994443
1977.12	0.02779	40	25.9015	1.069378317	1.081675768	1.060480162	1.08967411	0.012297451	0.029193948	0.021195606	0.020295793
1978.01	0.02073	30	22.9629	1.0725052	1.083802094	1.064107508	1.091400006	0.011296895	0.027292498	0.019694587	0.018894806
1978.02	0.02749	30	22.314	1.073033924	1.08433007	1.064136959	1.09162758	0.011296146	0.027490621	0.020193111	0.018593657

1978.03	0.03412	40	29.6453	1.072664621	1.084259914	1.062468759	1.091756872	0.011595294	0.029288112	0.021791155	0.019092251
1978.04	0.04059	50	36.6575	1.074139772	1.085236051	1.062543661	1.092833503	0.011096279	0.030289842	0.02269239	0.018693731
1978.05	0.03354	50	31.0922	1.077841301	1.086538406	1.063745991	1.094535745	0.008697106	0.030789753	0.022792415	0.016694444
1978.06	0.03328	40	27.1808	1.080614273	1.087312502	1.067017868	1.095710282	0.006698229	0.028692413	0.020294634	0.015096008
1978.07	0.02644	40	27.166	1.08347352	1.088371592	1.06967895	1.095568759	0.004898072	0.025889809	0.018692642	0.012095239
1978.08	0.03936	40	27.7724	1.082677661	1.086476179	1.070382457	1.094373099	0.003798518	0.023990642	0.016093722	0.011695438
1978.09	0.03901	40	25.6102	1.086119645	1.086619516	1.078221684	1.093917632	0.000499871	0.015695948	0.008397832	0.007797987
1978.10	0.02581	50	37.5872	1.091120018	1.08862066	1.079622969	1.095618864	-0.002499359	0.015995895	0.008997691	0.004498846
1978.11	0.02566	50	37.573	1.099679835	1.089883578	1.085985067	1.097880522	-0.009796257	0.011895455	0.00389851	-0.001799313
1978.12	0.03821	50	37.6275	1.102513183	1.091118214	1.090318567	1.098914772	-0.011394969	0.008596204	0.000799647	-0.003598411
1979.01	0.04416	60	38.0759	1.1036176	1.092022668	1.093022231	1.100818823	-0.011594932	0.007796592	-0.000999563	-0.002798777
1979.02	0.04371	50	32.8371	1.10192314	1.092127379	1.09272712	1.100323832	-0.009795761	0.007596713	-0.00059974	-0.001599308
1979.03	0.04328	50	29.1972	1.101960754	1.093165059	1.09426452	1.102060705	-0.008795696	0.007796185	-0.001099462	9.99511E-05
1979.04	0.04894	50	31.6158	1.100667389	1.093270968	1.094070581	1.102766373	-0.007396421	0.008695792	-0.000799613	0.002098984
1979.05	0.04839	50	27.9364	1.100673255	1.094476221	1.095575694	1.104171581	-0.006197034	0.008595886	-0.001099474	0.003498326
1979.06	0.04786	40	24.7225	1.095246061	1.092447221	1.090148174	1.103342706	-0.00279884	0.013194531	0.002299047	0.008096644
1979.07	0.04145	40	25.2955	1.095950063	1.091551869	1.091951705	1.102447396	-0.004398194	0.010495691	-0.000399836	0.006497333
1979.08	0.04105	40	23.392	1.099289391	1.091792873	1.094691526	1.102987673	-0.007496518	0.008296147	-0.002898654	0.003698282
1979.09	0.04645	40	21.2708	1.107890841	1.093897272	1.102093505	1.104892219	-0.013993569	0.002798714	-0.008196233	-0.002998622
1979.10	0.04596	30	19.7886	1.123825416	1.100737221	1.116429198	1.113430731	-0.023088196	-0.002998467	-0.015691977	-0.010394685
1979.11	0.05113	30	18.4513	1.123207176	1.106917224	1.117210875	1.119209642	-0.016289952	0.001998767	-0.010293651	-0.003997534
1979.12	0.06168	40	25.6983	1.119180814	1.106787671	1.119780483	1.119980372	-0.012393144	0.000199889	-0.012992812	0.000799558
1980.01	0.05532	40	23.4256	1.119927436	1.110233258	1.119327796	1.123525275	-0.009694178	0.004197479	-0.009094538	0.003597839
1980.02	0.06005	40	21.4461	1.138708533	1.123315177	1.128113106	1.135210043	-0.015393356	0.007096937	-0.004797929	-0.00349849
1980.03	0.04316	60	34.3292	1.157705251	1.129117468	1.151507899	1.144011103	-0.028587783	-0.007496796	-0.022390431	-0.013694148
1980.04	0.04274	50	34.6459	1.132520729	1.119926059	1.131521152	1.141416965	-0.01259467	0.009895812	-0.011595093	0.008896235
1980.05	0.04232	50	30.8543	1.093842453	1.109841611	1.085742879	1.131640465	0.015999158	0.045897585	0.024098732	0.037798011
1980.06	0.00526	190	153.5616	1.08126013	1.105452525	1.070363555	1.126745832	0.024192396	0.056382277	0.035088971	0.045485703
1980.07	0.03143	170	121.9229	1.086104806	1.110296004	1.080206952	1.126090257	0.024191198	0.045883305	0.030089052	0.039985451
1980.08	0.03639	140	106.0177	1.101945839	1.115940071	1.090850412	1.13103385	0.013994232	0.040183439	0.025089659	0.029088012
1980.09	0.04121	110	86.697	1.114688319	1.119686024	1.102194054	1.136478316	0.004997706	0.034284262	0.017491971	0.021789998
1980.10	0.04590	100	73.19	1.124445726	1.122646453	1.11574924	1.1418387	-0.001799273	0.02608946	0.006897214	0.017392973
1980.11	0.04040	100	60.5057	1.14104327	1.129247991	1.13684495	1.145941309	-0.011795279	0.009096359	-0.007596959	0.004898039
1980.12	0.04003	80	51.5482	1.148344545	1.131651166	1.154442127	1.150943514	-0.016693379	-0.003498612	-0.022790961	0.002598969

