Do Wall Street Economists Believe in Okun's Law and the Taylor Rule?

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Abstract

We use data from the *Wall Street Journal*'s semi-annual survey of professional economists to test whether individual economists' six-month-ahead predictions of real GDP growth, unemployment, short-term interest rates and inflation reflect Okun's Law and the Taylor Rule. We conclude the economists believe real growth is less responsive to unemployment-rate changes than the textbook version of Okun's Law; we also find the economists believe the Federal Reserve sets short-term interest rates by placing more weight on unemployment and less weight on inflation than the Taylor Rule prescribes.

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The *Wall Street Journal* has conducted a regular survey of professional economists for over twenty-five years, asking the economists for their forecasts of several macroeconomic variables. The panel is composed mostly of business economists from the financial and economic consulting industries. Unlike most such surveys, such as the Livingston Survey or the Survey of Professional Forecasters, the *Journal* identifies the forecasts by forecaster name and employer in its prominent, feature stories on the forecasts. Presumably these economists give presentations of these forecasts to customers and business groups, explaining their reasoning. This suggests that these forecasts should reflect any interrelationships among forecasts that the economists employ in producing their predictions. One possible relationship is Okun's Law, which links changes in the unemployment rate to the growth rate of real output. Another is the Taylor Rule, which prescribes that the Federal Reserve set the short-term interest rate it targets based on deviations of output and inflation from their targets.

We investigate whether forecasts made by these professional economists reflect Okun's Law or the Taylor Rule. We draw forecasts from 1986 – 1988 and from 1999 – 2007, the periods in which the *Journal* reports forecasts of all the variables needed for our investigation. We proceed by estimating standard models of Okun's Law and the Taylor Rule on economists' predictions and examining whether they conform to the conventional parameterizations of these relationships. To preview our results, we find that the economists' real-growth-rate predictions generally reflect less responsiveness to predicted unemployment-rate changes than the textbook version of Okun's Law, and that their interest rate predictions generally reflect less weight on predicted inflation and more weight on predicted unemployment than the Taylor Rule prescribes.

We believe our paper makes a novel contribution to the literature assessing professional economists' forecasts. Much of this literature seeks to ascertain the quality of forecasts of individual economic variables with respect to unbiasedness, accuracy vis-à-vis benchmarks, and homogeneity.[1]

[1] See Mitchell and Pearce (2007) for a brief review of this literature.

Instead of ascertaining the forecasting accuracy of the economists, we focus on whether the forecasts are consistent with relationships that form part of basic macroeconomic conventional wisdom.

The rest of the paper is organized as follows. Section 1 briefly reviews the literature on Okun's Law and the Taylor Rule. Section 2 describes our data and the models estimated. Section 3 presents and discusses our empirical results. Section 4 draws our conclusions.

1. Literature Review

If stable empirical relationships exist among macro-economic variables, we would expect that economists' forecasts of these variables that are publicly available should be consistent with these relationships. One such relationship between real output and unemployment is known as Okun's Law, which Alan Blinder (1997, p. 241) referred to as a "truly sturdy empirical regularity" that "closes the loop between real output growth and changes in unemployment with stunning reliability." Another, more recent, relationship is between the short-term nominal interest rate, the inflation rate and the output gap known as the Taylor Rule, which Taylor (1993) found to explain much of the variation in the short rate in the early years of the Greenspan era. We discuss each in turn.

1a. Okun's Law

Arthur Okun (1962) was the first to note a stable, negative relationship between unemployment and real output in a policy-oriented article aimed at clarifying the costs of unemployment. Using U.S. data from 1947-II to 1960-IV Okun estimated alternative models which produced similar estimates of the relationship between two variables: the percentage gap between potential real-GDP (gdp*) and actual real-GDP (gdp), and the gap, in percentage points, between the actual unemployment rate (u) and the natural rate of unemployment (u*). Okun summarized his findings with the following estimate:

$$(gdp_t^* - gdp_t)/gdp_t^* = 0.032\,(u_t - u_t^*) \qquad (1)$$

Thus a one-percentage-point rise in the unemployment rate above the natural rate was associated with a 3.2% widening of the gap between potential and actual real output.

