NBER WORKING PAPER SERIES

INFLATION, MONETARY POLICY AND STOCK MARKET CONDITIONS

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Working Paper 14019
http://www.nber.org/papers/w14019

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2008

The authors thank Christopher Martinek for research assistance. The views expressed in this paper are not necessarily official positions of the Federal Reserve Bank of St. Louis, the Federal Reserve System, Russell Investments, or the views of the National Bureau of Economic Research.

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NBER Working Paper No. 14019
May 2008
JEL No. E31,E52,G12,N12,N22

ABSTRACT

This paper examines the association between inflation, monetary policy and U.S. stock market conditions during the second half of the 20th century. We estimate a latent variable VAR to examine how macroeconomic and policy shocks affect the condition of the stock market. Further, we examine the contribution of various shocks to market conditions during particular episodes and find evidence that inflation and interest rate shocks had particularly strong impacts on market conditions in the postwar era. Disinflation shocks promoted market booms and inflation shocks contributed to busts. We conclude that central banks can contribute to financial market stability by minimizing unanticipated changes in inflation.

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I. **Introduction**

The association between monetary policy and the performance of stock and other asset markets has long piqued the interest of economists and policymakers. Stocks are claims on real assets and, hence, monetary neutrality implies that monetary policy should not affect real stock prices in the long run. Although real stock returns and inflation have been negatively correlated historically (Fama and Schwert, 1977), the correlation is widely seen as an anomaly resulting from the simultaneous impacts of real economic activity on inflation and stock returns (Fama, 1981).[1]

Despite the presumed irrelevance of inflation for real stock returns in the long run, researchers have found considerable evidence that monetary policy can affect real stock prices in the short run.[2] Further, economists have conjectured that the nature of the monetary policy regime can affect the performance of asset markets over longer horizons. Goodfriend (2003), for example, argues that before 1980 the policies of the Federal Reserve and other central banks were an important source of macroeconomic and financial instability that could explain the negative correlation between real stock prices and inflation. Rising inflation, for example, tended to depress stock returns because higher expected inflation would increase long-term interest rates (and thereby raise the rate at which investors discount future dividends) and because monetary policy actions to limit inflation would tend to slow economic activity (and thereby depress current and forecast earnings).[3]

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[1] See also Lee (1992) or Rapach (2001; 2002). By contrast, Modigliani and Cohn (1979) argue that the negative correlation between stock returns and inflation reflects “inflation illusion” on the part of investors. For supporting evidence, see Campbell and Vuolteenaho (2004) and Ritter and Warr (2002).

[2] See Bernanke and Kuttner (2005) and He (2006), and references therein for estimates of the short-run impact of monetary policy on stock prices.

[3] Some economists argue that asset price bubbles or other forms of financial instability are more likely when monetary policy fails to maintain a stable price level (e.g., Schwartz, 1995; Woodford, 2003).

The "Fed model" of stock returns, which links market returns to inflation through nominal bond yields has had considerable success as a historical description of stock prices (Campbell and Vuolteenaho, 2004), and many observers believe that disinflation contributed to the U.S. stock market boom of the 1990s, as well as to booms historically.[4] Indeed, at a Federal Open Market Committee meeting in 1996, Chairman Alan Greenspan observed:

> We have very great difficulty in monetary policy when we confront stock market bubbles. That is because, to the extent that we are successful in keeping product price inflation down, history tells us that price-earnings ratios under those conditions go through the roof. What is really needed to keep stock market bubbles from occurring is a lot of product price inflation, which historically has tended to undercut stock markets almost everywhere. There is a clear tradeoff. If monetary policy succeeds in one, it fails in the other. (FOMC meeting transcript, September 24, 1996, pp. 30-31)[5]

Thus, while monetary policy and inflation probably have little or no long-run impact on real stock returns, the view that monetary policy can affect the stock market in the short-to-intermediate run both through unanticipated policy shocks and through its impact on inflation is widely held.

In this paper we seek to quantify the extent to which various macroeconomic and policy shocks, including inflation shocks, can explain the behavior of U.S. real stock prices during the second half of the 20th century. Prior research has found that the impact of monetary policy actions on stock returns has varied over time with changes in market conditions. Chen (2007), for example, uses a Markov-switching model to identify bull and bear markets, and finds that monetary policy shocks have a larger impact on market

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[4] Bordo and Wheelock (2007) review the histories of major 20th century stock market booms in the United States and nine other countries and find that booms usually arose when inflation was below its long-run average, and that booms typically ended when inflation began to rise and/or monetary authorities tightened policy in response to rising or a threatened rise in inflation.

[5] Borio and Lowe (2002) argue similarly, contending that disinflation can promote financial imbalances, including stock market bubbles.

returns in bear markets and that contractionary monetary policy increases the probability of the market moving to a bear market state.

We also investigate the impact of macroeconomic and policy shocks on stock market conditions, and whether the response of real stock prices to shocks differs during extended periods of unusually rapid growth and decline in real stock prices ("booms" and "busts") compared with periods of more normal market conditions. Unlike Chen (2007), who assumes that the stock market is always in either a bull- or a bear-market state, our approach allows a majority of observations to belong to a middle ("normal") category, which enables us to test explicitly for differences in behavior during highly unusual episodes. If all observations were forced to lie within either a boom or bust state, the magnitude of the difference between these two qualitative states would be diluted if most observations actually belong to a middle ("normal") category. The historical record suggests that equity and other asset markets are characterized by occasional extended periods of extreme optimism and extreme pessimism that seem to defy fundamentals.[6] If true, it would suggest that the impact of a given policy or economic shock on real stock prices might differ during such periods from more normal times.

We employ a latent-variable vector autoregression (Qual-VAR) model to estimate the impact of macroeconomic and policy shocks on the growth of real stock prices and stock market conditions. By explicitly taking account of market conditions, the Qual-VAR is well suited to studying experiences that fall outside the norm, such as stock market booms and busts, that comprise relatively little of the overall sample variance of stock price movements. Thus, the Qual-VAR provides evidence about whether

[6] Discussions of this phenomenon include Kindleberger (1989) and Shiller (2005).

relationships observed during booms or busts differ from those of periods that could be characterized as normal.

Qual-VAR models have been used to examine recessions, where researchers are interested in estimating relationships during periods of unusually weak activity that nonetheless account for relatively little of the overall sample variance of output (e.g., Dueker, 2005; Dueker and Nelson, 2006). However, unlike recession dates, which a researcher can reasonably treat as data, the identification of when the stock market is in a boom or bust state inherently involves judgment on the part of the researcher, which is a potential drawback of the basic Qual-VAR approach.[7] To address this drawback, we use a hybrid approach that combines an otherwise standard Qual-VAR model with a dynamic factor model. This hybrid model allows the data to partly identify market conditions guided by our initial classification of periods of exceptionally rapid and prolonged increase in real stock prices as "booms," and significant decline as "busts."