1981.01	0.03966	70	45.1525	1.140463444	1.12776719	1.14986067	1.149960641	-0.012696253	9.99705E-05	-0.02209348	0.009497197
1981.02	0.02951	60	38.497	1.145420061	1.133223042	1.147619524	1.153418107	-0.012197019	0.005798583	-0.014396482	0.007998045
1981.03	0.02444	50	34.6124	1.136768662	1.132969769	1.133269681	1.153063912	-0.003798893	0.01979423	-0.000299913	0.01629525
1981.04	0.02915	50	31.4196	1.142759336	1.138361032	1.136461765	1.155154557	-0.004398304	0.018692792	0.001899268	0.01239522
1981.05	0.03856	60	34.8072	1.161445698	1.142654666	1.162445221	1.158946891	-0.018791032	-0.00349833	-0.019790555	-0.002498807
1981.06	0.04773	50	35.8585	1.148219959	1.137123632	1.146920389	1.157616849	-0.011096327	0.01069646	-0.009796757	0.00939689
1981.07	0.03310	60	38.1936	1.156712011	1.143317662	1.149015258	1.161210113	-0.013394349	0.012194855	-0.005697596	0.004498102
1981.08	0.04219	50	34.9921	1.167036942	1.148739499	1.154938633	1.163237473	-0.018297443	0.00829884	-0.006199134	-0.003799469
1981.09	0.01397	90	66.7995	1.164983783	1.154685695	1.146787161	1.168983041	-0.010298089	0.022195881	0.007898534	0.003999258
1981.10	0.01856	80	59.2336	1.153640015	1.153839987	1.135242566	1.170937616	0.000199972	0.03569505	0.018597421	0.017297601
1981.11	0.01387	70	50.4637	1.123944629	1.142042127	1.108446772	1.163739128	0.018097498	0.055292357	0.033595356	0.039794499
1981.12	0.01382	60	43.7282	1.128344516	1.142142614	1.108347271	1.165339418	0.013798099	0.056992147	0.033795343	0.036994902
1982.01	0.01378	50	38.6891	1.1432	1.1518	1.1228	1.171	0.0086	0.0482	0.029	0.0278
1982.02	0.00000	80	68.7204	1.147142426	1.152541684	1.134644142	1.171639061	0.005399258	0.036994918	0.017897542	0.024496635
1982.03	0.01374	70	54.7895	1.139033566	1.145330987	1.126338764	1.167721818	0.006297421	0.041383054	0.018992223	0.028688252
1982.04	0.04095	150	118.3932	1.139235722	1.144033346	1.126442059	1.16722186	0.004797624	0.040779801	0.017591287	0.027986138
1982.05	0.04953	200	151.1744	1.133146982	1.142344928	1.120649772	1.166139615	0.009197946	0.045489843	0.021695156	0.032992633
1982.06	0.02233	170	129.2802	1.140598493	1.147997834	1.124599916	1.169095957	0.007399341	0.04449604	0.023397918	0.028497464
1982.07	0.00890	150	111.3544	1.1324	1.1461	1.1135	1.168	0.0137	0.0545	0.0326	0.0356
1982.08	0.00000	110	93.9311	1.114102309	1.136898264	1.086607188	1.162993633	0.022795955	0.076386446	0.050291076	0.048891325
1982.09	0.01774	100	81.7992	1.108549101	1.129450027	1.079247803	1.156351218	0.020900926	0.077103415	0.050202224	0.047802117
1982.10	-0.00443	130	100.2163	1.09334558	1.121349309	1.077243436	1.147452785	0.028003729	0.070209348	0.044105873	0.054107204
1982.11	-0.01332	140	119.9291	1.091503061	1.116700823	1.080604029	1.142898496	0.025197762	0.062294467	0.036096794	0.051395435
1982.12	0.00888	120	99.7447	1.089051713	1.118250419	1.079352143	1.141349394	0.029198705	0.061997251	0.038898275	0.052297681
1983.01	0.00443	110	90.4762	1.086151891	1.117850487	1.078552228	1.139349535	0.031698596	0.060797307	0.039298259	0.053197644
1983.02	0.00443	120	99.1017	1.088863766	1.119754227	1.080766266	1.139148238	0.030890461	0.058381972	0.038987961	0.050284472
1983.03	0.03088	160	126.7347	1.090208698	1.117103979	1.083309909	1.13590068	0.026895281	0.052590772	0.03379407	0.045691982
1983.04	0.01755	140	101.8415	1.089704682	1.115002469	1.082005356	1.132800913	0.025297787	0.050795557	0.032997114	0.04309623
1983.05	0.00875	100	83.5328	1.088810094	1.11440563	1.081711333	1.130702788	0.025595536	0.048991455	0.032694298	0.041892693
1983.06	0.01744	90	78.9782	1.096457073	1.117254362	1.087758207	1.133552237	0.020797289	0.045794031	0.029496155	0.037095165
1983.07	0.01304	80	63.4622	1.101856799	1.121354265	1.090658254	1.133752653	0.019497466	0.043094399	0.030696011	0.031895855
1983.08	0.01300	70	50.8234	1.105109168	1.124905749	1.093211222	1.136203798	0.019796581	0.042992576	0.031694527	0.031094631
1983.09	0.01727	60	49.8927	1.101457843	1.123554991	1.08985934	1.135353469	0.022097148	0.045494128	0.033695651	0.033895625
1983.10	0.01291	60	41.1688	1.097958715	1.122355575	1.08626022	1.134454019	0.024396861	0.048193798	0.036095355	0.036495304

1983.11	0.01287	40	37.2109	1.099071621	1.123764243	1.087275145	1.135760659	0.024692622	0.048485514	0.036489098	0.036689038
1983.12	0.02988	70	53.3498	1.100866438	1.12546122	1.089768793	1.137258717	0.024594782	0.047489924	0.035692427	0.036392279
1984.01	0.02122	60	43.674	1.098860663	1.121857747	1.088861931	1.136355908	0.022997084	0.047493978	0.032995816	0.037495246
