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UNEMPLOYMENT EXPECTATIONS: THE IMPACT OF PRIVATE INFORMATION ON INCOME UNCERTAINTY

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The formation and accuracy of unemployment expectations are investigated in this paper. Unemployment expectations were found to contain predictive information that was not captured by past trends in unemployment and other economic variables. The predictive content of expectations was based on private information about future unemployment and overall economic prospects. The data indicated a greater consistency with the rational expectations hypothesis than with adaptive, extrapolative, and error-learning models, although households did not optimally use all available information. The data indicate that unemployment expectations are to an important extent derived from more general expectations about the future performance of the economy.

1. Introduction

The incorporation of precautionary motives in models of consumer spending and saving behavior represents a significant innovation in economic theories (Browning and Lusardi, 1996). Conventional economic models that omit precautionary motives can generate incorrect forecasts even if the degree of income uncertainty is relatively small. Higher uncertainty about future income is associated with lower consumption and higher saving, with the size of the shift toward saving dependent on the level of current assets compared with expected future labor income. Large asset holdings among older consumers can significantly diminish the impact of income uncertainty on consumption. Among younger consumers with few assets, in contrast, income uncertainty can have a significant impact on their consumption decisions.

This paper focuses on the formation of expectations about income uncertainty, rather than on the impact of uncertainty on spending and saving decisions. More specifically, this paper is limited to uncertainty about future labor income, the most important income source among the working population. Labor income uncertainty was measured by household surveys of expected changes in the national unemployment rate during the year ahead.

While only a small fraction of the total population actually becomes unemployed at any one time, the associated changes in overall employment conditions have a more pervasive impact on the entire population. Changes in work hours and wages, opportunities for career advancement and bonuses, and workers' sense of job and income security all vary with the overall state of the labor market. Indeed, the U.S. recession and the slow initial recovery in the early 1990s were characterized by widespread apprehensions about future job and income security. The sustained weakness in consumption spending, not predicted by macro models,

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was attributed to a spontaneous consumption shock (Blanchard, 1993; Hall, 1993). Data on consumers' expectations about unemployment, which are not usually included in macro models, did provide useful predictive information. Carroll and Dunn (1997) found that unemployment expectations were robustly correlated with every measure of consumer spending, even after controlling for permanent income and for other information about future income changes. While unemployment expectations cannot serve as a proxy for all potential sources of income uncertainty, they do capture the essential implications of precautionary motives for spending and savings decisions among the working population.

Carroll and Dunn, however, point out ". . . that there has been virtually no recent research on how consumers' observable expectations are determined . . ." (p. 214). To be sure, there is no lack of theories on the formation of expectations, which range from the simple extrapolation of the past to the rational expectations of the future. There is a considerable degree of skepticism, however, about the ability of ordinary consumers to forecast changes in the national unemployment rate. To address these concerns, the paper first presents an assessment of the accuracy of unemployment expectations, based on the same series used by Carroll and Dunn. The analysis then turns to the determinants of consumers' unemployment expectations.

The analysis will focus on two general properties of the various models of expectations. The first difference involves the postulate of rationality. When full rationality is assumed, the tests determine whether the expectations are unbiased forecasts that efficiently utilize all available information. These tests focus on actual outcomes compared with prior expectations. When bounded rationality is assumed the analysis focuses on the inputs, on how information was used to form expectations. Of course, these two approaches are not inconsistent, as the former test expectations based on their relationship with future changes in unemployment, while the latter test expectations based on past changes in unemployment. Based on reduced form models, the data indicate that expectations do not meet the strict standards of full rationality, nor do they closely conform to the extrapolative, adaptive, or error correction models. Nonetheless, unemployment expectations do contain a significant amount of additional and independent information about future changes in unemployment.

The second difference involves the relative impact of public and private information on the formation of unemployment expectations. Most models rely on the assumption that consumers base their expectations on the official public announcements of the unemployment rate. While the importance of "private" sources of information is often cited, it has been rarely subject to empirical tests. The analysis found that private information was critical to the formation of unemployment expectations. Measures of private information about potential changes in unemployment had a substantial independent impact on expectations, even after controlling for changes in official information on the unemployment rate as well as other publicly available information on economic trends.

2. Theoretical Models of Expectations

The formation of expectations depends on two factors: informational inputs (I) and the process of transforming information into expectations (f). Let the

expectation of the unemployment rate (*Uex*) formed by the *i*-th individual be defined as:

$$Uex_{it} = f(I_{it-1}) \tag{1}$$

where the subscript *t* on *Uex* indicates the period for which the expectation applies. The information set *I* is specific to each individual to allow for the use of private as well as public information. Two general classes of specifications based on assumptions about rationality have long dominated the literature. The first class includes the extrapolative, adaptive, and error learning models, which I will refer to as "adaptive" expectations, and the second, the rational expectations hypothesis.