From the Qual-VAR estimation we find evidence that inflation shocks have had a significant impact on the U.S. stock market historically, with disinflation shocks promoting booms and inflation shocks promoting busts. Interest rate shocks also have had a large impact, with unexpected increases in the long-term interest rate pushing the market toward a bust and unexpected rate declines moving the market toward a boom. Further, our counterfactual analysis indicates that disinflation shocks can explain more of the stock market boom of 1995-99 than output shocks, and that inflation shocks also contributed to prior episodes of market instability. Our results are thus consistent with

[7] See Harding and Pagan (2006) for warnings about working with constructed classifications. This problem arises in many contexts, e.g., in studies of financial or currency crises (e.g., Kaminsky and Reinhart, 1999).

the view that a policy regime that minimizes unanticipated fluctuations in inflation can contribute to financial market stability.

Section II describes our econometric model and approach for identifying market conditions. Section III presents estimation results and a counterfactual exercise to identify the importance of various shocks on market conditions throughout the period spanned by our data. Section IV concludes.

II. Estimating the Impact of Macroeconomic and Policy Shocks on Real Stock Prices

Several studies have investigated the impact of macroeconomic shocks on stock market variables using vector autoregression techniques.[8] However, unlike prior studies, we focus on the extent to which macroeconomic and policy shocks can explain changes in stock market conditions, and whether the impact of shocks on real stock prices historically has varied with the market's condition. Relatively little of the overall sample variance of stock returns occurs during booms or busts because those episodes occur infrequently. Hence, estimates from models that do not account for the condition of the market will be heavily influenced by data from normal periods. Our latent variable vector autoregression (Qual-VAR) approach can provide evidence about whether the relationships we observe during booms and busts differ from those of more ordinary market conditions.

A potential drawback of the basic Qual-VAR approach to modeling stock market conditions stems from its reliance on the subjective determination by the researcher of when the market is in a boom or bust state. In making use of a constructed chronology of financial booms and busts, one has to decide how heavily to rely on the judgmental dates.

8 Recent examples include Lee (1992), Rapach (2001), and Hayford and Malliaris (2004).

If they are given full credence, a multivariate dynamic ordered probit approach, such as the Qual-VAR from Dueker (2005) and Dueker and Nelson (2006), would treat the constructed chronology as part of the data. However, in the absence of widely accepted criteria for identifying differences in market conditions, we adopt the hybrid approach described below that makes the determination of market conditions at least partly endogenous, and thereby lessens the influence of our own judgments about how to define booms and busts. This approach could be applied in other settings where the identification of an episode being studied is based on ad hoc criteria.

Econometric Model

To fix ideas, consider a generic unobserved component state-space model with the following state equation, where X are the observable variables and *z* is the latent unobserved component:

$$\begin{pmatrix} X_t \\ z_t \\ z_{t-1} \end{pmatrix} = \begin{pmatrix} c_X \\ c_z \\ 0 \end{pmatrix} + \begin{pmatrix} \Phi_{XX} & \Phi_{Xz} & 0 \\ \Phi_{zX} & \Phi_{zz} & 0 \\ 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} X_{t-1} \\ z_{t-1} \\ z_{t-2} \end{pmatrix} + \begin{pmatrix} \varepsilon_{X,t} \\ \varepsilon_{z,t} \\ 0 \end{pmatrix} \quad (1)$$

The measurement equation is

$$X_t = \begin{pmatrix} I & 0 & 0 \end{pmatrix} \begin{pmatrix} X_t \\ z_t \\ z_{t-1} \end{pmatrix} \quad (2)$$

As an example of the Qual-VAR approach, consider the following relationship between the latent variable and the three categories of stock market conditions:

$$\begin{aligned} bust\ state\ iff &\quad z_t < c_1 \\ normal\ state\ iff &\quad c_1 \le z_t < c_2 \\ boom\ state\ iff &\quad z_t > c_2 \end{aligned}$$

The constants c_1, c_2 are estimated and serve as truncation limits for the latent variable, based on the three categories of stock market conditions. Imposing these truncation limits on the latent variable is tantamount to treating the boom/bust classifications as data. This approach is used in the Qual-VAR model, which is a multivariate dynamic probit in which a continuous latent variable lies behind observed qualitative categories. Alternatively, the unobserved components model in equations (1) and (2) can be a dynamic factor model in which the latent variable takes on whatever values best explain the observed data vector X over time.

In this paper, we adopt a hybrid approach that bridges the Qual-VAR model and the dynamic factor model. The hybrid approach consists of running two state-space models in parallel. The first is a Qual-VAR model that imposes the truncation limits on the latent variable implied by our *ex ante* determination of market conditions. The second model ignores our judgmental determination and amounts to a dynamic factor model. In both cases, the state-space form is that of equations (1) and (2). The only difference between the Qual-VAR and dynamic factor versions is the imposition of the truncation limits on the latent variable in the Qual-VAR, but not in the dynamic factor model. The Qual-VAR model is used to generate a vector of mean values for the latent variable. The vector is then randomized around these means using the variance implied by the dynamic factor model to obtain the sampled values:

$$sampled\ value \quad z_t = \bar{z}_t^{DP} + \sigma_t^{DF} e_t$$

where DP denotes a value implied by the Qual-VAR (dynamic probit) model, DF refers to the dynamic factor model and *e* is a standard normal shock. Note that the sampled values of the latent variable need not conform with the truncation limits imposed in the Qual-VAR. Also note that, in keeping with the Bayesian nature of the estimation procedure outlined here, one can easily scale the variances up or down. A scaling factor less than one implies a greater degree of confidence in the *ex ante* determination of market conditions, which amounts to a stronger prior on their relevance. Similarly, a scaling factor greater than one amounts to a weaker prior on the *ex ante* determination. We set the scaling factor to 1.0, which we consider to be a neutral baseline value, to generate the results presented here.

A key property of the hybrid procedure is that the draws of the latent variable can lie outside the truncation limits and so the model-implied category for a given observation can differ from the category assigned to it by the researcher. Nevertheless, unlike the dynamic factor model, by centering the randomization of the latent variable at the values implied by the *ex ante* determination, the latent variable is tailored to reflect the judgmental determination on average across the sample period. In this way, the hybrid Qual-VAR / dynamic factor model helps overcome the "what does the factor represent?" question that hinders interpretation of dynamic factor models. At the same time, however, the hybrid model also addresses concerns about the accuracy with which the researcher assigned observations to particular categories.

