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The Stock Market's Reaction to Unemployment News: Why Bad News Is Usually Good for Stocks

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ABSTRACT

We find that on average, an announcement of rising unemployment is good news for stocks during economic expansions and bad news during economic contractions. Unemployment news bundles three types of primitive information relevant for valuing stocks: information about future interest rates, the equity risk premium, and corporate earnings and dividends. The nature of the information bundle, and hence the relative importance of the three effects, changes over time depending on the state of the economy. For stocks as a group, information about interest rates dominates during expansions and information about future corporate dividends dominates during contractions.

THIS STUDY INVESTIGATES THE SHORT-RUN response of stock prices to the arrival of macroeconomic news. The particular news event we consider is the Bureau of Labor Statistic's (BLS) monthly announcement of the unemployment rate. We establish that the stock market's response to unemployment news arrival depends on whether the economy is expanding or contracting. On average, the stock market responds positively to news of rising unemployment in expansions, and negatively in contractions. Since the economy is *usually* in an expansion phase, it follows that the stock market *usually* rises on the announcement of bad news from the labor market.[1]

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[1] For example, on December 6, 1974, the Labor Department released substantial bad news: The unemployment rate had risen from 6.0% to 6.6%. Around the announcement, the S&P 500 index declined by about 3.6%. However, it is just as easy to find cases in which the stock market *rose* sharply in response to bad unemployment news. On August 3, 1984, the Labor Department announced that the unemployment rate had increased from 7.2% to 7.5%, and around that announcement the S&P 500 index gained 5.4%. It is no coincidence that the first case occurred during a contraction and the second during an expansion.

We next provide an explanation for this seemingly odd pattern of stock price responses. Conceptually, three primitive factors determine stock prices: the risk-free rate of interest, the expected rate of growth of corporate earnings and dividends (hereafter, "growth expectations"), and the equity risk premium. Thus, if unemployment news has an effect on stock prices, that must be because it conveys information about one or more of these primitives.

We begin our explanation by determining whether the pattern of stock price responses can be explained solely by information about future interest rates. If this were the case, stock and bond prices would respond in the same way, except for differences that might arise due to differences in their durations. They do not. During contractions, stock prices react significantly and negatively to rising unemployment, but bond prices do not react in any significant way. Since bond prices do not respond significantly during contractions, it must be the case that unemployment news contains little information about future interest rates in that business cycle phase. Since stock prices do respond significantly during contractions, it must also be the case that the unemployment news contains information about growth expectations and/or the equity risk premium.

During expansions, both bond and stock prices rise significantly on the announcement of rising unemployment. Given the bond response, it must be the case that during expansions, bad labor market news causes expected future interest rates to decline. This could also be what causes stock prices to rise during expansions, but it need not be, since growth expectations and the equity risk premium could be changing also. For example, suppose the real interest rate remains the same, but inflation goes down when unemployment goes up. This would result in a decline in the nominal interest rate and would be good news for bonds. If higher unemployment also signals lower real earnings in the future on equities, stock prices need not go up.

The next step in understanding the pattern of stock price responses over the business cycle is to examine the effect of news arrival on the other two primitive factors: the equity risk premium and growth expectations. We must use proxy measures for both variables since neither is directly observable. In brief, we find evidence that an unanticipated increase in unemployment may lead to an increase in the risk premium during expansions, but we find no evidence of an effect during contractions.

There is also evidence that growth expectations change in response to the unemployment news. Specifically, we find that unemployment news is helpful in predicting the actual growth rate of the index of industrial production (IIP), one proxy measure for growth expectations. Rising unemployment is always followed by slower growth, but this relationship is much stronger during contractions than it is during expansions. Thus, if equity investors study the real sector data, they would be expected to revise their growth expectations more significantly during contractions than during expansions.

A. Related Literature

Blanchard (1981) shows that in equilibrium, the same news can sometimes be good and sometimes bad for financial assets, depending on the state of the economy. This study can be viewed as providing the necessary theoretical motivation for our work. Orphanides (1992) gives empirical support for this view by showing that stock price responses to macroeconomic news may depend on the state of the economy. In particular, he shows that the stock price response to unemployment news depends on the average unemployment rate during the previous year.

McQueen and Roley (1993) also find a strong relationship between stock prices and macroeconomic news, such as news about inflation, industrial production, and the unemployment rate, based on their own definition of business conditions. However, their purpose is to demonstrate the state dependence of stock price responses to all macroeconomic news. Krueger (1996) studies the market rationality of bond price responses to labor market news. His focus is on the market reaction to the availability of more reliable information, as the unemployment data are revised. His study found (as we do) that market prices were strongly affected by the unemployment announcements. Fleming and Remolona (1998) analyze the response of U.S. Treasury yields across the maturity spectrum to different types of macroeconomic announcements using high frequency data over four-and-one-quarter years. They find that the yields on intermediate term bonds are most sensitive to unemployment news.

Veronesi (1999), based on theoretical arguments, shows that bad news in good times and good news in bad times would generally be associated with increased uncertainty and hence with an increase in the equity risk premium. Jagannathan and Wang (1993) find that monthly stock returns are negatively correlated with the per-capita labor income growth rate. Jagannathan, Kubota, and Takehara (1998) report similar findings using Japanese data. Since most of the variation in per-capita labor income arises from variation in hours worked and not from the wage rate, these findings are consistent with the unconditional positive correlation between the growth rate in unemployment and stock returns that we find in our data set.

B. The Rest of the Study

Briefly, the rest of the study proceeds as follows. Section I describes the data set and the empirical methods for forecasting unemployment rates. Section II examines the effect of unemployment news on the S&P 500 stock index portfolio returns and on government bond returns. Section III examines how unemployment news affects growth expectations and the equity risk premium. Finally, Section IV summarizes and concludes.

I. Data and Methodology

A. Unemployment Announcements

Although there are various macroeconomic information releases we could have considered, we chose the unemployment rate because it is viewed as newsworthy. It has frequently been the reference point of Federal Reserve policy and the target of wide speculation on Wall Street. In addition, and important for our purposes, this release has a long and accurately dated time series.

The monthly unemployment announcements used in this paper cover the period from February 1957 to December 2000. The announcements were usually made at 8:30 a.m. on a Friday, although during earlier years some announcements were made on other days. All announcement dates, whether Fridays or not, are included in our study. On announcement days, the Department of Labor releases other information besides the most recent unemployment rate. This includes the total number of employed and its distribution across regions and industries. It also releases revisions of past unemployment announcements for the previous 3 months, after which the announcement is considered final. It also releases employment totals, weekly and hourly earnings, and weekly hours worked. This study focuses only on unemployment rate announcements.

A.1. Measuring Unemployment News

The focus of this paper is on examining how stocks respond to unemployment news. That requires a model to measure the anticipated and the unanticipated (news) component of the unemployment figures that are announced every month.[2] We use the following statistical model to forecast the unemployment rate change on announcement dates:

$$\begin{aligned}\mathrm{DUMP}_t = {} & b_0 + b_1 \cdot \mathrm{IPGRATE}_{t-1} + b_2 \cdot \mathrm{IPGRATE}_{t-2} + b_3 \cdot \mathrm{IPGRATE}_{t-4} \\ & + b_4 \cdot \mathrm{DUMP}_{t-1} + b_5 \cdot \mathrm{DTB3}_t + b_6 \cdot \mathrm{DBA}_t + e_t, \end{aligned} \tag{1}$$

where DUMP_t is the change in the unemployment rate, $\mathrm{IPGRATE}_t$ is the growth rate of monthly industrial production, $\mathrm{DTB3}_t$ is the change in the 3-month T-bill rate, and DBA_t is the change in the default yield spread between Baa and Aaa corporate bonds, all for the periods $t-1$ and t. The unemployment rate is very persistent, so our forecasts are based on the first differences.[3] We used data for the period 1957 to 1962 to select the specification of the time series model used in constructing unemployment surprises. Appendix B describes the model selection procedure we used to choose the specification in equation (1).