The format of the appropriate empirical tests of these two models is just as distinctive as their assumptions about rationality: one focuses on the information inputs to the formation process, the other on the outcomes of the process. The extrapolative and adaptive expectations models define what information is used and how it is used in the formation of expectations, including the availability and cost of information as well as the capacity of individuals to effectively utilize the information. The empirical tests were designed to determine whether variations in expectations are related to these hypothesized factors. In contrast, tests of the rational expectations hypothesis focus on whether the observed expectations are unbiased future forecasts and whether all of the information was used efficiently and optimally. In the former case, expectations are analyzed as the dependent variable, while in the latter case expectations are viewed as an independent variable in the analysis.

This difference makes the comparison of the relative merits of the two models difficult. For the adaptive expectations models, confirmation essentially entails finding a significant empirical relationship between expectations and some informational inputs. Confirmation of the rational expectations hypothesis, in contrast, requires the finding of unbiased and efficient future predictions. In tests of adaptive expectations, any statistically significant finding is taken as confirmation even if it accounts for a trivial proportion of the variance, whereas anything short of full rationality requires the rejection of the rational expectations hypothesis. This asymmetry in the evaluation of empirical evidence has stunted theoretical developments.

This situation is nowhere more important than in the assessment of the forward-looking content of expectations. Adaptive expectations models are inherently bound to the past. Aside from the special case where future outcomes are extrapolations of the past, no method is usually hypothesized to test the forward-looking content of expectations. Indeed, by their very construction, adaptive expectations models portray the formation process as a relatively transparent function of past outcomes where individuals never fully learn from their past errors. Rational expectations models, in contrast, place their entire emphasis on assessing the forward-looking information, but do not posit any specific process for the formation of expectations. When empirically rejected, the rational expectations framework provides no insight into which limitations on rationality proved to be most important. While the data in this paper cannot resolve this issue, the data do directly confront the issue of whether consumers' unemployment expectations

contain information about the future over and above the information contained in past changes in the unemployment rate.

Adaptive Expectations

The various adaptive, extrapolative, and error learning models can be summarized by the following autoregressive distributive lag representation:

$$Uex_t = \alpha + \sum_{j=1}^{n} \beta_j Uex_{t-j} + \sum_{j=1}^{n} \gamma_j U_{t-j} + \sum_{j=1}^{n} \zeta_j Z_{t-j} + \varepsilon_t \tag{2}$$

where Uex is unemployment expectations, U is the unemployment rate, the vector Z includes variables other than the unemployment rate that are part of the relevant information set, j is the lag length, and ε_t is the error term, with the i subscript dropped for convenience. Defining the unique characteristics of the various models involves the specification of coefficients β, γ, and ζ.

Perhaps the most basic hypothesis is that expectations essentially represent random responses to the survey questions, unrelated to either the past realizations of the variable or even past expectations. In this case, the β, γ, and ζ coefficients would be hypothesized to be equal to zero, so that variations in expectations about its mean (α) are simply equal to the error term.

The pure extrapolative model is obtained by setting the coefficients β and ζ equal to zero, so that expectations solely depend on the lagged values of the unemployment rate. The most restricted version of this model can be characterized as "static expectations," where expectations simply depend on the most recent realization. The more general version holds that expectations represent a weighted average of past realizations. Under the extrapolative hypotheses, the γ coefficients are hypothesized to be positive.

The adaptive or error learning hypothesis posits that consumers revise their expectations for the following period based on the error in their expectations in the current period (Fisher, 1930; Cagan, 1956; Friedman, 1957; Nerlove, 1958). In terms of the above equation, this implies that only one lag of the actual and expectation variables are used, with the coefficient on the difference between the expected and actual outcomes (the speed of the learning adjustment) hypothesized as being positive with an upper bound of 1.0. By use of the Koyck (1954) transformation, however, the adaptive expectations model can be shown to be equivalent to a weighted average of past realizations.

Another approach has been to utilize error correction models, which postulate equality in equilibrium between unemployment expectations and the unemployment rate. The basic error correction model can be expressed by using one lag of the expectations variable and two lags of the actual unemployment rate, and fixing these coefficients at 1.0 to express the notion that the equilibrium rate of unemployment is equal to its expectation. The error correction equation thus relates the change in expectations to past changes in the actual unemployment rate as well as the error in the prior period's expectation.