We estimate our hybrid model using a Bayesian Markov Chain Monte Carlo estimation procedure in which the randomized values of the latent variable are treated as a proposal value in a Metropolis-Hastings step. This proposal draw is either accepted or rejected depending on how the draw fits the data density.[9] The proposal density has the mean implied by the Qual-VAR and the variance implied by the dynamic factor model. The data density is derived from the forecast errors for the observed data X conditional on a vector of values for the latent variable z. According to the Metropolis-Hastings sampling algorithm for the latent variable, the proposal value is accepted with probability

$$\alpha\left(z^{new}\right) = \min\left\{\frac{g\left(z^{old}\right) f_T\left(X \mid z^{new}\right)}{g\left(z^{new}\right) f_T\left(X \mid z^{old}\right)}, 1\right\}$$

The current value z^{old} is retained if the proposal value is rejected by a uniform draw on the unit interval, where the acceptance probability is α, g is the proposal density for the latent variable vector and f is the target density for the data conditional on a set of values for the latent variable.

Probit models are nonlinear regressions. Even though we are working in a vector autoregression framework, the latent variable leads to a nonlinear response of the macroeconomic variables to a change in stock prices. If a change in stock prices is associated with a change in market conditions, say from normal to boom, then the effect is magnified (or possibly dampened) relative to a change in stock prices of the same size that is not associated with a change in conditions. This nonlinearity arises because the latent variable is relatively constant within each category of market conditions but undergoes sizable jumps between categories.

Data and Model Specification

We use the hybrid Qual-VAR / dynamic factor model to estimate the effects of output, inflation, and other shocks on real stock prices and the latent variable representing

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[9] See Chib and Greenberg (1995) for details about the estimation procedure.

market conditions. First, we identify extended periods of exceptional increase or decline in real stock prices (the nominal S&P 500 index deflated by the Consumer Price Index) using the approach of Pagan and Sossounov (2003). Specifically, we identify peaks and troughs in the real stock price within rolling, 25-month windows. To ensure that peaks and troughs alternate, we eliminate all but the highest maximum that occurred before a subsequent trough and all but the lowest minimum that occurred before a subsequent peak. We classify as booms all periods of at least 36 months from trough to peak with an average annual rate of increase in the real stock price index of at least 10 percent or of at least 24 months with an annual rate of increase of at least 20 percent. We define market busts as all periods of at least 12 months from a market peak to a market trough in which the index declined at an average rate of at least 20 percent per year. Following Pagan and Sossounov (2003), we also treat the 1987 stock market crash as a bust even though the stock market decline lasted for less than 12 months. Similarly, we also treat the 10-month decline in 1966 as a bust. Table 1 lists the boom and bust periods we identify and the average annual percentage change in the stock market index during each episode. For comparison, the real stock price index rose at an average annual rate of 4.4 percent throughout 1947-2004.

As described above, our estimation procedure uses the boom and bust periods listed in Table 1 as starting values, but the implied classifications for individual periods are determined endogenously by fitting the model to the data, thereby reducing the extent to which our estimation results are driven by our personal judgments about how to define booms and busts. Our *ex ante* determination of market conditions guides the sampling of the latent variable but some percentage of the Markov Chain Monte Carlo draws for a given observation will imply a different classification than the one we chose. For example, not all draws will have $z_t > c_2$ within periods listed as booms in Table 1. Figures 1-3 show the percentage of Qual-VAR draws in which the given model-implied stock market category corresponds with the market booms and busts listed in Table 1. For example, Figure 1 shows the percentage of draws for which $z_t > c_2$ within periods designated *ex ante* as booms (indicated by the shaded regions). For the most part, the figures show that a high percentage of the model-implied draws of the latent variable lie within the categories we identified *ex ante*. Note, however, that the percentages are by no means constant during these periods, illustrating the difference between the latent market conditions variable and the *ex ante* determination of market booms and busts.

III. Estimation Results

The hybrid Qual-VAR / dynamic factor model allows us to present results through familiar vector autoregression tools such as impulse responses and variance decompositions. These tools are available once we specify an ordering of the VAR variables. The selected ordering also permits us to conduct counterfactual analysis by way of shutting down one structural shock at a time and then calculating counterfactual histories of the model variables. In doing so, we can investigate the extent to which stock market conditions would have differed over our sample period in the absence of various shocks.

We are interested in estimating the impact of shocks to output, inflation, and various other nominal variables on real stock prices and market conditions. To apply standard VAR tools to our hybrid model, we identify shocks through the following ordering of variables: (log) industrial production, inflation, money stock growth, 10-year

Treasury security yield, 3-month Treasury bill yield, real stock price index, and the latent stock market variable (*z*), representing market conditions.[10] The variables are ordered so that variables that are pre-determined to a greater extent appear first. Shock measures for variables ordered last condition on a greater number of forecast errors and therefore ought to be cleaner. In ordering the stock market variables last, we assume that stock market shocks have no contemporaneous impact on the other variables in the model, which seems preferable to assuming that policy and other shocks have no contemporaneous impact on the stock market.[11] We use monthly data for August 1952 – December 2005, and six lags in the Qual-VAR autoregressions.

Figure 4 presents impulse responses of the real stock price index (S&P 500) and stock market conditions for output (industrial production) and inflation shocks. The figures show point estimates and the bounds of two standard deviations on either side of the point estimates. The initial impacts of output shocks on the real stock price index and on market conditions are both positive, but die out quickly and are not statistically significant. By contrast, inflation shocks have a negative, statistically significant and persistent impact on both the real stock price and market conditions. Not only do positive inflation shocks reduce the real stock price, they also move market conditions away from boom and normal states toward busts. Moreover, the impact on stock market conditions

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[10] We experimented by excluding money stock growth and by reversing the order of the 10-year and 3-month Treasury security yields. In so doing we obtained results that are qualitatively similar to those reported here except as noted below. See the appendix for variable definitions and data sources.

[11] Evidence on whether or not the Fed reacted to the stock market boom of the 1990s has been mixed. Rigobon and Sack (2003) use an identification scheme based on the heteroskedasticity of stock returns to sort out the simultaneous response of equity prices and interest rates. They estimate that during 1985-99, a 5 percent rise in the S&P 500 stock price index increased the likelihood of a 25 basis point policy tightening by about one half. Cecchetti (2003) also concludes that the Fed tightened in response to the booming stock market in the 1990s. On the other hand, Hayford and Malliaris (2004) estimate a forward-looking Taylor Rule and find no evidence that the Fed reacted to the stock market during the 1990s, and Meyer (2004) contends that the Fed did not react systematically to movements in the stock market during his tenure as a member of the Federal Reserve Board of Governors, 1996-2002.

appears to induce further decline in real stock prices. In a simple VAR model that does not include the latent stock market conditions variable, inflation shocks account for only 25 percent of the variance of the real stock price at a 36 month horizon – a horizon at which the central bank is certainly responsible for the thrust of inflation shocks. However, in the hybrid Qual-VAR model, which allows both a direct effect of inflation on stock prices and an indirect effect via stock market conditions, inflation shocks account for almost 33 percent of the variance of real stock prices. Thus, our latent variable approach captures a quantitatively important channel by which inflation shocks affect real stock prices through their impact on stock market conditions.