Note that for these and most of the other regressions presented in this paper, both heteroskedasticity and autocorrelation are present in the residuals. We therefore compute hetereoskedasticity and autocorrelation consistent standard errors and t-statistics with the Bartlett kernel. The bandwidth parameter is chosen to match the degree of autocorrelation in the residuals, where the length of autocorrelation is first estimated by the Yule-Walker method. For

[2] McQueen and Roley (1993) and Krueger (1996) used forecasts made by Money Market Services International (MMS) to identify the surprise element of the unemployment rate announcement. We do not follow this procedure since MMS forecasts have only been available since November 1977, whereas our data set goes back to January 1962. Seeking to employ as much data as possible, we use our own time-series models to forecast the unemployment rate announcement and its unanticipated component.

[3] Regression model (1) can be expanded to include Friday and day of the week dummy variables to account for the fact that announcements were not always made on Fridays. We do not report these results since inclusion of these variables did not affect our results in any substantial way.

many regressions, especially daily stock returns, autocorrelation is not an important factor, thus only White t-statistics are reported.

Forecasts for the change in the unemployment rate from month $t-1$ to month t were constructed by first estimating equation (1) using monthly observations up to month $t-1$. Adding back the unemployment rate at month $t-1$ to this forecast gives us the predicted unemployment rate in month t.

Actually, equation (1) was estimated in three different ways. The first estimation method (Method 1) is the best, in the sense of achieving the smallest out-of-sample forecast errors. In this case, we used final release numbers for unemployment and industrial production and we also included a dummy variable, which took on the value 1.0 during contractions and 0.0 during expansions. This procedure could be criticized on two grounds. First, it takes into account the information conveyed by the state of the economy. However, it can be argued that agents do not necessarily know the state of the economy at the time a forecast is made, since the NBER's announcement of an official turning point typically comes several months after the turning point date.[4] To address this criticism, our second estimation method (Method 2) omits the business cycle dummy variable that allows the intercept for contractions to be different from that for expansions. This results in a small but significant bias in the forecasts: The average forecast error during expansions and contractions for the model is different from zero. Such a bias does not occur with Method 1.

A second criticism of our forecasting procedure relates to the use of final release data both for the unemployment rate and the IIP. Since the final release numbers come out about 3 months after the initial release, forecasts made in this way could not have been made in real time. In view of this criticism, our third forecasting method (Method 3) uses final release figures for the unemployment rate and the IIP, but only employs data available up to 1 year before the estimation date. Then we employ the estimated parameters and the initial release numbers of the unemployment rate data and originally published and subsequently revised IIP to construct our estimate of the unemployment surprise. With this very conservative method, we can be sure we are only using information that was available to investors at the time the forecast was made. This method also has a small but significant bias in the forecasts.

All the three forecasting methods have the expected properties: Method 1 results in smaller forecast errors than Method 2, and Method 2 results in smaller errors than Method 3. We feel that these three estimating methods span the space of reasonable real-time unemployment forecasts. That is, estimates made using Method 1 are undoubtedly better than market participants could actually have made, and estimates made using Method 3 are clearly worse. What is most important for present purposes is that none of the results are particularly sensitive to the choice of estimation methods. We therefore present the results only for Method 3, for which the results are the weakest.

[4] For example, the NBER Business Cycle Dating Committee, in its October 16, 2003 meeting, determined that a trough in the business activity occurred in the U.S. economy in November 2001.

Table I

Properties of the Forecasted Unemployment Rate

Forecasts are made using the following model described in equation (1) in the text:

$$\text{DUMP}_t = b_0 + b_1 \cdot \text{IPGRATE}_{t-1} + b_2 \cdot \text{IPGRATE}_{t-1} + b_2 \cdot \text{IPGRATE}_{t-1}$$
$$+ b_4 \cdot \text{DUMP}_{t-1} + b_5 \cdot \text{DTB}_t + b_6 \cdot \text{DBA}_t + e_t,$$

where DUMP_t denotes the change of unemployment rate from month $t-1$ to t; IPGRATE_t denotes the growth rate in industrial production; DTB3_t denotes the change in the 3-month T-bill rate; and DBA_t denotes the change in the yield spread between low and high grade bond yields. Appendix A describes the data in detail. Appendix B describes the forecasting methods used. We report the mean and the standard error for the mean (in parentheses) for the change in unemployment rate, DUMP_t (in percent, annualized), its forecasted value, DUMPF_t, and the forecast error, $\text{ERRUMP}_t = \text{DUMP}_t - \text{DUMPF}_t$ for the period June 1972 to December 2000 for forecasting Method 3 as described in Appendix B.

	Unemployment Rate	DUMP	DUMPF	ERRUMP
Whole sample	5.952	−0.0052	0.0220*	−0.0270*
	(0.0713)	(0.0100)	(0.0066)	(0.0090)
Contractions	6.819	0.222*	0.1612*	0.0605*
	(0.2397)	(0.0306)	(0.0291)	(0.0293)
Expansions	5.832	−0.0399*	0.00046	−0.0405*
	(0.0723)	(0.0090)	(0.0051)	(0.0091)

*Indicates significance at the 5% level.

A.2. Properties of Unemployment News

To understand the properties of the forecasts and forecast errors during expansions and contractions, we classified every sample month as an expansion or contraction month, using the NBER's reference dating. The properties of the unemployment rate forecasts for Method 3 are in Table I.[5] During the 343 monthly forecasts examined under Method 3, covering the period June 1972 to December 2000, the U.S. economy was in an expansion during 297 months and in a contraction during 46 months. There were four contractions and five expansions. The average duration of a contraction was 12 months and the average duration of an expansion was 61 months. Unemployment was higher at 6.82% during contractions and lower at 5.83% during expansions. On average, the unemployment rate increased by 0.22% per month during contractions and declined by 0.04% per month during expansions. The forecasted changes in unemployment rates are smaller in expansions than in contractions. There is a small but statistically significant bias in the forecasts made using Model 3—the forecasts are biased downward during contractions and upward during expansions. The average forecast error was 6 basis points during contractions and −4 basis points during expansions (Table I).

[5] Our data set actually begins in January 1957 (see Appendix A), but the first 5 years of data are used up in obtaining the initial forecasts. The initial release data begin in January 1972, thus we have a smaller sample size for Method 3 compared to Methods 1 and 2. Our findings are similar for all three methods, but we report the results for Method 3 only.