The reliance on information about past changes in unemployment is the source of the most important disadvantage of all adaptive expectations models because systematic prediction errors result since expectations tend to underesti-

mate (overestimate) the true change whenever the underlying variable is trending upward (downward). In response to this deficiency, augmented models have been proposed, which incorporate information on other variables that are assumed to influence the formation of expectations (the Z variables). The use of this additional information can help to offset the tendency toward systematic prediction errors.

Rational Expectations

The strong appeal of the rational expectations hypothesis is that it avoids the bias toward systematic prediction errors by shifting its focus from the variable's history to its future realizations. The rational expectations hypothesis equates the expectation with the expected value of the actual subsequent realization, conditional on all available information (Muth, 1961). Unbiased expectations under the rational expectations hypothesis require that the coefficients α and β are zero and one, respectively, in the equation:

$$U_t = \alpha + \beta Uex_t + \varepsilon_t \tag{3}$$

The strong test of rationality also requires that all of the available information has been efficiently and optimally used in forming the expectation. This involves tests on the statistical properties of the prediction errors to determine if they are consistent with those stipulated by the hypothesis (orthogonality, efficiency, consistency, as well as unbiasedness). Tests of this assumption take the form:

$$\xi_t = \alpha + \sum_{j=1}^{n} \gamma_j U_{t-j} + \sum_{j=1}^{n} \zeta_j Z_{t-j} + \varepsilon_t \tag{4}$$

where ξ_t is the prediction error, the coefficients γ and ζ are expected to be zero, and the prediction errors are serially uncorrelated. This expresses the notion that if any of the available information was systematically related to the prediction errors, the information was not efficiently and optimally incorporated into the formation of the original expectation.

3. Empirical Models

Since the major goal of this analysis is to provide a comparative assessment of the two major classes of models, rather than a detailed assessment of any one model, the following representation of the rational expectations model will be considered:

$$U_t = \alpha + \sum_{j=1}^{4} \beta_j Uex_{t-j} + \sum_{j=1}^{8} \gamma_j U_{t-j} + \sum_{j=1}^{4} \zeta_j Z_{t-j} + \varepsilon_t \tag{5}$$

The empirical results will then be contrasted with those for the general representation of the adaptive expectations model:

$$Uex_t = \alpha + \sum_{j=1}^{4} \beta_j Uex_{t-j} + \sum_{j=1}^{8} \gamma_j U_{t-j} + \sum_{j=1}^{4} \zeta_j Z_{t-j} + \varepsilon_t \tag{6}$$

In both models the number of lags included for the actual unemployment rate is twice the number of lags for the expectation measure. Since past changes in the actual unemployment rate are considered a determinant of current expectations, it is necessary to purge the expectation variable of its influence to correctly assess the forward information content of expectations. The lag length (in quarters) was chosen to correspond with the one-year horizon of the expectation measure. All of the extrapolative and adaptive expectation models hypothesize that the coefficients on the lagged unemployment rate would be positive.

The data for unemployment expectations were taken from the Surveys of Consumers, conducted by the Survey Research Center at the University of Michigan. Since the early 1960s, representative national samples have been asked this question: "How about people out of work during the coming twelve months—do you think that there will be more unemployment than now, about the same, or less?" An index was defined by the percentage that expected more unemployment minus the percentage that expected less unemployment.[1] The quarterly sample sizes were approximately 1,500 and the 95% confidence interval is approximately ±2.9 points. The actual unemployment rate used was that for all workers, published by the U.S. Department of Commerce.

Since analytic focus is on the new information contained in each quarterly measurement, all variables were defined as quarterly differences, using data from 1961:1 to 2002:4. The use of quarterly differences eliminates first order serial correlation in the levels of the series, with both series stationary after differencing.[2] The means for the quarterly change in both expectations and the unemployment rate were close to zero. The mean quarterly difference in unemployment expectations was 0.2 percentage points, with a standard error of the estimate equal to 0.8. The mean quarterly difference in the unemployment rate was –0.01, with the standard error of the estimate equal to 0.03.

4. Are Unemployment Expectations Forward Looking?

The first set of tests focus on the relationship between unemployment expectations and the actual unemployment rate, omitting the influence of any other potential determinant of either expectations or the unemployment rate. Given that the central purpose of these tests is to determine whether changes in household expectations contain significant independent information for forecasting future changes in the unemployment rate, the equation used eight lags of the unemployment rate in order to purge the expectations variable of all information

[1]The question wording has not changed since it was first asked in 1961. From 1961 to 2002 there were 11 quarters that the question was not included in the survey. For these missing observations, the data from the prior quarter were used as a proxy for the missing quarter's observation. While the usual practice is to interpolate the data, such a procedure would have been inappropriate for the analysis included in this paper since the interpolation would have been based on information only available in the subsequent quarter. The surveys were conducted quarterly prior to 1978 and monthly since 1978. The monthly samples are independent so that they can be pooled into quarterly samples (Curtin, 1982). The data used in this analysis and other information about the surveys are available at www.umich.edu/~umsurvey.