Figure 5 shows the impacts of shocks to money stock growth and interest rates on the stock market index and market conditions. Money stock growth shocks do not have a statistically significant impact on the market. However, shocks to the long-term interest rate have a negative, statistically-significant and persistent impact on the real stock price. The estimated impact on market conditions is also negative, though statistically significant only for the first three months. Rising interest rates can depress stock prices by raising the rate at which investors discount future earnings and/or by reducing the growth rate of earnings, and thus it is not surprising to find that interest rate shocks tend to reduce stock prices and push the market away from boom conditions. Finally, controlling for shocks to the long-rate, we find that the initial impact of short-term interest rate shocks on the real stock price is negative (though not statistically significant) whereas the initial impact on stock market conditions is positive. Over the long-run, however, short-term interest rate shocks have a negative impact on both the real stock price and stock market conditions.[12]

Next we examine the impacts of output, inflation, and interest rate shocks on stock market conditions over time by comparing counterfactual values of the latent market conditions variable constructed by shutting down individual shocks with values estimated from the full model. The black lines in Figures 6-8 show the posterior mean values of the latent stock market conditions variable z_t relative to the constants c_1 and c_2 that demarcate the bust, normal, and boom regions (c_1 and c_2 are indicated by the dashed horizontal lines).[13] The grey lines in Figures 6-8 show counterfactual values of the latent variable calculated by setting the indicated structural shock to zero. This provides an indication of the importance of various shocks to stock market conditions throughout our sample period.

Figure 6 shows that output shocks can account for little of the change in stock market conditions over time, as the simulated path of market conditions is nearly identical to the actual path of the latent variable. Inflation shocks appear to have had a more pronounced impact on the market. Figure 7 indicates, for example, that stock market conditions would have been stronger in the early 1990s but weaker later in the decade in the absence of inflation shocks. U.S. inflation spiked following a sharp increase in energy prices at the start of the Gulf War in 1990. Although inflation then fell, it remained above historical norms and higher than one might forecast given the

[12] We find the impact of short-term interest rate shocks to be somewhat sensitive to whether the short-term interest rate is ordered before or after the long-term interest rate in the Qual-VAR as well as to the estimation period. Short-term interest rate shocks are found to have a stronger negative impact on stock prices if the short-term rate is placed before the long-term rate in the variable ordering, and also when the estimation is restricted to the post-1980 period. It should be noted, of course, that shocks to short-term interest rates capture idiosyncratic movements and not the endogenous response of interest rates or monetary policy to inflation, output or stock prices.

[13] The values shown for c_1 and c_2 are posterior means estimated under the restriction that $c_1 < 0$ and $c_2 > 0$.

stance of monetary policy.[14] Our counterfactual series indicates that positive inflation shocks kept a lid on the stock market before 1995. Further decline in the inflation rate in the mid-1990s, however, appears to have promoted a boom state during 1995-99 according to our counterfactual. In the absence of unexpected decline in inflation, the counterfactual suggests the stock market would have dropped out of a boom state in mid-1997 into the normal region.

Inflation shocks were also important for U.S. stock market conditions at other times over our sample period. For example, our counterfactual indicates that lower-than-expected inflation can help explain the stock market boom of 1953-56, whereas higher-than-expected inflation may have contributed to the market bust of 1973-75. Further, we find that stock market conditions would have been decidedly weaker in the absence of shocks associated with disinflation in the early 1980s.

Figure 8 presents a counterfactual path for market conditions in the absence of shocks to the long-term Treasury security yield. The counterfactual series indicates, for example, that market conditions might have been stronger in the absence of positive interest rate shocks during 1978-81, especially after the abrupt tightening of monetary policy in October 1979. However, negative interest rate shocks can help account for the stock market boom conditions of the mid-1980s and late 1990s. Thus, our results indicate that unanticipated changes in inflation and interest rates were important determinants of both real stock prices and market booms and busts over the post-war era.

[14] In an op-ed article in the *Wall Street Journal* on 23 October 1992, Milton Friedman argued that "monetary policy has been extremely tight, not easy, in the U.S." Noting that M2 growth had fallen below 2 percent during the prior four quarters, Friedman argued that "continuation of M2 growth at 2% per year would imply actual deflation, not negligible inflation." In the event, inflation remained between 2.5 and 3 percent until 1997.

IV. Conclusion

Policymakers and others often link the performance of the stock market to changes in inflation and monetary policy, especially during extended periods of rapid appreciation or decline in real stock prices. This paper presents an empirical model that allows the impact of macroeconomic and policy shocks on real stock prices to vary with stock market conditions. Further, the approach enables us to examine the contribution of various shocks to stock market conditions during particular episodes. Thus, the use of a latent boom/bust measure of stock market conditions captures an additional channel through which a central bank's efforts to reduce fluctuations in inflation can contribute to greater asset market stability. Methodologically, our hybrid Qual-VAR / dynamic factor model offers an innovative approach to estimating the determinants of asset booms and busts that lessens the influence of researcher judgment on the identification of market conditions.

The evidence reported here provides support for the view that unanticipated changes in inflation and interest rates have played important roles in major movements in the U.S. stock market since World War II. We find that inflation and interest rate shocks have large, negative impacts on stock market conditions, apart from their effects on real stock prices. Disinflationary shocks, for example, can help explain the U.S. stock market boom of 1994-2000, whereas inflationary shocks can help explain the bust of 1973-74. The policy lesson we draw concerns not necessarily what policymakers ought to do when faced with a bubbling stock market but how they can contribute to equity market stability by minimizing unanticipated fluctuations in inflation. Similarly, the impulse responses to long-term interest rate shocks suggest that monetary policies that induce financial markets to reduce inflation risk premia in long-term interest rates will promote financial market stability.

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Appendix

This appendix provides information about the data and sources used in this paper.

Stock Price Index:

Standard and Poor's 500 Composite Index, monthly average of daily data. Source: Haver Analytics.

Consumer Price Level:

All Items Consumer Price Index for urban consumers (not seasonally adjusted, 1982-84=100). Source: Haver Analytics.