Table II

Properties of the Computed Unemployment Rate Surprises

Forecasts are made using the following model described in equation (1) in the text:

$$\mathrm{DUMP}_t = b_0 + b_1 \cdot \mathrm{IPGRATE}_{t-1} + b_2 \cdot \mathrm{IPGRATE}_{t-1} + b_2 \cdot \mathrm{IPGRATE}_{t-1} + b_4 \cdot \mathrm{DUMP}_{t-1} + b_5 \cdot \mathrm{DTB}_t + b_6 \cdot \mathrm{DBA}_t + e_t,$$

where DUMP_t denotes the change of unemployment rate from month $t-1$ to t; $\mathrm{IPGRATE}_t$ denotes the growth rate in industrial production; $\mathrm{DTB3}_t$ denotes the change in the 3-month T-bill rate; and DBA_t denotes the change in the yield spread between low and high grade bond yields. Appendix A describes the data in detail. Appendix B describes the forecasting methods used. Let DUMPF_t denote the forecasted value of DUMP_t made using information available prior to month t. We report the mean and the standard deviation for the forecast error, $\mathrm{ERRUMP}_t = \mathrm{DUMP}_t - \mathrm{DUMPF}_t$, during expansions and contractions for the period June 1972 to December 2000, for forecasting Method 3 described in Appendix B. Expansions and contractions are based on NBER's dating of business cycle turning points. Numbers are expressed as annualized percentages.

	Good News (Actual Unemployment Less Than Predicted)		Bad News (Actual Unemployment Greater Than Predicted)	
	Number of Observations	Mean (Standard Deviation)	Number of Observations	Mean (Standard Deviation)
Contractions	18	−0.1255	28	0.1801
		(0.1201)		(0.1321)
Expansions	184	−0.1336	113	0.1110
		(0.1042)		(0.1010)

Table II shows the distribution of unemployment surprises, when classified according to whether unemployment increased by less or more than forecast. Out of a total of 343 months, there are 202 negative surprises (good news) and 141 positive surprises (bad news) indicating a bias. The bias is much less for Models 1 and 2 (results not reported).[6]

B. Daily Returns on Stocks and Bonds

We ignore dividends when computing stock returns and define daily stock returns as the percentage change in the S&P 500 stock index. Daily bond returns are constructed from daily yields. Daily government bond price data were not available to us, so we converted the daily yields into bond prices (see Appendix A).

Table III reports average daily returns on announcement days and nonannouncement days during contractions and expansions. Bond returns are on average higher in contractions than in expansions, and stock returns are higher in expansions than in contractions. In Table IV, we partition the sample further,

[6] To see how our forecasts compared to the predictions of experts, we studied the period February 1992 to August 1994 during which Fleming and Remolona (1998) report statistics for unemployment rate surprises, based on consensus forecasts published in the *Wall Street Journal*. Their mean was −6.3 basis points with a standard deviation of 17.1 basis points. The forecast errors for the three models we use have comparable properties.

Table III

Returns on Announcement Days and Other Days During Expansions and Contractions

This table gives the means and standard deviations of stock and bond returns during unemployment announcement dates and other dates for the period June 1972 to December 2000. Unemployment announcement dates are from the BLS. S&P 500 returns are from CRSP, University of Chicago. Bond returns are computed from bond yields as described in Appendix A. Bond yields are from the Federal Reserve Board. Figures are in percentages.

		Mean	Standard Deviation
	Panel A: All Days		
Announcement days	S&P 500 Index	0.1047	1.0316
	1-year government bond	0.0157	0.1321
Nonannouncement days	S&P 500 index	0.0397	0.9743
	1-year government bond	−0.00015	0.0942
	Panel B: Only Announcement Days		
Contractions	S&P 500 index	0.0049	1.0031
	1-year government bond	0.0794	0.2066
Expansions	S&P 500 index	0.1195	1.0366
	1-year government bond	0.0061	0.1141

computing average daily returns for both Thursday (day before the announcement) and Friday (day of the announcement), when the data are sorted into good news and bad news unemployment surprises. Using the finer sort, a pattern seems to emerge in the response of stock prices. In contractions, the cumulative average stock returns over the 2-day window are −0.24% on bad news and 0.36% on good news, about equal in magnitude but opposite in sign. During expansions, the cumulative average stock returns over the 2-day window are 0.41% on bad news and −0.01% on good news. Bad news has a positive effect that is the opposite of its effect during contractions. Good news has little effect in expansions, again in contrast to its effect during contractions. In the case of bonds, during contractions the 2-day cumulative return for good news is 0.115% and for bad news it is 0.109%, that is, about the same in sign and magnitude. Both good and bad news have little effect on bond prices in expansions. To summarize, unlike stock prices, bond prices do not react differently to good and bad news.

II. Regression Results: Stock and Bond Price Responses to Unemployment News

A. S&P 500 Responses to the Unemployment News

In this section, we further investigate the response of the S&P 500 stock price index to unemployment news arrival using the linear model given in equation (2),

$$\mathrm{SPRTRN}_t = \alpha + b_1 \cdot \mathrm{XRIC}_t \cdot \mathrm{ERRUMP}_t + b_2(1 - \mathrm{XRIC}_t) \cdot \mathrm{ERRUMP}_t + u_t, \quad (2)$$

Table IV

Announcement Day (Friday) and Pre-announcement Day (Thursday) Returns

"Friday" denotes an unemployment announcement day and "Thursday" the day before. Unemployment announcement dates are from the BLS. Appendix A gives the data sources. Expansions and contractions are based on NBER's dating of business cycle turning points. News is good (bad) when the announced unemployment rate is less (more) than its forecasted value using the model. Figures are in percentages.

Mean (Standard Deviation), Conditional on the State of Economy		
	Good News	Bad News
Panel A: S&P 500 Stocks		
Thursday (expansion)	−0.0446	0.1484
	(0.6942)	(0.8815)
Thursday (contraction)	0.1570	−0.1063
	(1.0169)	(1.3950)
Friday (expansion)	0.0316	0.2648
	(1.0438)	(1.0126)
Friday (contraction)	0.1978	−0.1286
	(1.0861)	(0.9397)
Panel B: 1-Year Government Bond		
Thursday (expansion)	−0.0090	−0.0005
	(0.0605)	(0.0535)
Thursday (contraction)	0.0245	0.0367
	(0.0594)	(0.1994)
Friday (expansion)	−0.0048	0.0240
	(0.1138)	(0.1130)
Friday (contraction)	0.0901	0.0723
	(0.2973)	(0.1201)

where SPRTRN_t denotes the return on day t on the S&P 500 index, ignoring dividends; ERRUMP_t denotes the proxy for unemployment news, that is, the surprise component of the unemployment rate announcement; XRIC_t is the experimental coincident recession index available at the end of month $t-1$ constructed by Stock and Watson (1989), and u_t is the error term.[7,8] The recession index, XRIC, provides an estimate of the probability that the economy was in a recession. It is computed using four monthly series in the experimental

[7] Note that unemployment news is not observed. Hence, we use a forecasting model to construct a proxy for it. The use of a proxy gives rise to the well-known errors in variables problem, meaning that the estimated slope coefficients will be biased towards zero. The classical solution for the errors in variables problem is to use an instrumental variable that is correlated with the proxy but uncorrelated with that part of the stock index return that is orthogonal to the proxy. We have not been able to identify such an instrument and thus this bias is to some degree present in our estimates.