1984.02	0.01268	60	43.0898	1.10021462	1.120611183	1.09071622	1.135708639	0.020396563	0.044992419	0.029894963	0.035494019
1984.03	0.01685	50	37.2912	1.105807109	1.125605446	1.095108008	1.139804253	0.019798337	0.044696245	0.030497438	0.033997144
1984.04	0.00840	40	35.4505	1.108907029	1.128005427	1.096808043	1.14300417	0.019098399	0.046196127	0.031197384	0.034097141
1984.05	0.00838	40	32.843	1.116413339	1.132610631	1.098116398	1.14720819	0.016197292	0.049091792	0.034494233	0.030794851
1984.06	0.01672	40	30.4516	1.120659943	1.135358106	1.098562705	1.150356232	0.014698163	0.051793527	0.036795401	0.029696289
1984.07	0.01250	30	25.8691	1.120160408	1.134258651	1.101062787	1.15135652	0.014098243	0.050293732	0.033195863	0.031196112
1984.08	0.01246	30	23.0529	1.118014853	1.128513114	1.104517088	1.1461102	0.010498261	0.041593112	0.023996026	0.028095347
1984.09	0.01656	30	20.1906	1.115707881	1.126506989	1.10360888	1.143405594	0.010799108	0.039796714	0.022898109	0.027697713
1984.10	0.00826	30	23.9383	1.108908616	1.126207191	1.097309572	1.139306111	0.017298574	0.041996539	0.028897619	0.030397495
1984.11	0.00824	30	22.391	1.098109677	1.122807646	1.086010673	1.134706667	0.024697969	0.048695995	0.036796973	0.03659699
1984.12	0.00823	20	19.6942	1.093031303	1.121024421	1.080334424	1.1337213	0.027993119	0.053386876	0.040689997	0.040689997
1985.01	0.02458	50	43.2541	1.089977864	1.120571629	1.077380431	1.132369224	0.030593765	0.054988793	0.043191198	0.042391361
1985.02	0.02038	50	36.6599	1.092811206	1.121208899	1.082612035	1.132208005	0.028397693	0.04959597	0.038596864	0.039396799
1985.03	0.00813	50	36.8844	1.09851091	1.12550872	1.085111997	1.136807804	0.02699781	0.051695807	0.040396724	0.038296894
1985.04	0.00811	40	32.1568	1.091267555	1.122163805	1.079368999	1.134962252	0.03089625	0.055593253	0.042794806	0.043694697
1985.05	0.01214	30	26.9497	1.084512454	1.117109823	1.074713245	1.131408668	0.032597369	0.056695423	0.042396578	0.046896214
1985.06	0.00807	30	25.0369	1.077913148	1.109310618	1.069413833	1.123909442	0.03139747	0.054495609	0.039896785	0.045996294
1985.07	0.00806	30	22.0153	1.078513261	1.10961076	1.070713888	1.124209586	0.031097499	0.053495698	0.038896872	0.045696325
1985.08	0.00804	20	19.1586	1.080326711	1.110321899	1.07122817	1.124819574	0.029995189	0.053591404	0.039093729	0.044492863
1985.09	0.01604	20	20.0047	1.080484253	1.110478264	1.07078619	1.124575449	0.029994011	0.05378926	0.039692074	0.044091196
1985.10	0.01997	30	19.4755	1.07988536	1.109979378	1.071387049	1.123376715	0.030094018	0.051989666	0.038592329	0.043491356
1985.11	0.01988	30	18.4457	1.078629191	1.105324964	1.072230204	1.119722684	0.026695773	0.047492479	0.033094759	0.041093493
1985.12	0.01584	30	16.7991	1.076785181	1.101687151	1.07108473	1.115888274	0.02490197	0.044803544	0.030602421	0.039103093
1986.01	-0.00791	60	48.4113	1.077556661	1.100762188	1.070955088	1.1146655	0.023205527	0.043710411	0.0298071	0.037108839
1986.02	-0.02382	120	99.0726	1.076271688	1.096874974	1.07077081	1.111277272	0.020603287	0.040506462	0.026104164	0.035005584
1986.03	-0.01595	110	92.2741	1.070171905	1.089869548	1.065472468	1.104867752	0.019697642	0.039395285	0.02439708	0.034695847
1986.04	0.01197	110	83.0056	1.0642307	1.087726962	1.060431304	1.101724735	0.023496262	0.041293431	0.027295658	0.037494035
1986.05	0.01591	80	66.8812	1.066457683	1.090856715	1.061457882	1.102856239	0.024399032	0.041398357	0.029398833	0.036398556
1986.06	0.00397	80	66.4452	1.06725769	1.091256739	1.062057896	1.103356259	0.023999049	0.041298363	0.029198842	0.036098569
1986.07	0.00396	70	53.3913	1.062531894	1.088627765	1.05813259	1.10142574	0.026095871	0.04329315	0.030495175	0.038893846
1986.08	0.01582	60	51.0886	1.059216437	1.087114237	1.055216753	1.101713085	0.027897799	0.046496332	0.031897484	0.042496647

1986.09	0.00789	50	42.7958	1.057616715	1.088814258	1.052017156	1.101913227	0.031197543	0.049896071	0.036797102	0.044296512
1986.10	0.00787	50	40.1411	1.057033973	1.088429042	1.051634821	1.102226875	0.031395069	0.050592054	0.036794221	0.045192902
1986.11	0.01571	70	61.2532	1.057751912	1.086545158	1.053252967	1.100441899	0.028793247	0.047188932	0.033292192	0.042689987
1986.12	0.02345	100	78.5622	1.058535227	1.084731149	1.055135756	1.099528846	0.026195922	0.04439309	0.029595393	0.040993619
1987.01	0.01557	90	63.049	1.057635955	1.083431954	1.054136498	1.097029845	0.025795999	0.042893347	0.029295456	0.03939389
1987.02	0.01551	70	52.0843	1.059395424	1.083590752	1.055696139	1.0962883	0.024195328	0.040592161	0.027894613	0.036892876