[2]The levels of both series exhibit a considerable degree of first order serial correlation, with a simple AR1 model estimating $\rho = 0.83$ for expectations and $\rho = 0.98$ for the unemployment rate.

contained in the past changes in the actual unemployment rate. The estimated results were:

$$\Delta U_t = -0.008 + 0.024\sum_{t=1}^{4}\Delta Uex_{t-i} + 0.618\sum_{t=1}^{8}\Delta U_{t-i} \tag{7}$$

$$(0.020)\ (0.007) \qquad (0.143)$$

$$\overline{R}^2 = 0.456 \quad \theta = 0.039 \quad LM(\chi^2) = 0.937$$

$$(0.262) \qquad (p = 0.333)$$

with the coefficients representing the sum of the distributed lags. The regression was calculated using nonlinear least squares to estimate a moving average error term (θ), using a consistent estimate of the covariance matrix that allows for serial correlation and heteroscedasticity. The corrected standard errors appear in parentheses. The moving average error term proved to be insignificant, and the presence of first order serial correlation in either the autoregressive or moving average form was rejected by the LM test.[3]

Overall, the results indicate that expectations were significantly correlated with future changes in unemployment, and this correlation was independent of the information included in the lagged changes in unemployment. The exclusion of the four lags of the expectations variable was rejected with a probability value of 0.004, indicating that expectations were useful predictors of future changes in unemployment. The regression indicates that for each percentage point increase in the sum of the expectation index, the future unemployment rate was 0.024 percentage points higher. Thus when the sum of the changes in the survey index rose by 10 percentage points, the subsequent unemployment rate rose by about one-quarter of a percentage point.

Switching to the adaptive expectations framework, the equation is now estimated with the change in expectations rather than the unemployment rate as the dependent variable. Again, eight lags of the unemployment rate, and four lags of expectations are used, with the following results:

$$\Delta Uex_t = 0.192 - 0.292\sum_{t=1}^{4}\Delta Uex_{t-i} - 28.8\sum_{t=1}^{8}\Delta U_{t-i} \tag{8}$$

$$(0.937)\ (0.501) \qquad (9.63)$$

$$\overline{R}^2 = 0.19 \quad \theta = 0.218 \quad LM(\chi^2) = 0.680$$

$$(0.363) \qquad (p = 0.409)$$

The results indicate a significant influence of lagged changes in the actual unemployment rate on expectations, but no significant impact of lagged expectations. The sign of the coefficient on lagged changes in unemployment is negative, however, indicating that recent *increases* in the unemployment rate led households to expect *decreases* in unemployment in the future. The sum of the coefficients did not mask any positive impact, as all of the individual coefficients that were significant were also negative.

[3]The Durbin–Watson statistic is not appropriate with the presence of lagged dependent variables. The LM test is a generalization of Durbin "h-statistic" (Breusch, 1978; Godfrey, 1978).

This is certainly not what the extrapolation or adaptive hypotheses would indicate.[4] Each of these hypotheses would require a positive coefficient on the lagged unemployment rate. This would indicate that rather than extrapolating past trends, consumers anticipate future unemployment to revert to past levels. While such theories of the reversion of expectations have been hypothesized, they have been typically framed in terms of the return to long-term trends, and not as a response to quarterly changes in unemployment.

While the typical equation used to test adaptive expectations does not provide for any assessment of the forward-looking content of expectations, a familiar modification can be used to accomplish such an assessment. The equation can be modified to determine whether *future* changes in the unemployment rate are significantly correlated with *current* expectations. The above equation was refitted to include the future four quarters in the unemployment rate as well as the contemporaneous change in unemployment. Many will recognize the resulting equation as simply another method to test for "Granger causality" (Geweke *et al.*, 1982).[5] The estimated equation was:

$$(9)\quad \Delta Uex_t = 0.067 + 0.275\sum_{i=1}^{4}\Delta Uex_{t-i} - 19.9\sum_{t=1}^{8}\Delta U_{t-i} + 10.2\Delta U_t + 8.40\sum_{i=-1}^{-4}\Delta U_{t-i}$$