[8] Stock, James H., and Mark W. Watson, "New Indexes of Coincident and Leading Economic Indicators," NBER Macroeconomics Annual 1989, pp. 351–394.

coincident index (XCI). This index is constructed using only information that is available at a particular point in time, unlike NBER's dating of contractions and expansions, which makes use of information that becomes available later. The four series in the XCI are industrial production, real personal income less transfer payments, real manufacturing and trade sales, and total employee-hours in nonagricultural establishments. When XRIC_t takes the binary form, that is, $\text{XRIC}_t \equiv D_t$, which takes the value of 1 in contractions and 0 in expansions, we can rewrite equation (2) as follows:

$$\text{SPTRN}_t = \alpha + b_1 D_t \text{ERRUMP}_t + b_2(1 - D_t)\text{ERRUMP}_t + u_t, \qquad (2a)$$

where the slope coefficients, b_1 and b_2, measure the stock price response to unemployment news in contractions and expansions, respectively. In that case, b_1 measures the stock price sensitivity to unemployment news during contractions and b_2 measures the sensitivity during expansions.

We estimate equation (2) using data for the period January 1962 to December 2000 for Methods 1 and 2 (not reported) and using data for the period January 1972 to December 2000 for Method 3 (reported). Table V presents the estimates when the dependent variables are the stock index return on the day prior to the announcement day (Thursday), on the announcement day (Friday), and on Thursday and Friday taken together. For all of the three event windows, and for all three estimation methods (we report the results for Method 3 only), a consistent pattern emerges. The coefficients are negative in contractions and positive in expansions, and are usually statistically significant. Moreover, for Friday and for Thursday/Friday, the difference between the contraction and expansion coefficients is statistically significant at (at least) the 95% confidence level. Also, in all cases the announcement effect is much larger (in absolute value) in contractions than it is in expansions.

Table V

Change in the S&P 500 Index in Response to Unemployment News

The table reports the estimated values of the slope coefficients in the equation,

$$\text{SPRTRN}_t = b_0 + b_1 \cdot \text{XRIC}_t \cdot \text{ERRUMP}_t + b_2 \cdot (1 - \text{XRIC}_t) \cdot \text{ERRUMP}_t + u_t.$$

SPRTRN_t denotes the return on day t on the S&P 500 index, ignoring dividends. XRIC_t is the experimental coincident recession index constructed by Stock and Watson (1989) that indicates the probability that the economy was in a recession. ERRUMP_t is the surprise component of the unemployment rate announcement. White t-statistics are reported in parentheses. The period covered is June 1972 to December 2000.

	Thursday	Friday	Thursday + Friday
b_1	−0.99	−1.475	−2.465
	(−0.97)	(−2.02)	(−1.50)
b_1	0.5626	0.6568	1.2194
	(1.69)	(1.64)	(2.07)
$b_1 - b_2$	−1.553	−2.131	−3.685
	(−1.39)	(−2.41)	(−2.01)

B. Bond Price Responses to the Unemployment News

We next turn our attention to the bond market response to unemployment news. The analog of equation (2) for the bond market is given by equation (2b) below:

$$\mathrm{BRTRN}_t = \alpha + b_1 \cdot \mathrm{XRIC}_t \cdot \mathrm{ERRUMP}_t + b_2(1 - \mathrm{XRIC}_t) \cdot \mathrm{ERRUMP}_t + u_t, \quad \text{(2b)}$$

where BRTRN_t is the return on the bond of interest on date t, and other variables in equation (2b) are defined in the previous section. In the regressions that follow, the dependent variables are the return on a hypothetical 1-year government bond, the 3-month T-bill, and the 10-year government bond (see Appendix A for a discussion of how we constructed these returns). Table VI shows the bond price responses for all event windows and using forecasting Method 3. Notice that unemployment news never has a significant effect on bond prices in contractions for any event window. In expansions, it has a positive and significant effect for the 1- and 10-year bonds, but not for the 3-month T-bill. The difference in responses across the two states is not statistically significant.

To summarize results, government bond price responses to the arrival of unemployment news are different from stock prices; therefore the former cannot possibly explain the latter. Moreover, the unemployment news must convey information about the other two primitive factors, namely, growth rate expectations and the equity risk premium. These two factors affect stock prices but not bond prices, and therefore account for the differences in their responses. In

Table VI

T-Bill and T-Bond Price Responses to Unemployment News

This table reports the slope coefficients in the equation,

$$\mathrm{BRTRN}_t = b_0 + b_1 \cdot \mathrm{XRIC}_t \cdot \mathrm{ERRUMP}_t + b_2 \cdot (1 - \mathrm{XRIC}_t) \cdot \mathrm{ERRUMP}_t + u_t,$$

for T-bills and bonds. XRIC_t is the experimental coincident recession index constructed by Stock and Watson (1989) that indicates the probability that the economy was in a recession. ERRUMP_t is the surprise component of the unemployment rate announcement. White t-statistics are reported in parentheses. The dependent variables, from left to right, are the Thursday return of a 1-year bond, Friday return of a 1-year bond, Thursday plus Friday return of a 1-year bond, Thursday plus Friday return of a 3-month T-bill, and Thursday plus Friday return of a 10-year government bond. The period covered is June 1972 to December 2000.

	Thursday (1-Year Bond)	Friday (1-Year Bond)	Thursday + Friday (1-Year Bond)	Thursday + Friday (3-Month T-Bill)	Thursday + Friday (10-Year Bond)
b_1	−0.049	−0.027	−0.076	−0.029	−0.444
	(−0.43)	(−0.19)	(−0.35)	(−0.53)	(−0.47)
b_2	0.0294	0.1258	0.1552	0.0117	0.884
	(0.98)	(2.67)	(2.63)	(0.48)	(2.87)
$b_1 - b_2$	−0.079	−0.153	−0.232	−0.041	−1.328
	(−0.65)	(−0.96)	(−0.97)	(−0.64)	(−1.37)

the next section, we examine the role of growth expectations and the equity risk premium in determining how stock prices respond to unemployment news.

III. Unemployment News, Growth Expectations, and the Equity Risk Premium

To see how the three primitive factors influence stock prices, it is convenient to consider the Gordon constant growth model used for security valuation. Let r be the interest rate on long-term risk-free claims, P the price of a security or portfolio, D the current dividend, g the expected (constant) rate of growth in D, and π the risk premium investors required to invest in stocks. Then according to the Gordon model,

$$P = \frac{D(1+g)}{r+\pi-g}. \tag{3}$$

Jagannathan, McGrattan, and Scherbina (2000) show that when growth rates, interest rates, and risk premiums change over time, the Gordon model continues to hold. In that case, the long-run growth rate, g, is to be interpreted as a weighted average of expected future growth rates.

Let u denote the unanticipated surprise in the unemployment rate (ERRUMP), so that $(dP/P)/du$ represents the percentage change in the price of a security in response to an unemployment rate surprise. Then from the Gordon model it follows that

$$\begin{aligned}\frac{dP/P}{du} &= -\frac{P}{D}\frac{1}{1+g}\left[\frac{dr}{du}+\frac{d\pi}{du}-\left(1+\frac{D}{P}\right)\frac{dg}{du}\right]\\ &\approx -\frac{P}{D}\left[\frac{dr}{du}+\frac{d\pi}{du}-\frac{dg}{du}\right].\end{aligned} \tag{3a}$$

It is useful to estimate that part of the change in stock prices that is due strictly to the change in the interest rate factor r. Letting P_{s} denote stock index price and P_{b} denote bond price, we define that component of stock price response that is strictly due to a change in the interest rate factor as

$$\left.\frac{dP_{\mathrm{s}}/P_{\mathrm{s}}}{du}\right|_{dg=d\pi=0.0}.$$

From inspecting equation (3a), it is clear that

$$\left.\frac{dP_{\mathrm{s}}/P_{\mathrm{s}}}{du}\right|_{dg=d\pi=0.0} = -\frac{P_{\mathrm{s}}}{D}\left[\frac{dr}{du}\right].$$

Here P_{s}/D is the inverse of the dividend yield (which we calculate on average from the CRSP tapes to be 30.1 in expansions and 21.1 in contractions).