Output:

Index of Industrial Production (seasonally adjusted, 2002=100). Source: Haver Analytics.

Money Stock:

Broad money stock (1952-58). Source: Friedman and Schwartz (1963), Table A-1, column 8. Board of Governors M2 (1959-2005). Source: Federal Reserve Bank of St. Louis.

Long-term Treasury Yield:

Yield on 10-year constant maturity Treasury security. Source: Haver Analytics.

Short-term Interest Rate:

Secondary market (discount) yield on 3-month Treasury bills (1953-2005). Source: Haver Analytics.

Table 1
U.S. Stock Market Booms and Busts

Booms			Busts		
Boom Start	Boom End	Avg. Annual % Change	Bust Start	Bust End	Avg. Annual % Change
Sept. 1953	Apr. 1956	28.8	Dec. 1961	June 1962	-49.8
June 1962	Jan. 1966	13.3	Jan. 1966	Oct. 1966	-29.2
July 1984	Aug. 1987	22.9	Dec. 1968	July 1970	-26.5
Apr. 1994	Aug. 2000	17.1	Jan. 1973	Dec. 1974	-38.3
			Nov. 1980	July 1982	-19.9
			Aug. 1987	Dec. 1987	-91.0
			Aug. 2000	Feb. 2003	-23.7

Source: Text.

Figure 1: **United States Boom Category Model-Implied Draws of the Latent Variable**