$$(0.278)\ (0.272)\qquad (4.64)\qquad (5.00)\qquad (3.42)$$

$$\overline{R}^2 = 0.356\quad \theta = -0.610\quad LM(\chi^2) = 2.90$$

$$(0.170)\qquad (p = 0.090)$$

The data indicate that higher *future* changes in the unemployment rate were positively associated with increases in *current* expectations. The coefficients for the four-quarter lead (indicated by t ranging from –4 to –1) in the rate of unemployment were both positive and significant, at more than twice its standard error. A separate chi-square test on their exclusion of the four-quarter lead was easily rejected (p = 0.008). The adjusted r-square also improved significantly, nearly doubling from 0.19 to 0.36.

Overall, the analysis based on both the rational and adaptive expectations models indicate that consumers' expectations contain forward-looking information about future changes in unemployment rate. Expectations also incorporate contemporaneous information on the unemployment rate, although it should be noted that the survey has always been completed well in advance of the announcement of the official unemployment rate. In addition, unlike past changes in unemployment, contemporaneous changes in unemployment had the anticipated positive impact on expectations.

5. Are Unemployment Expectations Rational?

The data indicate that unemployment expectations are more closely correlated with future changes rather than past developments in the unemployment rate.

[4]Regressions using the levels of unemployment and expectations provide the same results: past changes in the unemployment rate were negatively related to expectations.

[5]The term "causality" is used here in an informal sense. There is no suggestion that the expectation caused the change in unemployment.

Does this mean that unemployment expectations are best characterized by the rational expectations hypothesis? Or are unemployment expectations forward-looking, but not rational in the strict sense of the hypothesis?

The data indicate that household unemployment expectations fall short of the stringent tests of the rational expectations hypothesis. Fitting the model with the unemployment rate as a function of expectations yields the following result:

$$\Delta U_t = -0.005 + 0.025\sum_{t=1}^{4}\Delta Uex_{t-i} \quad \rho = 0.535 \quad \overline{R}^2 = 0.431 \quad D-W = 2.07 \tag{10}$$
$$(0.041)\ (0.006) \qquad\qquad (0.067)$$

Given that the unemployment rate and unemployment expectations are not measured using the same scales, there is no presumption that β should be equal to 1.0, although α should be equal to zero if the expectations series is unbiased. The estimated value of α is not significantly different from zero, so there is no evidence of bias, and the β coefficient is highly significant at four times its standard error. The fitted equation, however, exhibited highly significant first-order autoregressive errors, in clear violation of a strict interpretation of the theory.[6] The serially correlated prediction error indicates the presence of important information that households failed to utilize in their formation of unemployment expectations. Cukierman (1986) has suggested that this is not a clear violation of the rational expectations hypothesis, since households may not always correctly distinguish between temporary and permanent shocks and thus their forecasts could exhibit serially correlated errors. In addition, Croushore (1998) notes that the overlapping forecast intervals generated by the quarterly questions could produce serially correlated errors even among perfectly rational agents.

The prediction error from the above equation was tested against other available information to determine whether the errors could be reduced. In addition to past changes in the unemployment rate, several other candidates were tested. The variables tested were changes in real GDP, changes in household employment, and changes in initial claims for unemployment insurance.[7] Each of the variables was defined as the quarterly change in their logs. Since quarterly changes in GDP reflect the overall strength of the economy, recent trends in GDP provide households with some information about prospective changes in the unemployment rate. Changes in employment capture the strength of the labor market, and as such can indicate future changes in unemployment. Claims for unemployment insurance are a more direct measure of changes in unemployment, even though state unemployment insurance programs do not cover all workers.

The regression of the prediction errors for these additional sources of information achieved only modest results, with an adjusted r-square of 0.08. Chi-square tests were used to determine the probability that the coefficients on the additional variables were zero, and thus could be deleted from the model, with all tests based

[6]Note the similarity of this estimate with equation (7) that also included eight lags of the change in the unemployment rate. The coefficient on expectations is of similar size, but the estimate of the serial correlation coefficient was just 0.015. This suggests that the lags on the unemployment rate acted to eliminate the serial correlation but did not significantly improve the adjusted r-square (0.43 versus 0.46).