The results presented in Table VI suggest that for bonds $(dP_{\mathrm{b}}/P_{\mathrm{b}})/du > 0$ during expansions, which, of course, implies that $dr/du < 0$. During contractions, the estimates of $(dP_{\mathrm{b}}/P_{\mathrm{b}})/du$ are never statistically significant and frequently change signs depending on the estimation method. Thus, it seems reasonable to assume that during contractions,

$$\frac{dP_{\mathrm{b}}/P_{\mathrm{b}}}{du} \approx \frac{dr}{du} \approx 0.0.$$

We must next estimate dr/du during expansions. To a first order,

$$\frac{dr}{du} = -\frac{1}{\text{Duration}} \frac{dP_{\mathrm{b}}/P_{\mathrm{b}}}{du}.$$

Assuming a duration of 7.4 for the 10-year government bond, and using the results from Table VI, we obtain $dr/du = -0.12$ during expansions. Columns 3 and 4 of Table VII show estimates of the effect on stock returns due to interest rates alone,

$$\left.\frac{dP_{\mathrm{s}}/P_{\mathrm{s}}}{du}\right|_{dg=d\pi=0.0},$$

as well as estimates of the total stock price response to unemployment news, $(dP_{\mathrm{s}}/P_{\mathrm{s}})/du$ (from Table V). In contractions, there is obviously no predicted stock price change due to news-induced interest rate changes; for example,

$$\left.\frac{dP_{\mathrm{s}}/P_{\mathrm{s}}}{du}\right|_{dg=d\pi=0.0} = 0.0.$$

However, the estimated total effect of unemployment news on stock prices, $(dP_{\mathrm{s}}/P_{\mathrm{s}})/du$, is negative. The implication is that the risk premium π must be rising, or the expected future growth rate g must be falling, or both.

During economic expansions, on the other hand, the sensitivity of stock returns to unemployment news due to its effect on the interest rate alone is about 3.6. However, the total effect of unemployment news on stock prices is estimated to be a little more than 1. That is, the predicted effect on stock prices through the interest rate factor is much larger than the actual combined effect of all the three factors. The logical implication is thus the same during expansions as it is during contractions: The equity risk premium must be rising, or the growth expectations must be falling, or both.

Column 5 in Table VII takes this exercise a bit further and back-solves for the values of

$$-\frac{P}{D}\left[\frac{d\pi}{du} - \frac{dg}{du}\right],$$

which are implied by the Gordon equation and the estimated values of the bond and stock price responses to unemployment news. This provides an answer to the question. How large would the combined risk-premium and growth rate effect have to be, in order to jointly explain the observed responses in stock and

Table VII

A Decomposition of Stock Price Response to Unemployment

This table provides a decomposition of the stock price response to unemployment news arrival into that due to interest rate news and that due to news about future dividend growth and future risk premia. Column 1 gives the change in the 10-year government bond price due to news, taken from Table VI for expansions and assumed to be zero during contractions. Column 2 gives the change in the 10-year government bond rate, computed from column 1, using the formula, [e.g., (−column 1)/7.4], formally

$$\frac{dr}{du} = -\frac{1}{\text{Duration}}\frac{dP_b/P_b}{du}.$$

Column 3 gives the change in stock price due to interest rate effects only,

$$\left.\frac{dP_s/P_s}{du}\right|_{dg=d\pi=0.0} = -\frac{P_s}{D}\left[\frac{dr}{du}\right],$$

that is, negative of (column 2) × (column 8). Column 4 gives the actual total stock price change due to unemployment news, $(dP_s/P_s)/du$. Entries are from Table V. Column 5 gives the total stock price change—stock price change predicted by interest rates (Col (4) − Col (3)), $d\phi/du$. Column 6 gives the implied change in growth, dg/du, assuming no change in risk premium. (Col (5)/Col (8)). Column 7 = (column 6, contractions)/(column 6, expansions). Column 9 gives the price/dividend ratio from CRSP.

Col (1) 10-Year Bond Price Change	Col (2) 10-Year Interest Rate Change	Col (3) Implied Stock Price Change Due to Interest Rate Effects Only	Col (4) Actual Total Stock Price Change	Col (5) Implied Stock Price Change Due to Changes in Growth Expectations and Risk Premium	Col (6) Implied Change in Risk Premium Minus Long Run Weighted Average Growth Rate	Col (7) Ratio of Contractions to Expansions from Column (6)	Col (8) Average Price/ Dividend Ratio
				Contractions			
0	0	0	−2.47	−2.47	−0.12	1.51	21.1
				Expansions			
0.88	−0.12	3.58	1.22	−2.36	−0.08	na	30.1

bond prices? Obviously, at this stage we cannot separate the effects of $d\pi/du$ and dg/du, and for convenience we define

$$\frac{d\phi}{du} = -\frac{P}{D}\left[\frac{d\pi}{du} - \frac{dg}{du}\right].$$

Separate estimates of $d\phi/du$ are provided for expansions and contractions. The main feature to note from column 5 in Table VII is that the estimate of $d\phi/du$ is negative, meaning that a bad unemployment shock causes the risk premium to increase, or the growth expectations to decline, or both. Column 6 gives the implied change in growth, dg/du, assuming that there is no change in the risk premium. This is about 50% larger in absolute value during contractions than during expansions. The corresponding numbers for Methods 1 and 2 (not reported) are 2.30 and 2.19 times larger, respectively.

These findings, based solely on the stock and bond price responses to unemployment news, make predictions for other primitive variables' news responses. And these are empirically testable. In the next two sections, we separately examine the response of the equity risk premium, π, and the dividend growth expectation, g, to unemployment surprises. In effect, we employ different data to test the several predictions just reviewed. Looking ahead, we find evidence that growth expectations are negatively affected by bad news in both business cycle phases. However, the magnitude of this effect appears to be several times larger in contractions than in expansions. Thus, changes in growth expectations are exactly in accord with the predictions of Table VII. There is also evidence that the equity premium increases in response to the arrival of bad news during expansions, but is unaffected during contractions. This finding, too, is consistent with the predictions.