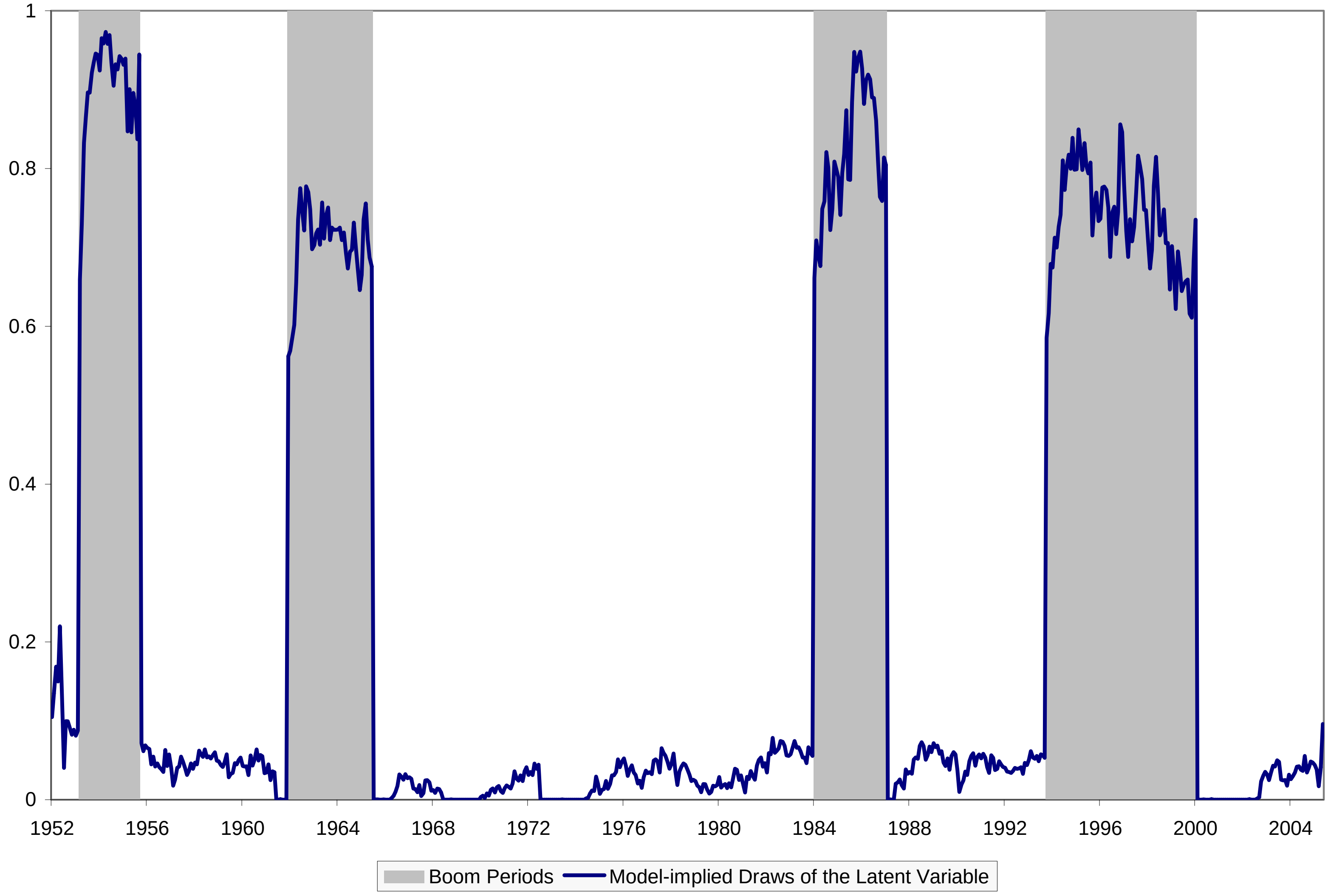

Figure 2: United States Bust Category Model-Implied Draws of the Latent Variable

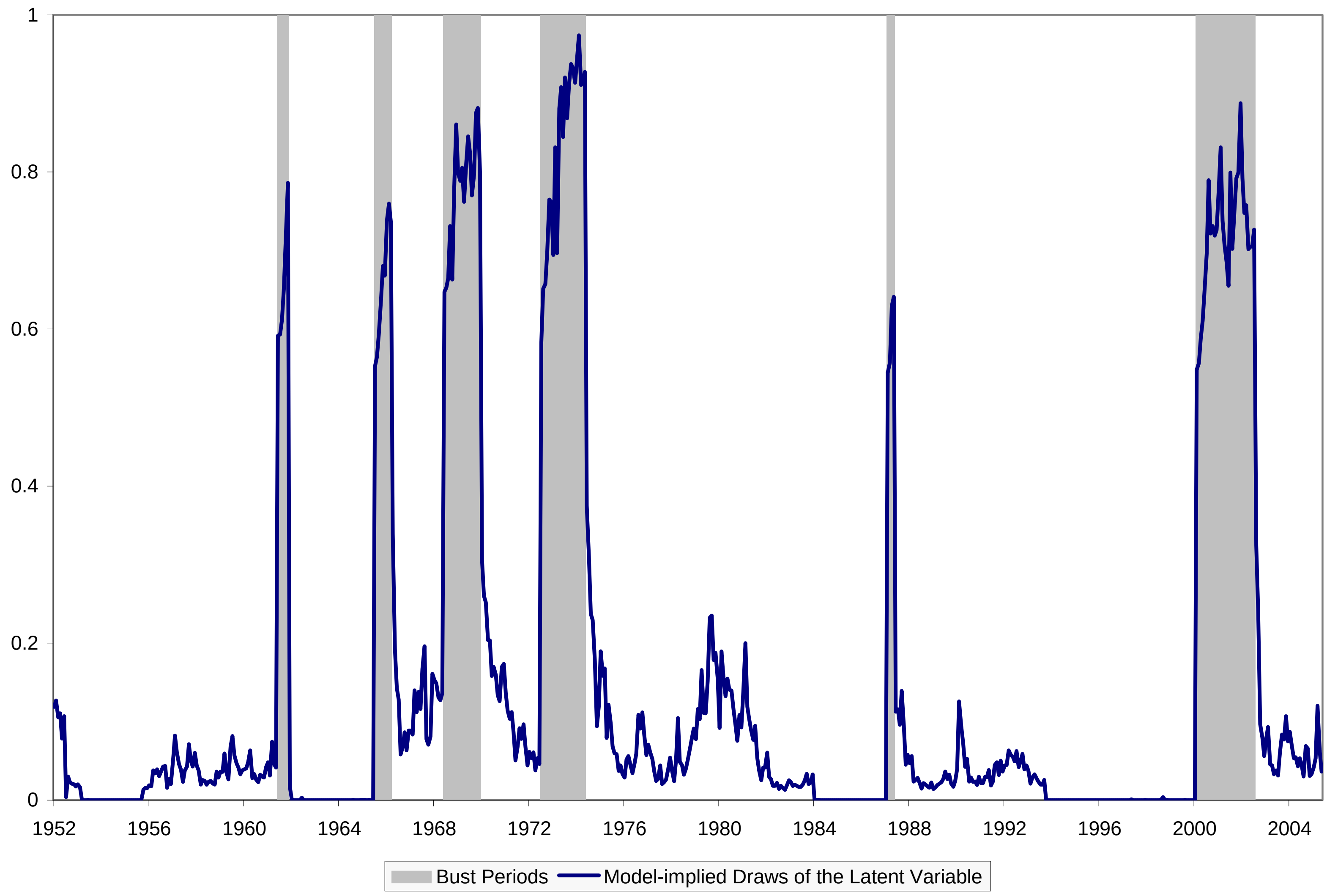

Figure 3: United States Normal Category Model-Implied Draws of the Latent Variable

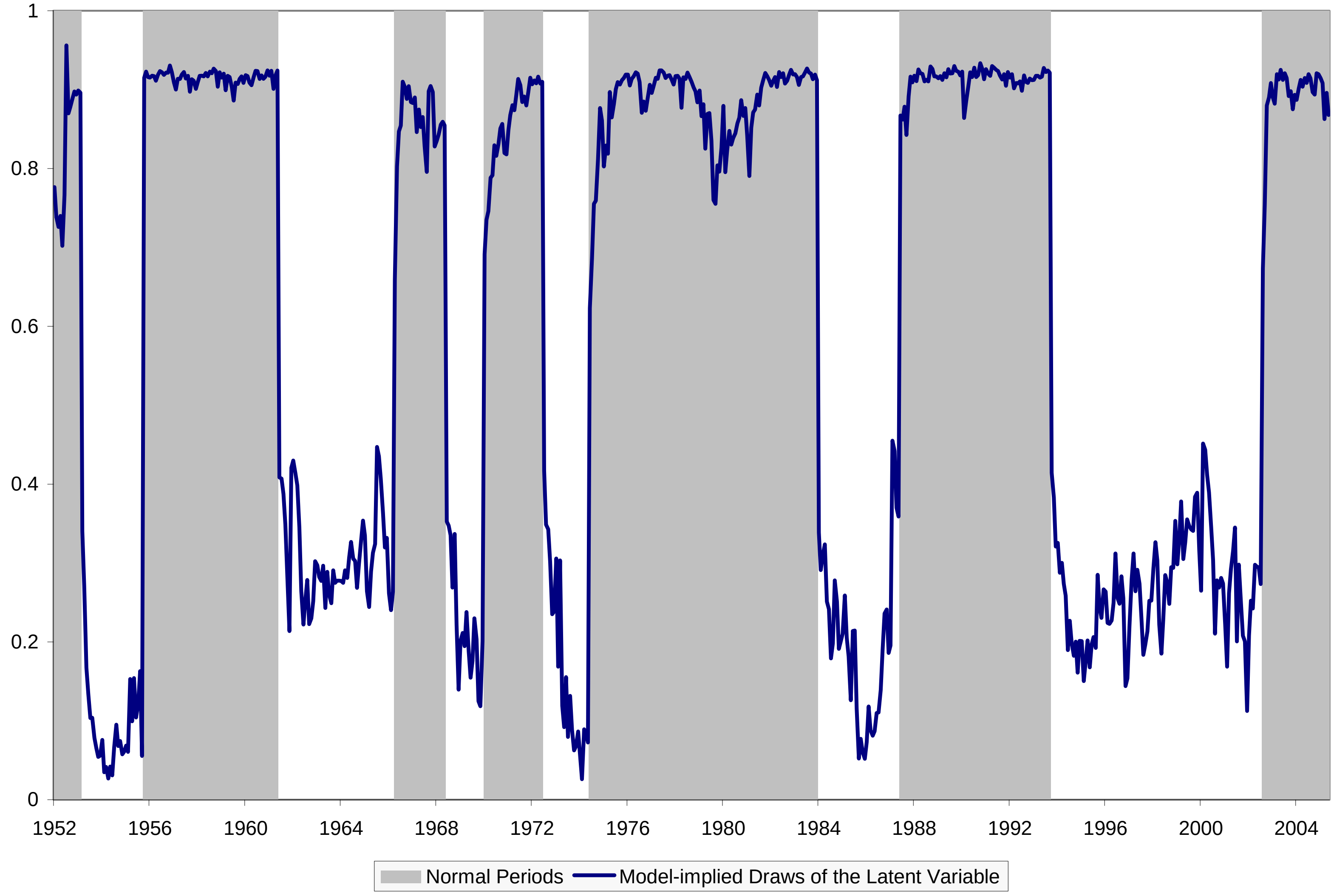

Figure 4: Impulse Response Functions of Stock Market Variables to Output and Inflation Shocks