1987.03	0.01931	50	45.9313	1.0601776	1.08347491	1.055778108	1.095973467	0.02329731	0.040195359	0.027696802	0.035795867
1987.04	0.01155	50	37.7156	1.064795834	1.088291329	1.056197483	1.100189048	0.023495495	0.043991565	0.032093846	0.035393214
1987.05	0.01917	50	40.0815	1.069877349	1.093174678	1.056478885	1.104973326	0.023297329	0.048494441	0.036695793	0.035095977
1987.06	0.01146	40	35.1973	1.067796695	1.092991898	1.056498846	1.104989613	0.025195203	0.048490768	0.036493052	0.037192919
1987.07	0.01904	40	34.8609	1.066638171	1.094034015	1.056739673	1.105932209	0.027395844	0.049192537	0.037294342	0.039294038
1987.08	0.01517	40	29.2681	1.070178597	1.096575602	1.060279719	1.10787432	0.026397005	0.047594601	0.036295883	0.037695724
1987.09	0.01134	30	26.0567	1.076537662	1.101633877	1.063839576	1.112932173	0.025096216	0.049092597	0.037794301	0.036394512
1987.10	0.01508	30	22.4962	1.075819096	1.105116892	1.061220194	1.116116065	0.029297797	0.054895872	0.043896699	0.04029697
1987.11	0.00752	30	23.5065	1.069439567	1.099934993	1.056741472	1.112133163	0.030495425	0.05539169	0.04319352	0.042693595
1987.12	0.01500	30	23.693	1.071619828	1.101017629	1.057620875	1.112816746	0.029397801	0.055195871	0.043396753	0.041196918
1988.01	0.00748	30	24.7713	1.069780206	1.09867697	1.057981528	1.110575638	0.028896764	0.052594111	0.040695443	0.040795432
1988.02	0.01120	30	21.516	1.066122628	1.09371545	1.056325177	1.105912276	0.027592821	0.049587099	0.037390272	0.039789648
1988.03	0.02602	50	38.9235	1.066981538	1.093778563	1.056882659	1.105577253	0.026797025	0.048694594	0.036895904	0.038595715
1988.04	0.01110	50	38.1571	1.069902695	1.09649779	1.058904723	1.108795523	0.026595095	0.049890799	0.037593067	0.038892828
1988.05	0.01844	50	36.3161	1.073802813	1.098798223	1.062404906	1.11019613	0.02499541	0.047791224	0.036393317	0.036393317
1988.06	0.01836	40	31.5225	1.074703479	1.098399146	1.064405362	1.109797061	0.023695667	0.0453917	0.033993784	0.035093583
1988.07	0.01829	40	28.3584	1.077303829	1.099399805	1.067105686	1.110897712	0.022095976	0.043792026	0.032294119	0.033593883
1988.08	0.01821	30	24.4061	1.081543038	1.100940223	1.070444649	1.111938627	0.019397185	0.041493978	0.030495574	0.030395589
1988.09	0.01451	30	21.2011	1.080743676	1.098041174	1.072244906	1.108839613	0.017297498	0.036594707	0.025796269	0.028095936
1988.10	0.01446	20	18.6261	1.080944166	1.094942148	1.073345262	1.103940851	0.013997982	0.030595589	0.021596887	0.022996685
1988.11	0.01442	20	16.6935	1.084605275	1.094303534	1.077406568	1.104601685	0.009698259	0.027195118	0.016896966	0.01999641
1988.12	0.01795	20	15.7998	1.089744063	1.095543233	1.080545379	1.106341687	0.00579917	0.025796309	0.014997854	0.016597625
1989.01	0.01431	20	15.5888	1.090266941	1.095965723	1.082468608	1.106263522	0.005698782	0.023794914	0.013497115	0.015996581
1989.02	0.02138	30	18.2823	1.092151948	1.096050705	1.084954242	1.105747615	0.003898758	0.020793373	0.011096464	0.013595667
1989.03	0.03187	40	31.3965	1.095468676	1.09776819	1.087970259	1.106466353	0.002299514	0.018496094	0.009797931	0.010997678
1989.04	0.02112	40	28.3117	1.09344669	1.097746087	1.086347685	1.105944937	0.004299397	0.019597252	0.011398402	0.012498248
1989.05	0.01402	40	27.7228	1.089647714	1.09554689	1.084148483	1.104445646	0.005899176	0.020297163	0.011398407	0.014797932
1989.06	0.01398	30	24.1314	1.0844	1.091	1.0815	1.1003	0.0066	0.0188	0.0095	0.0159

1989.07	0.00000	50	44.4772	1.078787241	1.089186155	1.078687252	1.098585172	0.010398913	0.01989792	0.010498903	0.019797931
1989.08	0.01045	50	36.3707	1.081574713	1.089373089	1.078775296	1.098571173	0.007798376	0.019795877	0.010597793	0.01699646
1989.09	0.02083	40	34.8392	1.082013007	1.089911642	1.077313819	1.098910087	0.007898635	0.021596268	0.012597823	0.01689708
1989.10	0.01728	40	29.4275	1.079751251	1.08904997	1.076251733	1.097948744	0.009298719	0.021697011	0.012798237	0.018197493
1989.11	0.01378	30	27.2715	1.077257588	1.08845299	1.076457917	1.097649214	0.011195402	0.021191297	0.011995074	0.020391625
1989.12	0.04107	110	85.4828	1.07701693	1.088414993	1.076117083	1.098013361	0.011398063	0.021896278	0.01229791	0.020996431
1990.01	0.01700	110	82.3908	1.078980859	1.089678686	1.076181428	1.099176757	0.010697827	0.02299533	0.013497259	0.020195898
1990.02	0.02031	90	68.1014	1.080990609	1.092089486	1.077290984	1.101288555	0.011098877	0.023997572	0.014798502	0.020297946
1990.03	0.01012	70	62.0282	1.08342705	1.093626363	1.078927353	1.102025798	0.010199313	0.023098445	0.01469901	0.018598748
1990.04	0.00673	60	51.2448	1.083709251	1.094306408	1.07741094	1.102704155	0.010597157	0.025293214	0.016895467	0.018994904