A. The Equity Risk Premium: Its Response to Unemployment News

The equity risk premium is not directly observable and therefore we have to employ a proxy that can be observed. Lee, Myers, and Swaminathan (1999) (hereafter LMS) show that the intrinsic value to price ratio (V/P) of Dow 30 stocks has a statistically and economically significant ability to predict future excess returns on the Dow 30 stocks. In fact, they find that V/P has a superior ability to predict future excess returns when compared to term and credit spreads, dividend yield, earnings yield, and book to market ratios. Lee and Swaminathan (1999) reach similar conclusions when V/P computed with the Dow 30 stocks is used to predict future excess returns on the S&P 500 index portfolio and on a small-stock index portfolio. We therefore employ the V/P ratio they compute as a proxy for the equity premium.[9]

LMS estimate the intrinsic value of the Dow 30 stocks as the discounted present value of future cash flows to equity. That is, the intrinsic value, V, is a function $f(\text{eps}, r_f, \pi)$ of the expected future stream of earnings eps, the long-term risk-free rate r_f, and the risk premium on stocks, π. To represent eps, LMS use consensus analyst earnings forecasts for the next 3 years for each

[9] We would like to thank Bhaskaran Swaminathan for making the V/P series available to us.

firm. Then, they assume that after 3 years, earnings go to the industry median return on book equity at a constant rate after T years ($T = 3$ produces the best results). The long-term bond rate is used for r_f, and the historical average risk premium on the value-weighted portfolio of stocks traded on the NYSE and AMEX is used for π.

We assume that the market price P of a stock is determined in the same way, that is, by computing the present value of future cash flows to the stocks, but with the following difference. Market participants use the same value of eps and of the risk-free rate r_f, but have a risk premium Π that may be different from the historical risk premium π used in computing the intrinsic value V. Thus, $P = f(\text{eps}, r_f, \Pi)$. With these assumptions, $V/P = f(\text{eps}, r_f, \pi)/f(\text{eps}, r_f, \Pi)$ is a measure of the time-varying risk premium on stocks. Suppose the intrinsic value V at a given point in time is greater than the market price P. Then market participants must be discounting future expected cash flows to equity at a higher rate than the historical risk premium used in computing V.[10] Hence, V/P is a monotone increasing function of Π. We therefore use the change in the V/P ratio as our proxy for the unobserved change in the equity risk premium. LMS consider two values for T, the year in which the firm's return on book equity reaches the industry median value, $T = 3$ and $T = 12$. Here, we report only the results for V/P computed with $T = 3$ since the results for $T = 12$ are very similar.

Our findings are given in Table VIII. When the change in the V/P ratio is used as the proxy for the change in equity risk premium, the slope coefficient is not significantly different from zero during contractions but is positive and statistically significant during expansions.[11] This finding is consistent with the predictions we reached by back-solving the Gordon model (in Table VII)—at least as far as it goes. That is, we showed in the previous section that to explain observed stock price responses during economic expansions, the risk premium would have to increase (or growth expectations would have to decrease) in response to the arrival of bad news. We find some evidence that the risk premium does increase during expansions. However, we find no evidence that the risk premium responds during contractions. Thus, if stock pricing during contractions is to be consistent with the predictions of Table VII, that depends on the response of growth expectations during contractions. We turn next to that issue.

B. Growth Expectations: Their Response to Unemployment News

We began by examining the earnings growth forecasts of securities analysts to see how these were affected by the arrival of employment news. These results

[10] See Lee, Myers, and Swaminathan (1999) for details. LMH also consider the 1-month T-bill rate as a proxy for the risk-free rate. We use the long-term bond rate to match the duration of stocks as closely as possible.

[11] When the change in a default interest rate spread (Baa–Aaa) is used as the dependent variable and the unemployment surprise is the independent variable, results are very similar to what we report with the value-price ratio. The slope coefficient is not significantly different from zero during contractions, but is positive and marginally significant during expansions. For brevity, these results are not reported.

Table VIII

The Reaction of the Risk Premium to the Unemployment Surprise

This table gives the estimated coefficients for the following equation:

$$\mathrm{DVP31}_t = a_1 \cdot \mathrm{XRIC}_t + a_2 \cdot (1 - \mathrm{XRIC}_t) + b_1 \cdot \mathrm{XRIC}_t \cdot \mathrm{ERRUMP}_t + b_2 \cdot (1 - \mathrm{XRIC}_t) \cdot \mathrm{ERRUMP}_t + \eta_t,$$

where $\mathrm{DVP31}_t$ denotes the change in $VP31_t$, our proxy for the risk premium, as explained in the text. $VP31_t$ is one of the intrinsic value to market price ratios computed by Lee, Myers, and Swaminathan (1999, p. 1702 and Panel C, Table III, p. 1720). The text provides justification for using $\mathrm{DVP31}_t$ as a measure of the change in the risk premium. XRIC_t is the experimental coincident recession index constructed by Stock and Watson (1989) that indicates the probability that the economy was in a recession. ERRUMP_t is the surprise component of the unemployment rate announcement. The period covered is June 1972 to June 1996.

Variable	Change in Risk Premium (i.e., Change in $VP31_t$)
Intercept, contraction	−0.0024
a_1	(−0.28)
Intercept, expansion	0.0024
a_2	(0.91)
Slope coefficient, contraction	−0.0223
b_1	(−0.43)
Slope coefficient, expansion	0.0480
b_2	(2.59)

(not presented) suggest that there is no statistically significant effect during either expansions or contractions. However, the time-series of analysts' forecasts is only available for 18 years, a period that includes very few observations of economic contractions. Thus, the insignificant results may just reflect a lack of statistical power.

Our next approach is to construct an indirect measure of growth expectations. We assumed that equity investors are good econometricians who study the data and make forecasts. On that basis, we estimated the *true* relationship between the announced unemployment rate (the actual rate, not the surprise component) and subsequent dividend growth, using the IIP as a monthly proxy for corporate dividends.[12] The idea was to see if this actual real sector relationship is significantly different in contractions than in expansions. If that is true, then that fact should be reflected in the expectations formation of investors.

Since each month the announcement of the IIP is made around the 15[th] (about 1 week after the announcement of the unemployment rate), we studied the relation between IIP in the same month and 1–4 months following the reference month of the unemployment announcement. We estimated the following equation:

$$\mathrm{IPGRATE}_s = a_0 + a_1 \cdot D_t \cdot \mathrm{DUMP}_t + a_2 \cdot (1 - D_t) \cdot \mathrm{DUMP}_t + v_t, \qquad (4)$$

[12] The correlation between the annual rate of growth in dividends and the IIP is only 0.247. However, it is well known that dividend payments are intentionally smoothed, even at annual frequencies. The correlation between quarterly earnings growth and IIP growth is a more respectable 0.464. Unfortunately, we know of no better proxy variable for dividends that is observable at monthly intervals.

Table IX

Linear Relation between Unemployment Rates and Growth Rates of Industrial Production

This table reports the slope coefficient in the regression of the growth rates in industrial production on the changes in the unemployment rate,

$$\text{IPGRATE}_s = a_0 + a_1 \cdot \text{XRIC}_t \cdot \text{DUMP}_t + a_2 \cdot (1 - \text{XRIC}_t) \cdot \text{DUMP}_t + v_t,$$

where IPGRATE_s denotes the growth rate in industrial production during month s; we consider $s = t, t+1, t+2$, and $t+3$, that is, same month to 3 months ahead; DUMP_t denotes the change in the unemployment rate from month $t-1$ to t; and XRIC_t is the experimental coincident recession index constructed by Stock and Watson (1989) that indicates the probability that the economy was in a recession. The period covered is June 1972 to December 2000. The t-statistics reported in parentheses were computed as described in the text.