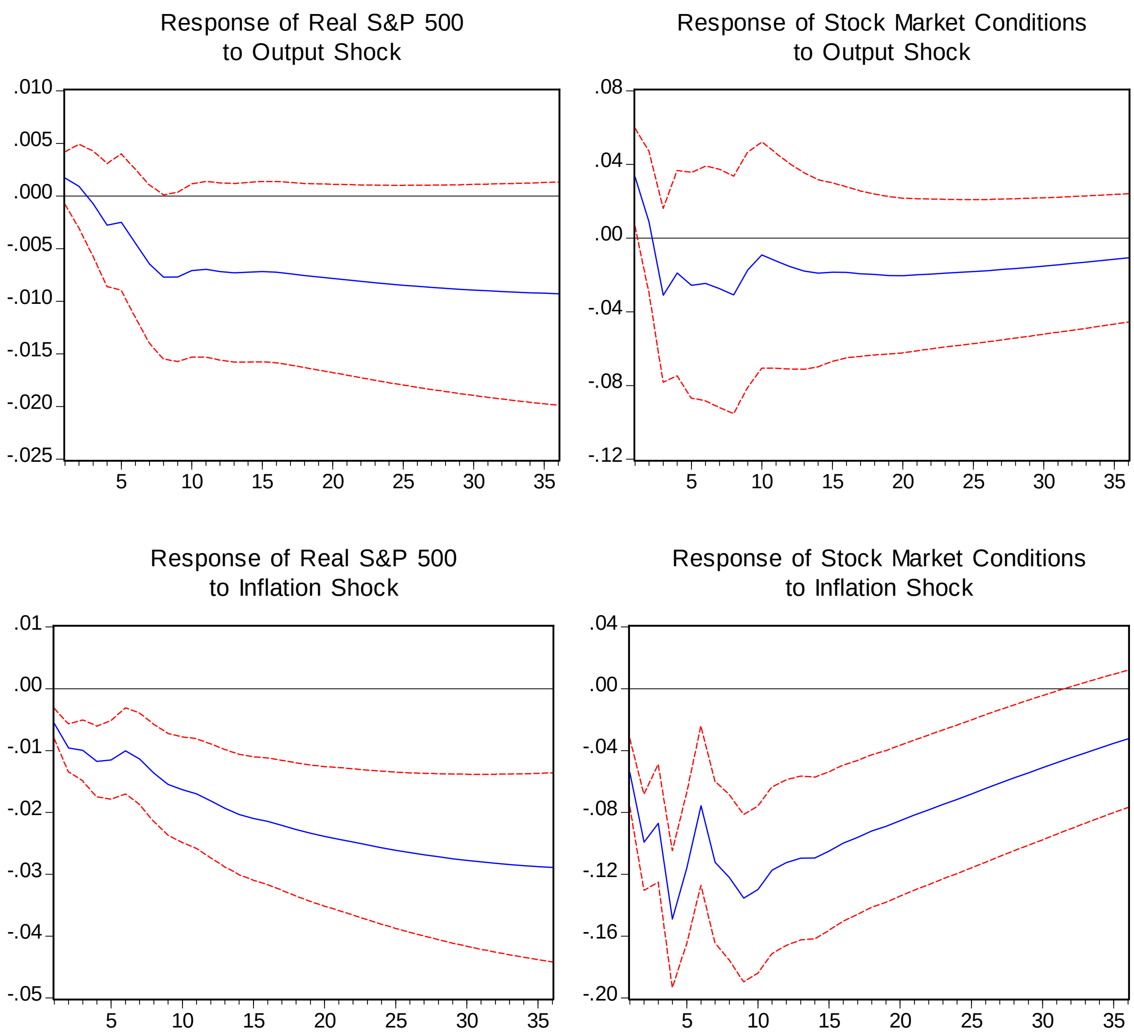

Figure 5: Impulse Response Functions of Stock Market Variables to Money and Interest Rate Shocks