1990.05	0.02683	80	60.8109	1.082983256	1.094480955	1.077184417	1.103879074	0.011497699	0.026694657	0.017296538	0.020895818
1990.06	0.02001	70	49.7489	1.080606078	1.092201851	1.076907427	1.101798353	0.011595773	0.024890926	0.015294425	0.021192275
1990.07	0.03645	90	66.9892	1.079080593	1.092076746	1.07588154	1.101673906	0.012996153	0.025792365	0.016195206	0.022593312
1990.08	0.02960	80	54.1308	1.077483225	1.093778434	1.074184195	1.103775495	0.016295209	0.0295913	0.019594239	0.02629227
1990.09	0.02940	70	45.5822	1.077494882	1.095493126	1.073495272	1.106292073	0.017998244	0.0327968	0.021997854	0.028797191
1990.10	0.00976	90	65.0296	1.075325678	1.095122469	1.071526294	1.107220508	0.019796791	0.035694214	0.023596175	0.03189483
1990.11	0.01621	70	53.6227	1.072926714	1.0928235	1.070427117	1.106021369	0.019896787	0.035594251	0.022396383	0.033094655
1990.12	0.01615	60	44.2235	1.070465499	1.090464855	1.067365599	1.10426441	0.019999355	0.036898811	0.023099256	0.033798911
1991.01	0.00322	70	55.8666	1.0664	1.0904	1.0622	1.1045	0.024	0.0423	0.0282	0.0381
1991.02	0.00000	80	66.161	1.062597411	1.088194939	1.059297729	1.100593742	0.025597529	0.041296013	0.02889721	0.037996332
1991.03	0.00965	60	53.2445	1.063829326	1.089125267	1.058930112	1.100723406	0.025295942	0.041793295	0.030195156	0.036894081
1991.04	0.01604	50	42.8689	1.062264113	1.088460762	1.056364868	1.099259381	0.026196649	0.042894513	0.032095894	0.036995267
1991.05	0.01279	50	39.5153	1.061232272	1.08853053	1.0545327	1.098529892	0.027298258	0.043997192	0.03399783	0.03729762
1991.06	0.00638	50	39.634	1.063464558	1.089961183	1.055565564	1.099459974	0.026496625	0.04389441	0.034395619	0.035995416
1991.07	0.01274	50	34.6033	1.062965017	1.089861602	1.055665944	1.098760472	0.026896584	0.043094528	0.034195658	0.035795454
1991.08	0.01270	40	29.1755	1.057732988	1.087431106	1.053233273	1.096430536	0.029698118	0.043197263	0.034197833	0.038697548
1991.09	0.00634	30	27.374	1.055499972	1.085894212	1.052000635	1.094892506	0.03039424	0.042891872	0.033893577	0.039392535
1991.10	0.01895	40	35.2735	1.053167425	1.085363372	1.049767853	1.094762189	0.032195947	0.044994336	0.035595519	0.041594764
1991.11	0.01259	40	29.1741	1.048867051	1.084765923	1.045567155	1.094465619	0.035898872	0.048898464	0.039198769	0.045598568
1991.12	0.00314	40	32.5955	1.043701782	1.082998084	1.040602074	1.092497191	0.039296302	0.051895116	0.04239601	0.048795408
1992.01	0.00941	30	27.3644	1.041337145	1.081830813	1.037837693	1.091129358	0.040493667	0.053291666	0.04399312	0.049792213
1992.02	0.01564	30	24.9192	1.042802431	1.082798689	1.038302852	1.092197809	0.039996258	0.053894957	0.044495837	0.049395378
1992.03	0.00936	30	22.8305	1.046202323	1.08339885	1.040302874	1.09239801	0.037196527	0.052095136	0.043095976	0.046195687
1992.04	0.00934	20	19.9374	1.042870504	1.0831655	1.037371187	1.091964408	0.040294996	0.054593221	0.045794314	0.049093904

1992.05	0.01242	20	17.7049	1.041771009	1.082665945	1.036171702	1.091164893	0.040894936	0.054993191	0.046494243	0.049393884
1992.06	0.01238	20	15.7445	1.041603513	1.082099762	1.036503985	1.090398993	0.040496249	0.053895008	0.045595776	0.04879548
1992.07	0.00926	20	15.2797	1.035904245	1.080600114	1.032004606	1.088299402	0.044695868	0.056294796	0.048595508	0.052395157
1992.08	0.00924	20	14.1214	1.034509357	1.079301102	1.031109983	1.086299813	0.044791746	0.055189829	0.048191119	0.051790456
1992.09	0.01843	30	19.7778	1.0316737	1.079067898	1.02897403	1.086067041	0.047394198	0.057093011	0.050093867	0.054393341
1992.10	0.01224	20	17.6109	1.032936906	1.079834041	1.028537175	1.088333522	0.046897135	0.059796348	0.051296867	0.055396616
1992.11	0.00611	20	18.7785	1.036642088	1.080835356	1.031142925	1.089434046	0.044193268	0.05829112	0.04969243	0.052791958
1992.12	0.01523	20	18.4498	1.037005485	1.079701593	1.032105931	1.088000837	0.042696109	0.055894906	0.047595662	0.050995352
1993.01	0.00911	20	18.0907	1.034937225	1.07903455	1.029937528	1.086634089	0.044097325	0.056696561	0.049097022	0.051696864
1993.02	0.00607	20	17.4027	1.033743626	1.076937092	1.029144322	1.083736064	0.043193466	0.054591742	0.04779277	0.049992438
1993.03	0.01513	20	17.7187	1.03317536	1.075670234	1.029375819	1.081369546	0.042494874	0.051993728	0.046294415	0.048194186
1993.04	0.01206	20	15.8006	1.032368918	1.074567648	1.02866903	1.081367443	0.04219873	0.052698413	0.045898618	0.048998525
1993.05	0.00301	30	20.8416	1.033537831	1.074235383	1.029538072	1.082034914	0.040697552	0.052496842	0.044697311	0.048497083