[7]Other candidates were also tested, including the Federal funds rate. None of the other variables tested proved to be significant in this or any other equation reported in the paper.

on Newey–West corrections to the covariance matrix. The tests rejected the inclusion of the lagged changes in GDP ($p = 0.338$), employment ($p = 0.357$) and unemployment insurance claims ($p = 0.211$), but not lagged changes in the unemployment rate ($p = 0.001$). Whether the significance of the lagged unemployment rate constitutes a violation of the rational expectations hypothesis is debatable (Cukierman, 1986; Croushore, 1998). While the format of the survey measure of unemployment expectations does not readily support an unambiguous test of the rational expectations hypothesis, the data appear to be more consistent with that hypothesis than with the adaptive expectations hypothesis.[8]

6. The Impact of Private Information

Do households utilize private information about potential trends in unemployment in forming their expectations? Although the importance of private information is often mentioned, most formal models of expectations are typically restricted to the official announcements of economic information by the government. The distinction between private and public information may seem artificial since nearly all information available to consumers about the nation's unemployment rate is in some sense public information. Nonetheless, it is useful to define public information as the official announcement as well as any other publicly available information that is highly correlated to those announcements. Private information about unemployment is independent from the official announcements, and is typically obtained from the public media, although personal experience or social networks are also potential sources.

The survey data included two questions that could be used to test the comparative impact of private and public information on the formation of expectations. Households were asked about the news that they had recently heard about changes in the economy, and the open-ended responses were coded for specific references to changes in employment and unemployment.[9] Since this question focused on recent changes known to respondents, such knowledge would presumably be highly relevant in the formation of their expectations for future changes in the unemployment rate. For analysis purposes, an index (NewsU) was formed equal to the proportion mentioning unfavorable changes minus favorable changes in employment. As with the other variables, the quarterly change in net references to unemployment was used in the analysis.

[8]Transforming the qualitative expectations into quantitative estimates has been done for inflation expectations with mixed success. Different methods have been used to "quantify" qualitative measures of expectations, with the Carlson–Parkin (1975) technique the most widely known. These techniques involve an assumption about the underlying and unobserved distribution of expectations (typically assumed normal, but other distributional assumptions have been used) combined with an assumption that across the entire time-series expectations are unbiased and equal realizations (although other identifying assumptions are possible). See Batchelor (1986) and Pesaran (1987) for a review of these techniques.

[9]The data include references to other economic events, such as inflation, interest rates, stock prices, federal taxes and spending, trade deficits, and so forth. Only references to changes in (un)employment were used in this analysis.

The other source of relevant private information was the household's expectation for the overall economy during the next twelve months. Since this variable focused on the expected growth in the economy, it should reflect any expected changes in employment as well. The analysis variable represented the quarterly change in an index (GDPex) that was set equal to the proportion that expected good times minus the proportion that expected bad times in the economy as a whole.[10] The quarterly change in the variable was then used in the analysis.

Three additional variables were also included in the model to control for publicly available information about the same topics: the growth rates in real GDP, employment, and unemployment insurance claims. Without these controls, the private information would simply be a proxy for the official announcements. The existence of an independent impact of private information does not mean that the information was not obtained from the media, only that the information had an impact that was independent of the official announcements. Indeed, it is likely that consumers obtain most of their information on changes in national employment conditions from the media.

Table 1 shows the results for the regressions predicting expectations using both the public and private sources of information. The table entries give the sum of the coefficients, their corrected standard errors in parentheses, and in brackets the probability that all of the coefficients were zero and thus could be excluded from the models. Given that the goal was a comparative assessment, the empirical tests were designed to determine if the addition of private information would dominate the official information sources. Since the forward rate of unemployment was not yet known at the time the expectation was formed, the test essentially involves identifying which sources of available information were significantly related to both current expectations as well as future changes in unemployment.

Public Information

When the publicly available information sources were added (see Table 1, equation 11), none had a significant impact on unemployment expectations. These additional sources of public information do not appear to represent the information used by households to form their expectations. The addition of GDP, employment, and unemployment insurance claims did not change the original results: the contemporaneous and forward changes in the unemployment rate had a significant impact on current expectations, and the lagged changes in the unemployment rate still had the anomalous negative coefficients. The major difference was that the presence of the additional variables acted to increase the size of the coefficients on the leads and lags of the unemployment rate, and thus slightly increased the explained variance from 0.36 to 0.39 (compare equations 9 and 11).[11]

[10]This question is included in U.S. Index of Leading Economic Indicators, and uses the same scoring method.

[11]None of the estimated coefficients change significantly when the cotemporaneous and forward unemployment rate was omitted from the equation, although the adjusted r-square dropped by one-third. The same was true for equation 15, but here the estimated r-square remained unchanged since these variables were insignificant.