	Same Month	1 Month Ahead	2 Months Ahead	3 Months Ahead
a_1	−4.552	−3.341	−2.399	−0.791
	(−10.25)	(−4.78)	(−5.17)	(−1.16)
a_2	−0.88	−0.385	−0.502	−0.86
	(−3.95)	(−1.83)	(−2.14)	(−3.63)
$a_1 - a_2$	−3.672	−2.956	−1.898	0.0689
	(−7.06)	(−3.80)	(−3.58)	(0.09)

where IPGRATE is the change in the IIP, s is the number of leads before announcement dates ($s = t, t+1, t+2$, and $t+3$), and v_t is an error term. The results with equation (4) are shown in Table IX. The coefficients a_1 and a_2 in equation (4) are consistently negative in sign at all five forecast horizons, and most of the coefficients are significantly different from zero. For expansion periods, however, the coefficients are much smaller in absolute value than they are during contractions. It is useful to compare coefficients in contractions and in expansions, dividing the former by the latter. Going from the same month to 3-month-ahead forecasts, this ratio is 5.2, 8.7, 4.8, and 0.9. This suggests that equity investors should revise their growth expectations much more strongly in contractions than in expansions.

This finding is of course consistent with the predictions from the previous section based on back-solving the Gordon model. That is, our prediction (Table VII) is that during contractions, either growth expectations decrease in response to bad unemployment news arrival, or the risk premium increases. We found no evidence of the latter but we do find evidence of the former. Note, finally, that the downward revision of growth expectations during expansions (although estimated to be smaller than during contractions) is also consistent with predictions in Table VII. What is predicted there is that, during expansions, the risk premium increases, growth expectations decrease, or both. We find some evidence that it is both.

IV. Summary and Conclusions

We have documented that on average, stock prices rise when there is bad labor market news during expansions, and fall during contractions. This pattern cannot be explained based solely on bond price reactions. On average, bond prices rise when there is bad unemployment news during expansions, but do not respond significantly during contractions. Stock price responses during contractions are therefore unexplained.

Logically, there are two factors that affect the price of stocks but do not affect the price of risk-free government bonds. One is the equity risk premium and the other is the expected future growth rate of dividends. Since stock prices respond differently than do bond prices, it seems that unemployment news must contain information about one or both of these factors. We cannot observe either the equity risk premium or growth expectations and therefore we used proxy measures for both. Our proxy measure for the equity risk premium is the value to price ratio developed by LMS. Our proxy measure for growth expectations is the actual change in the IIP in response to changes in the unemployment rate. To explain the documented joint pattern in stock price and bond price responses, risk premium (growth expectations) revisions would have to exhibit a particular pattern: They would have to respond positively (negatively) to unemployment shocks, and be larger during contractions than during expansions. In fact, we find that growth expectations respond negatively to unemployment news during both expansions and contractions, and have larger responses during contractions. We also find that the equity risk premium responds positively to unemployment news during expansions, but not during contractions. In summary, both growth expectations and the equity risk premium seem to react to the arrival of unemployment news in a way that could explain the observed response of stock and bond prices.

Overall, we see that interest rate effects appear to dominate stock price responses during expansions. Interest rate expectations fall on bad labor market news with a positive effect on stock prices. However, growth expectation effects appear to dominate stock price responses during contractions. They, too, appear to decline on bad labor market news but with the opposite effect on stock prices. The bottom line is that stocks usually rise on bad unemployment news because the economy is usually in an expansion. A corollary is that the nature of stock price responses to unemployment news indicates market expectations regarding whether the economy is in a contraction or an expansion.

A. Future Research

The facts we report raise two fundamental questions that are not addressed here. First, why is the response of bond prices to unemployment news so dependent on the state of the economy? And second, why do changes in the rate of unemployment have a much larger (lagged) effect on real activity during contractions than during expansions? There is a large literature on state contingencies in macroeconomic relationships (e.g., Hamilton (1989) or Neftci (1984)), but such issues are beyond the limited scope of this study.

The facts we report also have interesting and potentially important implications that need to be further investigated for asset-pricing factor models. Factor models are widely used in security valuation and risk management, and factor betas (i.e., the sensitivity of stock price changes to macroeconomic news) play a central role in such models. In several of these models, factor betas vary over time in a systematic and stochastic fashion.[13] Hence it is natural to seek an explanation for this time variation, especially for the systematic component of it. Campbell and Mei (1993) show that it is convenient to decompose the information in a given macroeconomic factor into the three primitive types of news that are relevant for valuing any stock. We show that the amount of the different primitive types of news in an unemployment rate announcement (which is, itself, a specific macroeconomic factor) depends on the state of the economy. This would lead the corresponding factor beta of a stock also to depend on the state of the economy. Clearly then, the sensitivity of stock returns to the same type of macroeconomic news changes over time. This is because other things such as the state of the economy are not the same. Whether other things can best be captured in the linear factor model by introducing other factors (such as the past growth rate in output)—or alternatively by modeling the stochastic process governing time variation in factor sensitivity—is an issue for future research.

Appendix A: Data

A. Unemployment Rate Announcements

The unemployment rate report along with wage earnings, weekly hours, and employment is the first indicator of economic trends announced each month. They are often used to construct other macroeconomic variables such as personal income, industrial production, and productivity that are announced late in the month.

We obtained unemployment announcement dates for the period from 1957 to 2000 from the Bureau of Labor Statistics. These announcements were usually made at 8:30 a.m. on the first Friday of the following month. Fridays were chosen as the usual announcement days after 1970.

B. Index of Industrial Production

Each month the announcement of the IIP is made around the 15$^{\text{th}}$ (about 1 week after the announcement of the unemployment rate). We obtained IIP data from the Federal Reserve Board. For Methods 1 and 2, we use final release data of the IIP to estimate equation (1) and also use them to construct the unemployment surprise. Our third forecasting method also uses final release figures for the unemployment rate and the IIP, but only employs data available up to 1 year before the estimation date. Then, we employ the estimated parameters and the initial release numbers of the unemployment rate data and

[13] For example, Bollerslev, Engle, and Woodridge (1988), Ferson and Harvey (1993, 1999), and Ferson and Korajczyk (1993) empirically examine linear beta pricing models where the betas are allowed to vary over time. Jagannathan and Wang (1993) and Harvey (1989) follow Chen, Roll, and Ross (1986) and use macroeconomic variables as factors, but allow factor betas to vary over time.

originally published and subsequently revised IIP to construct our estimate of the unemployment surprise. The initial release data begin in January 1972, and thus we have a smaller sample size for Method 3.

Computing growth rates using originally published and subsequently revised IIP requires some care. For example, one should divide the initial estimate of February 1972 (published in mid-March 1972) by the first revision of January 1972 IIP (also published in mid-March 1972) to get the initial estimate of growth in February 1972. We use the following formulas to calculate the published growth rates for a series:

$$\text{Initial growth rate: } 100 \times \left[\frac{\text{init}_t}{\text{rev1}_{t-1}} - 1\right]$$

$$\text{First revision of growth rate: } 100 \times \left[\frac{\text{rev1}_t}{\text{rev2}_{t-1}} - 1\right]$$

$$\text{Second revision of growth rate: } 100 \times \left[\frac{\text{rev2}_t}{\text{rev3}_{t-1}} - 1\right]$$

$$\text{Third revision of growth rate: } 100 \times \left[\frac{\text{rev3}_t}{\text{rev4}_{t-1}} - 1\right].$$

C. The S&P 500 Index Returns

Data for the daily S&P 500 Index after July 2, 1962, and for the monthly S&P 500 Index are from CRSP. Data for the daily Index before July 2, 1962, were provided by G. William Schwert and Robert Stambaugh. The S&P 500 Index return is constructed from these indices.