1993.06	0.00602	20	19.1775	1.035306748	1.073203335	1.030607172	1.080602669	0.037896587	0.049995497	0.042596163	0.04529592
1993.07	0.00901	20	16.9148	1.03463798	1.071635762	1.030338237	1.079235306	0.036997782	0.048897069	0.041297524	0.044597327
1993.08	0.00599	20	16.4329	1.034214527	1.068308412	1.03001528	1.075807068	0.034093886	0.045791788	0.038293133	0.041592541
1993.09	0.01793	30	25.4233	1.033476863	1.066472932	1.029377352	1.073272122	0.032996069	0.04389477	0.03709558	0.039795258
1993.10	0.01191	30	21.8226	1.033807839	1.066604915	1.030108169	1.073004345	0.032797076	0.042896176	0.036496746	0.039196506
1993.11	0.00891	20	19.1426	1.0358	1.0693	1.031	1.0766	0.0335	0.0456	0.0383	0.0408
1993.12	0.00000	30	27.5777	1.035977155	1.069173219	1.030477807	1.076772318	0.033196064	0.04629451	0.038695412	0.040795163
1994.01	0.01186	30	26.8682	1.035277572	1.069073576	1.029678234	1.076372713	0.033796003	0.046694478	0.039395341	0.04109514
1994.02	0.01183	30	22.7161	1.038669345	1.070768398	1.032469528	1.077568197	0.032099053	0.045098669	0.03829887	0.038898852
1994.03	0.00295	30	22.1198	1.043107767	1.074704973	1.034908492	1.081204399	0.031597206	0.046295906	0.039796481	0.038096631
1994.04	0.00884	20	19.3325	1.04807673	1.078673131	1.036678071	1.085072379	0.030596401	0.048394308	0.041995061	0.036995649
1994.05	0.01176	20	17.0022	1.052945667	1.079741739	1.041247382	1.086040816	0.026796072	0.044793435	0.038494358	0.033095149
1994.06	0.01466	20	17.1576	1.052515561	1.07951083	1.04121754	1.086309639	0.026995269	0.045092098	0.03829329	0.033794078
1994.07	0.01752	20	18.5563	1.054707867	1.08100557	1.043208872	1.087904967	0.026297703	0.044696096	0.037796698	0.0331971
1994.08	0.00874	20	17.6548	1.055569305	1.080668575	1.044769619	1.08736838	0.02509927	0.042598761	0.035898956	0.031799075
1994.09	0.00291	20	17.5308	1.057477204	1.083274208	1.046078528	1.089673465	0.025797004	0.043594938	0.037195681	0.032196261
1994.10	0.01161	20	17.5034	1.061007811	1.085605674	1.049408819	1.091905127	0.024597863	0.042496308	0.036196855	0.030897315
1994.11	0.00869	20	16.2053	1.065276874	1.086674401	1.052778319	1.093073662	0.021397527	0.040295343	0.033896082	0.027796787
1994.12	0.01156	20	15.1126	1.07127651	1.084474988	1.055878285	1.090874251	0.013198479	0.034995966	0.028596704	0.019597741
1995.01	0.01153	20	13.8682	1.070407672	1.084506456	1.057008828	1.090705921	0.014098784	0.033697093	0.027497628	0.020298249
1995.02	0.00863	20	13.0884	1.06681651	1.082413827	1.057518109	1.088312812	0.015597317	0.030794703	0.024895718	0.021496303

1995.03	0.01720	20	15.487	1.06420875	1.081107301	1.05720935	1.086906804	0.016898551	0.029697454	0.023897951	0.022698054
1995.04	0.00857	20	16.7255	1.062609067	1.080207561	1.056409597	1.085907073	0.017598494	0.029497476	0.023797963	0.023298006
1995.05	0.00856	20	15.1575	1.059939629	1.07643869	1.056639817	1.081938376	0.01649906	0.025298559	0.019798872	0.021998747
1995.06	0.00570	20	15.2577	1.056309902	1.072908486	1.054610047	1.078907974	0.016598584	0.024297928	0.018298439	0.022598072
1995.07	0.00853	20	14.3138	1.055840059	1.074039026	1.054140156	1.080338669	0.018198967	0.026198513	0.01989887	0.024498609
1995.08	0.00568	20	15.4687	1.057380179	1.075578117	1.053880575	1.081777414	0.018197938	0.027896839	0.021697541	0.024397235
1995.09	0.01133	20	14.3795	1.056140277	1.073139315	1.052740469	1.07923897	0.016999039	0.026498502	0.020398846	0.023098694
1995.10	0.00565	20	15.6837	1.055840371	1.071139507	1.052740546	1.077439151	0.015299136	0.024698605	0.018398961	0.02159878
1995.11	0.00565	20	14.8527	1.054062657	1.069959078	1.053362815	1.076557592	0.015896421	0.023194777	0.016596263	0.022494935
1995.12	0.02252	40	32.8652	1.053011401	1.068110131	1.051311544	1.074809567	0.01509873	0.023498023	0.016798587	0.021798166
1996.01	0.00841	40	29.0279	1.050753032	1.067950626	1.049853158	1.074549703	0.017197595	0.024696546	0.018097469	0.023796672
1996.02	0.01399	40	28.6319	1.049224516	1.069721088	1.0481247	1.076120018	0.020496572	0.027995318	0.021596388	0.026895502
1996.03	0.01673	30	27.5045	1.05331217	1.073410494	1.049512487	1.080209927	0.020098324	0.03069744	0.023898007	0.026897757
1996.04	0.00834	30	23.4929	1.055312172	1.074910541	1.049412663	1.081809967	0.019598369	0.032397304	0.025497878	0.026497795
1996.05	0.00832	30	20.639	1.056312257	1.076110612	1.050112772	1.082910047	0.019798355	0.032797276	0.02599784	0.026597791
1996.06	0.00831	20	18.7352	1.058041502	1.077040452	1.0508419	1.08394007	0.01899895	0.03309817	0.026198552	0.025898568
1996.07	0.00553	20	17.7546	1.058354037	1.076351555	1.051355002	1.08335059	0.017997518	0.031995587	0.024996553	0.024996553