Private Information

Private sources of information proved much more capable of explaining the formation of expectations. The question on news about unemployment was entered without lags since this information was obviously known to respondents when they answered the question on expected trends in unemployment. When entered into the regression (Table 1, equation 12), this variable was highly significant and had the correct sign, with a probability of less than 0.001 against its exclusion. Moreover, the addition of this variable erased the importance of the contemporaneous rate of unemployment. Without the news variable, for each percentage point change in the contemporaneous unemployment rate, the expecta-

TABLE 1

DETERMINANTS OF UNEMPLOYMENT EXPECTATIONS

	Dependent Variable: Change in Unemployment Expectations				
	(11)	(12)	(13)	(14)	(15)
Constant	–0.200	0.093	0.124	0.075	1.598
	(2.73)	(0.559)	(0.390)	(0.388)	(1.528)
$\sum_{i=1}^{4} \Delta Uex_{t-i}$	–0.424	–0.370	–0.224	–0.232	–0.146
	(0.529)	(0.216)	(0.156)	(0.147)	(0.158)
	[0.536]	[0.036]	[0.630]	[0.288]	[0.737]
$\sum_{i=1}^{8} \Delta U_{t-i}$	–25.4	–17.0	–14.9	–11.4	–10.7
	(9.33)	(4.61)	(3.34)	(3.32)	(5.08)
	[0.013]	[0.002]	[<0.001]	[0.016]	[0.118]
ΔU_t	12.6	0.190	6.97	2.22	1.20
	(4.16)	(3.21)	(2.86)	(2.79)	(2.96)
	[0.003]	[0.953]	[0.016]	[0.428]	[0.687]
$\sum_{i=-1}^{-4} \Delta U_{t-i}$	14.2	8.03	3.56	3.07	3.70
	(4.36)	(2.94)	(2.40)	(2.29)	(2.40)
	[0.006]	[0.060]	[0.200]	[0.229]	[0.277]
$\sum_{i=1}^{4} \Delta GDP_{t-i}$	–0.616				–1.89
	(3.05)				(1.68)
	[0.070]				[0.386]
$\sum_{i=1}^{4} \Delta EMP_{t-i}$	0.030				0.130
	(4.14)				(2.36)
	[0.401]				[0.440]
$\sum_{i=1}^{4} \Delta Claim_{t-i}$	–0.531				–0.362
	(0.431)				(0.258)
	[0.542]				[0.678]
$\Delta NewsU_t$		0.851		0.449	0.483
		(0.095)		(0.094)	(0.101)
		[<0.001]		[<0.001]	[<0.001]
$\Delta GDPex_t$			–0.522	–0.393	–0.364
			(0.043)	(0.049)	(0.054)
			[<0.001]	[<0.001]	[<0.001]
RSQD (adj)	0.387	0.601	0.683	0.725	0.721
θ	0.065	0.027	–0.197	–0.143	–0.152
	(0.352)	(0.137)	(0.115)	(0.112)	(0.123)
LM test (χ^2)	0.793	0.020	0.303	0.174	0.194
(p-level)	(0.373)	(0.889)	(0.582)	(0.676)	(0.660)

Notes: Time period was 1962:1 to 2002:4. All variables were defined as quarterly differences; see the text for the exact variable definitions. Where appropriate, table entries are the sum of the distributed lags. Standard errors in parentheses; the numbers in brackets give the probability that all of the coefficients were zero. The regressions were calculated using a consistent estimate of the covariance matrix that allows for serial correlation and heteroscedasticity. The LM test is for presence of first order serial correlation in either the autoregressive or moving average form.

tions index rose by 12.6 percentage points. When the news variable was entered, the impact of the contemporary unemployment rate was near zero. Note that the contemporary unemployment rate was not known at the time of the survey so that it is likely that the unemployment rate was acting as a proxy for private information. Moreover, private information about unemployment could account for a substantially higher fraction of variance in expectations, as the adjusted r-squared increased to 0.60.

The other source of relevant private information was changes in the households' expectation for growth in the overall economy during the next twelve months. This information was also collected at the same time as unemployment expectations, so it was entered without a lag in the regression. This variable was highly significant, with a probability of less than 0.001 against exclusion (Table 1, equation 13). More importantly, the addition of households' expectations for economic growth erased the impact of the forward unemployment rate. This result indicates that consumers were making judgments about the future strength of the national economy, and it was this assessment that corresponded with future change in the unemployment rate.

When the combination of news heard about unemployment and expectations about economic growth were both entered, the sizes of both coefficients were somewhat smaller, but they still remained quite significant, with a probability against exclusion of less than 0.001 (Table 1, equation 14). More importantly, the impacts from contemporaneous as well as the forward changes in the unemployment rate were no longer significant. To determine if the impact of this private information could be accounted for by past changes in GDP, employment growth, or unemployment claims, these variables were added to the regression (Table 1, equation 15). The regression results indicated that none of these factors had a significant impact.