D. Business Cycle Definitions

We use the NBER's dating of business cycles, which is published on their website. For our sample period, from 1962 to 2000, there were 411 expansion months and 57 contraction months. Table AI provides a summary. The NBER states that a recession is a recurring period of decline in total output, income, employment, and trade, usually lasting from 6 months to a year, and marked by widespread contractions in many sectors of the economy.

E. The 3-Month T-Bill, and 1-Year and 10-Year Treasury Bonds with Constant Maturity

Data for historical yields on the 3-month T-bill traded on the secondary market, and for the 1-year and 10-year Treasury bond yields with constant maturity are from the Federal Reserve Board. The daily changes of yields are used to construct the 1-year and 10-year government bond returns. The yield on the 10-year Treasury bond with constant maturity is interpolated by the U.S.

Table AI
Business Cycle Timing

Period	State of the Economy/Number of Months
1961.02–1969.12	Expansion/106
1970.01–1970.11	Contraction/11
1970.12–1973.11	Expansion/36
1973.12–1975.03	Contraction/16
1975.04–1980.01	Expansion/58
1980.02–1980.07	Contraction/6
1980.08–1981.07	Expansion/12
1981.08–1982.11	Contraction/16
1982.12–1990.07	Expansion/92
1990.08–1991.03	Contraction/8
1991.04–2000.12	Expansion/117

Treasury from the daily yield curve. Such a yield can be found even if there is no outstanding security that has exactly 10 years remaining to maturity. The returns for the 10-year government bond are constructed from a duration model.

Returns for the 3-month T-bill and 1-year government bond are constructed by converting yields to prices. For the 1-year government bond, the following formula is used for the bond equivalent yield:

$$r_{\text{bey}} = \frac{10{,}000 - p}{p} \times \frac{365}{n}.$$

For the 10-year government bond, we compute daily returns from daily yield changes, using the approximate relation between the change in price and yield:

$$\frac{dp}{p} = -D\frac{dy}{1+y}.$$

The duration of the 10-year government bond is taken to be the duration of the bond closest to 10 years in maturity in the CRSP Fixed Term Indices monthly file. For the 3-month T-bill, we convert quoted yields to prices using the discount yield formula:

$$r_{\text{bd}} = \frac{10{,}000 - p}{10{,}000} \times \frac{360}{n}.$$

Appendix B: Forecasting Unemployment Rates

To get the surprise component in the announcement of the unemployment rate, we require forecasts of the change in the unemployment rate. The variables used to forecast unemployment rates include the growth rate of industrial production, the past unemployment rate, inflation, and stock and bond returns. We find that past changes in the unemployment rate, the growth rate of industrial production, capacity utilization, and bond market variables are good predictors of unemployment rates. However, the inflation rate and stock market returns are not. We follow the Box and Jenkins method, and use the AIC (Akaike's Information Criterion), SBC (Schwarz's Bayesian Criterion), and the t-statistics for those coefficient estimates to select the best model. Specifically, we look for a model that has the lowest AIC and SBC values, with all regression coefficients being statistically significant. The final model we used to forecast the unemployment rate is presented in the paper. We selected the forecasting model using data prior to January 1962.

To obtain the forecasts, we first estimate coefficients month by month as more observations are added (our forecasts started in 1962.01 using all the previous monthly data available). The monthly forecasts of the change in the unemployment rate (called DUMPF_t) are the fitted values of DUMP_t in the above model. For Method 3 we only have data available from January 1972. We lose the first 5 months when we compute the unemployment surprises using Method 3: since we compute IPGRATE (the growth rate of monthly industrial production), we lose 1 month; we use 4 lags of IPGRATE and hence we lose another 4 months. The unemployment surprises for Method 3 are therefore for the period June 1972 to December 2000.

REFERENCES

Blanchard, Olivier J., 1981, Output, the stock market, and interest rates, *American Economic Review* 71, 132–143.

Bollerslev, Tim, Robert F. Engle, and Jeffrey M. Woodridge, 1988, A capital asset pricing model with time varying covariances, *Journal of Political Economy* 96, 116–131.

Campbell, John Y., and Jianping Mei, 1993, Where do betas come from? Asset price dynamics and the sources of systematic risk, *Review of Financial Studies* 6, 567–592.

Chen, Nai-fu, Richard Roll, and Stephen A. Ross, 1986, Economic forces and the stock market, *Journal of Business* 46, 529–554.

Ferson, Wayne E., and Campbell Harvey, 1993, The risk and predictability of international equity returns, *Review of Financial Studies* 6, 527–526.

Ferson, Wayne E., and Campbell R. Harvey, 1999, Conditioning variables and the cross-section of stock returns, *Journal of Finance* 54(4), 1325–1360.

Ferson, Wayne E., and Robert Korajczyk, 1993, Do arbitrage pricing models explain the predictability of stock returns? Working paper, Kellogg Graduate School of Management, Northwestern University.

Fleming, Michael J., and Eli M. Remolona, 1998, The term structure of announcement effects, Working paper, Federal Reserve Bank of New York.

Hamilton, James D., 1989, A new approach to the economic analysis of nonstationary time series and the business cycle, *Econometrica* 57, 357–384.

Harvey, Campbell R., 1989, Time-varying conditional covariances in tests of asset pricing models, *Journal of Financial Economics* 24, 289–318.

Jagannathan, Ravi, Keiichi Kubota, and Hitoshi Takehara, 1998, Relationship between labor-income risk and average return: Empirical evidence from the Japanese stock market, *Journal of Business* 71, 319–347.

Jagannathan, Ravi, Ellen R. McGrattan, and Anna Scherbina, 2000, The declining U.S. equity premium, *Quarterly Review*, Federal Reserve Bank of Minneapolis, 24, 3–19.

Jagannathan, Ravi, and Zhenyu Wang, 1993, The CAPM is alive and well, Staff Report #165, Federal Reserve Bank of Minneapolis.

Krueger, Anne B., 1996, Do markets respond more to more reliable labor market data? A test of market rationality, NBER Working paper 5769.

Lee, Charles M. C., James Myers, and Bhaskaran Swaminathan, 1999, What is the intrinsic value of the Dow? *Journal of Finance* 54 (5), 1693–1741.

Lee, Charles M. C., and Bhaskaran Swaminathan, 1999, Valuing the Dow: A bottom-up approach, *Financial Analyst Journal* September/October, 4–23.

McQueen, Grant, and Vance V. Roley, 1993, Stock prices, news, and business condition, *Review of Financial Studies* 6, 683–707.

Neftci, Salih N., 1984, Are economic time series asymmetric over the business cycle? *Journal of Political Economy* 92, 307–328.

Orphanides, Athanasios, 1992, When good news is bad news: Macroeconomic news and the stock market, Working paper, Board of Governors of the Federal Reserve System.

Stock, James, and Mark Watson, 1989, New indexes of coincident and leading economic indicators, in J. Olivier and Stanley Fisher, eds.: *NBER Macroeconomics Annual 1989*, Cambridge, Massachusetts.

Veronesi, Pietro, 1999, Stock market overreaction to bad news in good times: A rational expectations equilibrium model, *Review of Financial Studies* 12, 975–1007.