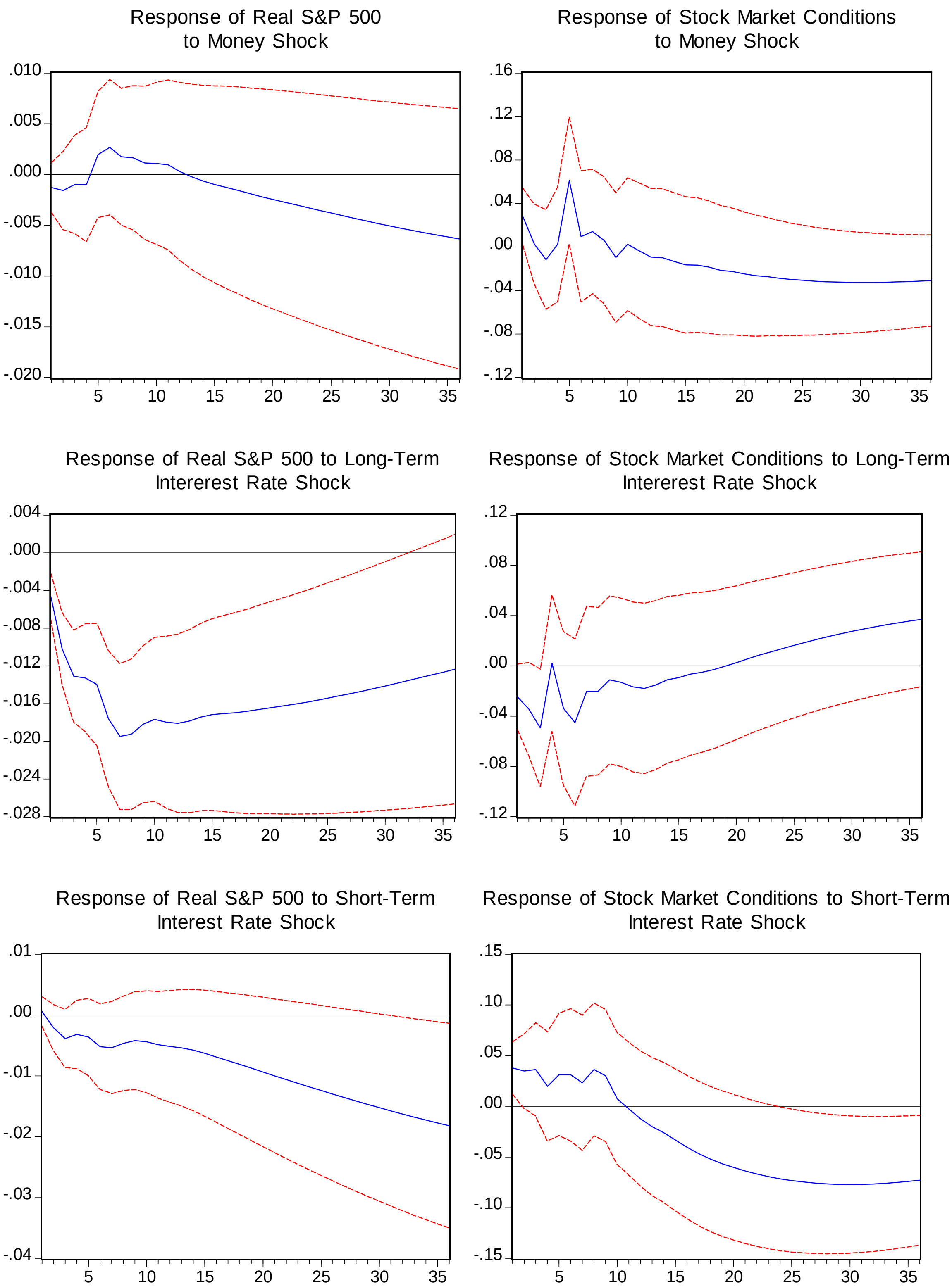

Figure 6: United States Counterfactual Simulations - Stock Market Conditions Without Output Shock

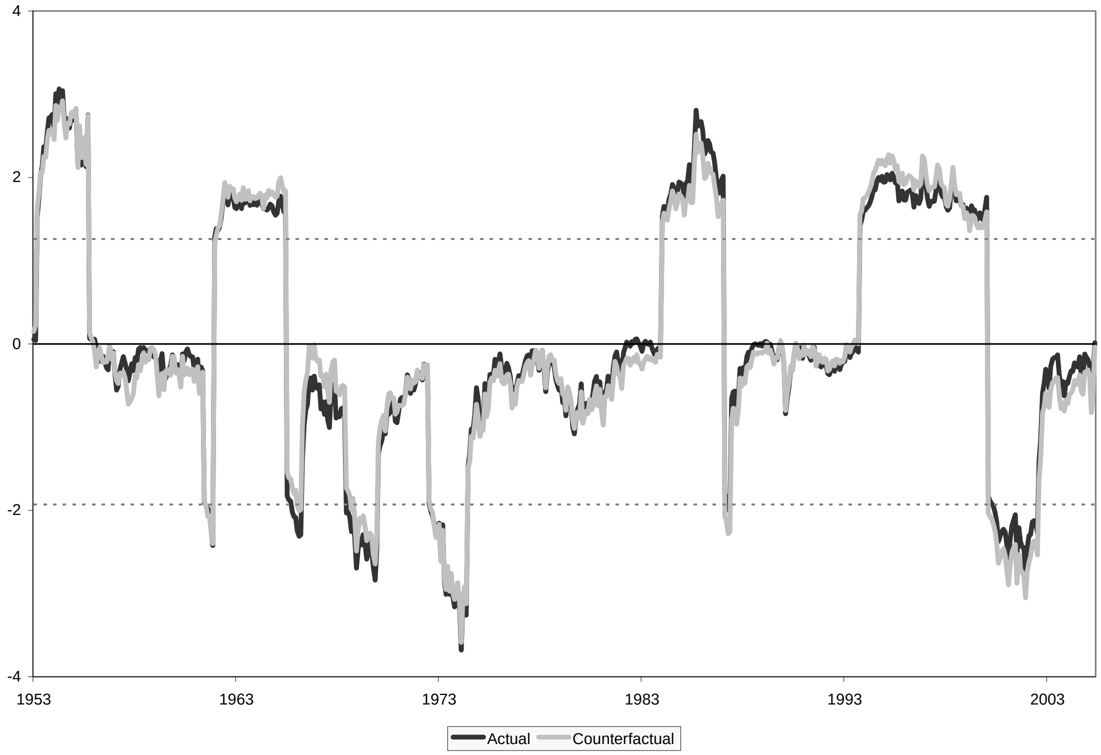

Figure 7: United States Counterfactual Simulations - Stock Market Conditions Without Inflation Shock

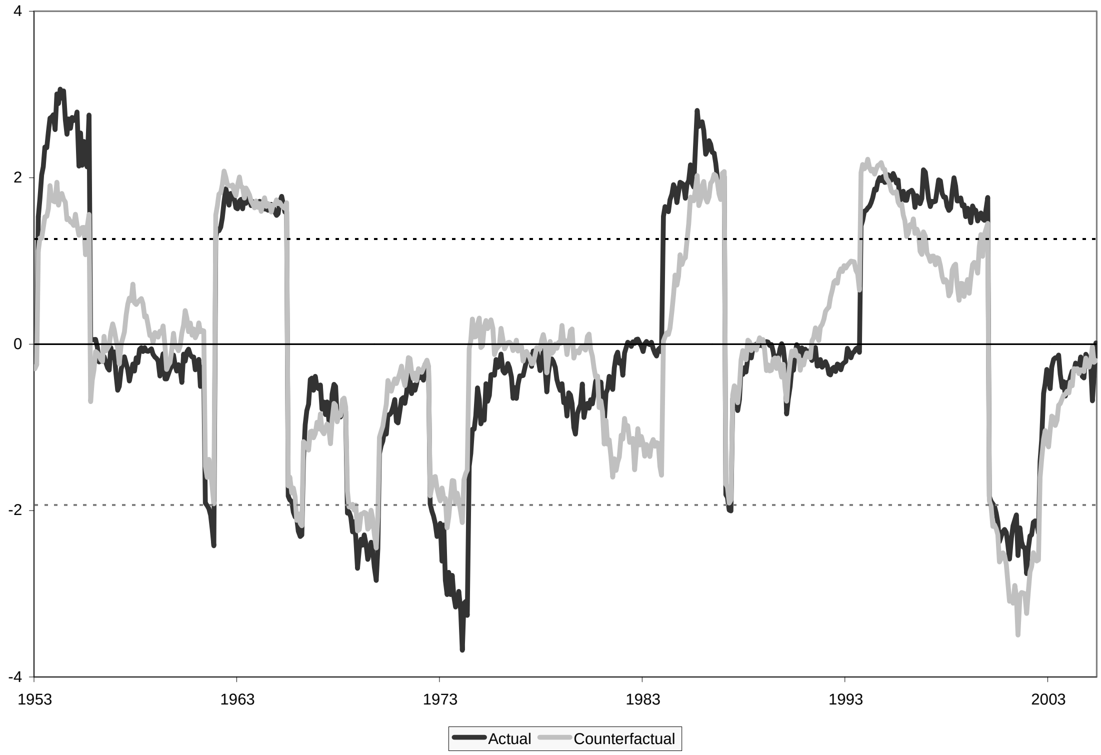

Figure 8: United States Counterfactual Simulations - Stock Market Conditions Without Long Rate Shock