1996.08	0.01379	20	17.2095	1.056554746	1.074452286	1.050355599	1.081651296	0.017897539	0.031295698	0.024096687	0.02509655
1996.09	0.01375	20	15.6821	1.058154985	1.076452478	1.050755999	1.083351532	0.018297492	0.032595533	0.025696478	0.025196547
1996.10	0.01370	20	14.6866	1.05538462	1.073782608	1.049785232	1.080581865	0.018397989	0.030796633	0.023997376	0.025197245
1996.11	0.01093	20	14.276	1.054113759	1.070912385	1.050214078	1.07781182	0.016798626	0.027597742	0.020698307	0.023698061
1996.12	0.00818	20	13.5367	1.05461388	1.071912468	1.049014338	1.078811904	0.017298587	0.029797567	0.02289813	0.024198024
1997.01	0.00817	20	12.9792	1.05607129	1.074170798	1.050271447	1.080870616	0.018099508	0.030599168	0.02389935	0.024799326
1997.02	0.00272	20	15.7053	1.055271329	1.073070846	1.050071471	1.079370675	0.017799516	0.029299204	0.022999375	0.024099345
1997.03	0.00272	20	15.4764	1.058	1.0755	1.0514	1.0818	0.0175	0.0304	0.0241	0.0238
1997.04	0.00000	20	20.988	1.059813726	1.07721231	1.051514402	1.083311813	0.017398584	0.031797412	0.025697908	0.023498087
1997.05	0.00814	20	18.1782	1.058642637	1.075741711	1.050443082	1.081941375	0.017099073	0.031498293	0.025298629	0.023298738
1997.06	0.00542	20	18.4365	1.05678569	1.073983829	1.049186512	1.08008317	0.01719814	0.030896658	0.024797318	0.02329748
1997.07	0.01082	20	16.8368	1.055286135	1.071284409	1.050386664	1.077383751	0.015998274	0.026997087	0.020897745	0.022097616
1997.08	0.01079	20	15.3549	1.055514768	1.072113428	1.051315107	1.078112944	0.01659866	0.026797836	0.020798321	0.022598175
1997.09	0.00807	20	14.0562	1.055143287	1.071442411	1.049443593	1.076942115	0.016299124	0.027498522	0.021998818	0.021798828
1997.10	0.00537	20	13.3403	1.054571685	1.069971272	1.049671817	1.075671119	0.015399587	0.025999302	0.020299455	0.021099433
1997.11	0.00268	10	13.216	1.054543424	1.068642668	1.051343596	1.074142373	0.014099244	0.022798777	0.017299072	0.019598949
1997.12	0.00536	10	12.1944	1.0553	1.0676	1.0516	1.0732	0.0123	0.0216	0.016	0.0179

1998.01	0.00000	20	15.2969	1.0524	1.0661	1.0504	1.0719	0.0137	0.0215	0.0157	0.0195
1998.02	0.00000	20	17.4585	1.053043574	1.066642846	1.050843692	1.072442535	0.013599271	0.021598843	0.015799153	0.019398961
1998.03	0.00536	20	15.6005	1.053787277	1.067085855	1.050187662	1.073085213	0.013298577	0.022897551	0.016898192	0.019297936
1998.04	0.01070	20	14.4926	1.053743745	1.066843046	1.049443974	1.073242704	0.013099301	0.023798729	0.017399071	0.019498959
1998.05	0.00534	20	14.5113	1.054287639	1.066786307	1.049888108	1.072885657	0.012498668	0.022997549	0.016898199	0.018598018
1998.06	0.01066	20	14.6679	1.054043936	1.06524334	1.049744164	1.071243021	0.011199404	0.021498856	0.015499176	0.017199085
1998.07	0.00532	20	13.9473	1.053572006	1.06547169	1.049572112	1.07147153	0.011899684	0.021899418	0.015899578	0.017899524
1998.08	0.00266	20	13.2226	1.051988363	1.065086973	1.048888692	1.071286315	0.01309861	0.022397623	0.016198281	0.019297952
1998.09	0.01061	20	15.3008	1.047044546	1.063943651	1.046044599	1.070843285	0.016899105	0.024798687	0.017899052	0.02379874
1998.10	0.00530	20	13.9792	1.041117415	1.063615631	1.039517542	1.071714988	0.022498215	0.032197446	0.024098088	0.030597573
1998.11	0.00793	20	13.2816	1.045217241	1.064015753	1.044017336	1.073315016	0.018798512	0.02929768	0.019998417	0.028097775
1998.12	0.00792	10	12.371	1.04522757	1.062228018	1.043927535	1.072328285	0.017000448	0.028400749	0.018300483	0.027100715
1999.01	-0.00264	30	24.0531	1.045044887	1.062343974	1.043344976	1.072843421	0.017299088	0.029498444	0.018998998	0.027798534
1999.02	0.00527	20	20.6793	1.046724992	1.063720527	1.044125675	1.073617926	0.016995535	0.029492251	0.019594852	0.026892934
1999.03	0.02627	70	54.264	1.047745144	1.066144181	1.044345322	1.075243704	0.018399037	0.030898382	0.021798859	0.02749856
1999.04	0.00524	60	45.8005	1.04687262	1.06637211	1.042872724	1.07477189	0.01949949	0.031899166	0.023499385	0.02789927
1999.05	0.00262	50	38.0767	1.048335834	1.069132577	1.044836382	1.07703134	0.020796743	0.032194958	0.024296195	0.028695506
1999.06	0.01566	40	36.5685	1.050890618	1.072188401	1.04559117	1.080087579	0.021297783	0.034496409	0.026597232	0.029196961
1999.07	0.01041	40	30.8473	1.050109352	1.071705431	1.045310223	1.079304052	0.021596079	0.033993828	0.026395208	0.0291947
1999.08	0.01816	50	37.5198	1.051918397	1.07391669	1.047118769	1.081416108	0.021998293	0.034297339	0.026797921	0.029497712
1999.09	0.00776	40	31.7605	1.052418503	1.073816846	1.046718945	1.081916219	0.021398343	0.035197274	0.027097902	0.029497716