Accuracy of GDP Expectations

It could be argued that the data on expected changes in GDP were related to unemployment expectations but not with future actual changes in GDP. Although this hypothesis was refuted by the elimination of future changes in the actual unemployment rate as a significant predictor when expectations about GDP were controlled, another test is possible. The following regression tests whether changes in GDP expectations were significantly associated with actual future changes in GDP. Using the same format and time period, the results were:

$$\Delta GDP_t = \underset{}{0.776} + \underset{(0.307)}{0.048}\sum_{t=1}^{4}\Delta GDPex_{t-i} + \underset{(0.350)}{0.098}\sum_{t=1}^{8}\Delta GDP_{t-i}$$
$$\underset{(0.019)}{}$$

$$\overline{R}^2 = 0.13 \quad \underset{(0.447)}{\theta = 0.273} \quad LM(\chi^2) = 0.889 \quad (p = 0.343)$$

Expectations of future changes in GDP had a significant predictive association with future GDP changes, even after controlling for the prior eight quarterly changes in GDP. Tests indicated that the probability that the GDP expectation

variable could be excluded was less than 0.01. The data thus indicate that consumer expectations of future changes in GDP do correspond to actual future changes, although the regression explains only a small amount of the variance. In contrast, past actual changes in GDP had no significant association with future changes.

7. Discussion

Unemployment expectations contain predictive information that is not contained in past trends in the unemployment rate or captured by changes in other objective economic variables. The data indicated that future changes in the national unemployment rate were robustly correlated with unemployment expectations derived from household surveys. Moreover, it was private information rather than the official announcements of economic information that dominated the formation of unemployment expectations. It was these private forward-looking sources of information that provided the additional explanatory power of unemployment expectations in models of consumer spending documented by Carroll and Dunn (1997). As a measure of uncertainty about future income, higher unemployment expectations reflect the impact of potential job loss as well as the possibility of slower income growth due to loss of overtime hours, bonuses, and smaller wage gains that accompany higher unemployment.

The data on unemployment expectations proved to be more consistent with the rational expectations hypothesis than with models that emphasize the formation of expectations by extrapolation, adaptive, or error learning processes. This result has also been found for the series on inflation expectations collected in the same survey. Thomas (1999) found that the median consumer forecasts of the year-ahead inflation rate fit the rational expectations model, and they outperformed the forecasts of professional forecasters on tests of accuracy and unbiasedness. This analysis extends those results to unemployment expectations, although there are some important qualifications. The most important difference was that the usual procedures to test the rational expectations hypothesis could not be implemented given how unemployment expectations were measured. As a result, no statements could be made about the degree of accuracy, although the data cannot reject the hypothesis that unemployment expectations are unbiased. While consumers did not make optimal use of all available information in forming their unemployment expectations, failure to meet the strict interpretation of the hypothesis does not necessarily reject rationality (Cukierman, 1986; Croushore, 1998). While there is no standard to quantify degrees of rationality, the data suggest that the rationality of consumers is much less bounded than has been widely believed in the past. Importantly, this result applies to consumers as a group, not to any individual consumer.

The most important additional factor in determining unemployment expectations was the anticipated overall strength of the economy. It is no surprise that the strength of today's economy has important implications for tomorrow's unemployment rate. Indeed, the unemployment rate is a lagging indicator of economic strength. While actual past changes in GDP were significant factors, expectations about future changes in GDP dominated the formation of unemployment expec-

tations. The data suggest that changes in unemployment were based on how consumers judged future prospects for the economy. This seems too obvious to dispute in theory or by the evidence. It does indicate that the formation of unemployment expectations is to an important extent derived from more general expectations about the future performance of the economy.

The issue can be conceptualized in a manner similar to the more comprehensive models of rational expectation: forecasts are based on models of the economy not on individual sources of information taken in isolation. To be sure, there is no presumption that consumers utilize the formal models of economists. Nonetheless, ordinary people do appear to strive toward a coherent interpretation of the economic events that directly influence their future financial situation. Compared with the formal models of economists, people's economic beliefs are more fragmented than cohesive, display internal inconsistencies more often than coherence, often rely on simple rules of thumb, and are recognized as imprecise even by consumers themselves. To fully comprehend the formation of unemployment expectations, research must move toward a comprehensive understanding of these more general economic models used by consumers. Importantly, the emphasis must shift from the backward to the forward-looking features of models of the formation of expectations.

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