1999.10	0.00774	30	27.3125	1.054191381	1.075389197	1.048491968	1.083688342	0.021197816	0.035196374	0.026897229	0.029496961
1999.11	0.01030	30	23.2007	1.055364437	1.073462112	1.050565053	1.081361097	0.018097675	0.030796044	0.022897059	0.025996661
1999.12	0.01285	30	21.6468	1.05823741	1.075334783	1.051838393	1.0817338	0.017097373	0.029895407	0.02349639	0.02349639
2000.01	0.01536	30	20.1931	1.060902657	1.077498006	1.052904899	1.082996465	0.016595349	0.030091566	0.024593107	0.022093808
2000.02	0.02803	60	41.0785	1.062226986	1.076827357	1.055526815	1.082927512	0.014600371	0.027400696	0.021300541	0.020700526
2000.03	-0.00254	70	53.2217	1.062119099	1.076717987	1.056819502	1.083617461	0.014598888	0.026797959	0.019898484	0.021498362
2000.04	0.00762	60	43.8979	1.061204824	1.076100681	1.056306187	1.083698567	0.014895857	0.027392381	0.019794494	0.022493743
2000.05	0.02782	60	47.0308	1.06319293	1.079791259	1.057793474	1.088890342	0.016598328	0.031096868	0.021997785	0.025697412
2000.06	0.01007	50	38.8564	1.0617	1.0767	1.0569	1.0848	0.015	0.0279	0.0198	0.0231
2000.07	0.00000	60	41.5572	1.060560591	1.076257048	1.059360862	1.083255468	0.015696457	0.023894606	0.016896186	0.022694877
2000.08	0.02257	60	49.1008	1.061720386	1.075419358	1.060820453	1.082518826	0.013698973	0.021698373	0.014598905	0.02079844
2000.09	0.00750	60	44.1304	1.06122056	1.076119445	1.059920658	1.083418899	0.014898885	0.023498241	0.016198787	0.022198338
2000.10	0.00749	50	36.2633	1.059994415	1.075392881	1.060994316	1.083292094	0.015398466	0.022297779	0.014398566	0.023297679

2000.11	0.00996	40	35.1358	1.060636933	1.074233561	1.061436735	1.082531503	0.013596628	0.021094768	0.012796826	0.02189457
2000.12	0.02480	70	58.3992	1.055895661	1.07199407	1.057595493	1.08009327	0.016098409	0.022497777	0.014398577	0.024197609
2001.01	0.00988	70	49.1565	1.0481	1.0715	1.0515	1.0793	0.0234	0.0278	0.02	0.0312
2001.02	0.00000	50	42.6957	1.046671046	1.070868065	1.048670799	1.078567116	0.024197019	0.029896317	0.022197265	0.03189607
2001.03	0.01232	40	35.8524	1.042769662	1.069563743	1.043969397	1.078161844	0.026794081	0.034192447	0.025594346	0.035392182
2001.04	0.02209	50	36.2979	1.039672917	1.071868982	1.038573052	1.080567919	0.032196065	0.041994867	0.03329593	0.040895001
2001.05	0.01222	50	33.2354	1.037901464	1.073004896	1.036301308	1.080805659	0.035103432	0.044504351	0.036703588	0.042904194
2001.06	-0.00978	80	60.4053	1.0358	1.0718	1.0349	1.0797	0.036	0.0448	0.0369	0.0439
2001.07	0.00000	80	61.0113	1.036048161	1.071143017	1.034948322	1.079541786	0.035094857	0.044593465	0.036194695	0.043493626
2001.08	0.01466	60	50.7654	1.034826348	1.070330683	1.033726214	1.078631696	0.035504335	0.044905483	0.036604469	0.043805348
2001.09	-0.01221	110	96.6499	1.028250317	1.071752446	1.026450229	1.080352867	0.043502129	0.053902638	0.045302217	0.05210255
2001.10	-0.00489	100	81.5347	1.023325059	1.07032621	1.021625018	1.079126426	0.047001151	0.057501408	0.048701193	0.055801366
2001.11	-0.00245	110	95.46	1.021724982	1.069621466	1.01862521	1.078020849	0.047896483	0.059395639	0.050996256	0.056295867
2001.12	0.00734	80	78.4278	1.02212508	1.067621745	1.016825468	1.080420807	0.045496665	0.063595339	0.050796277	0.058295727
2002.01	0.00733	70	61.4615	1.021450636	1.065344218	1.016351382	1.078542288	0.043893582	0.062190906	0.048992836	0.057091652
2002.02	0.01462	70	55.7168	1.022101501	1.06489319	1.017102472	1.078690511	0.04279169	0.061588039	0.047790719	0.05658901
2002.03	0.01942	70	56.8844	1.025650342	1.068048289	1.017850719	1.08104766	0.042397947	0.06319694	0.05019757	0.055397318
2002.04	0.00484	60	46.001	1.024725683	1.06752258	1.017126234	1.080221659	0.042796896	0.063095424	0.050396345	0.055495975
2002.05	0.00725	50	41.2301	1.023425901	1.067422716	1.01722635	1.080821746	0.043996815	0.063595396	0.050196366	0.057395844
2002.06	0.00724	40	34.9835	1.02190154	1.066197273	1.016902022	1.079396001	0.044295732	0.062493979	0.04929525	0.05749446
2002.07	0.00963	40	30.1218	1.019501989	1.065197596	1.016702258	1.078896279	0.045695607	0.062194021	0.048495338	0.05939429
2002.08	0.00961	40	29.8809	1.017526776	1.063623459	1.016126877	1.075722588	0.046096683	0.059595711	0.047496582	0.058195812
2002.09	0.00720	30	25.8465	1.017151269	1.061449147	1.016251312	1.073948548	0.044297878	0.057697236	0.045197835	0.056797279
2002.10	0.00479	30	24.8347	1.016451357	1.063149122	1.01575139	1.077248447	0.046697765	0.061497057	0.047397732	0.06079709
2002.11	0.00479	30	25.6681	1.014754634	1.06294773	1.012155006	1.076045853	0.048193096	0.063890847	0.050792724	0.06129122