In the 20 years following Okun (1962) his findings came to occupy an important place in the understanding of policymakers and academic economists alike. Gordon (1984, p.539) characterized empirical work from the 1960s and early 1970s as supporting an estimated "Okun coefficient" of 2.5 to 3.0. His estimates using more recent data suggest a coefficient closer to 2, as do estimates reported in recent macroeconomic textbooks.[2] The stability of the relationship together with its simplicity may explain the popularity of Okun's Law among policy-makers (Blinder, 1997) as well as its inclusion in macroeconomics textbooks, written both as:

$$(gdp_t^* - gdp_t)/gdp_t^* = \gamma\,(u_t - u_t^*) \qquad (2)$$

and as:

$$\Delta gdp_t/gdp_{t-1} \approx k - \gamma\,\Delta u_t \qquad (3)$$

where γ is the Okun coefficient. Equation (3), the growth-rate form of Okun's Law, is an approximation which presumes the natural unemployment rate is constant and the growth rate of potential real GDP is a constant, k (Abel and Bernanke, 2005).

1b. The Taylor Rule

John Taylor (1993) proposed a simple rule to guide the Federal Reserve in setting its nominal federal-funds-rate target, thereby joining the long-standing debate on whether rules-based or discretionary monetary policy better achieves price stability consistent with high employment, goals mandated by the Employment Act of 1946. Letting i^d_t represent the nominal federal-funds-rate target, the rule is expressed as

$$i_t^d = r_t^d + \pi_t + ½\,[\pi_t - \pi_t^d] - ½\,[(gdp_t^* - gdp_t)/gdp_t^*] \qquad (4)$$

where r_t^d and π_t^d are, respectively, the target equilibrium real federal funds rate and the target inflation rate, both assumed by Taylor to be a constant 2%; π_t is the actual inflation rate; and $(gdp_t^* - gdp_t)/gdp_t^*$ is the percentage gap between potential and actual real GDP, as it was in the Okun's Law equation, (1) and (2). The rule implies that when the inflation rate is at its target and real GDP is at its potential level, the nominal federal-funds-rate target should be set at 4%. Given constant targets, the Fed should respond to a one-percentage-point increase in the inflation rate above target with a 150-basis-point increase in the nominal federal-funds-rate target, and respond to a one-percentage-point real-GDP gap with a 50-basis-point decrease in the federal-funds-rate target. Although Taylor described his rule as but one representative of the class of policy rules with feedback, he found that his rule described quite well the path of the actual federal funds rate from 1987 through 1992.

Like Okun's Law, the Taylor Rule quickly came to prominence among policy makers and academic economists alike. Public statements by FOMC members charged with setting the federal-funds-rate target suggest that the Taylor Rule has and does influence their policy actions (Meyer, 2002; Poole, 2006). Descriptions of the Taylor Rule, along with (4), now appear in macroeconomics

[2] Gordon (1984, p. 550) estimated a more elaborate model on quarterly data, including lags, and estimated the long-run Okun coefficient to be about 2. Abel and Bernanke (2005, p. 100), Mankiw (2007, p. 257), and Gordon (2006, p. 53) reach similar estimates using annual data.

textbooks (e.g., Abel and Bernanke, 2005; Mankiw, 2007), often in sections discussing rules versus discretion in monetary policy.

Several authors assert that while the Federal Reserve may employ a Taylor-like Rule in setting its federal-funds-rate target, it does not adjust the actual federal funds rate to the target in one step but instead does so partially over several periods, smoothing the transition to target.[3] The adjustment mechanism:

$$i_t = \rho\, i_t^d + (1 - \rho)\, i_{t-1}, \quad 0 \leq \rho\ 1 \qquad (5)$$

is consistent with interest-rate smoothing. Combining this mechanism with (4) yields the partial-adjustment version of the Taylor Rule:

$$i_t = \rho\{ r_t^d + \pi_t + ½\ [\pi_t - \pi_t^d] - ½\,[(gdp_t^* - gdp_t)/gdp_t^*\,]\} + (1-\rho)\, i_{t-1} \qquad (6)$$

Interest-rate smoothing by the Fed would cause its short-run response to inflation and real economic activity to be smaller than predicted by the original Taylor Rule, depending upon the actual value of ρ.

In summary, Okun's Law – expressed as (2) or (3) – and the Taylor Rule – expressed as (4) or (6) – represent relationships among key macroeconomic policy variables that appear in most textbooks. We examine whether business economists reflect these relationships in their forecasts of real output, unemployment, inflation, and nominal interest rates.

2. The data and models

Before investigating whether forecasts from the *Wall Street Journal*'s surveys reflect Okun's Law or the Taylor Rule, we explore how empirical estimates of them using historical data might have appeared to professional economists tasked with making macroeconomic forecasts. We estimate the relationships for a variety of sub-periods including periods prior to our *WSJ* survey data, which run from 1986 to 1988 and from 1999 to 2007. We estimate simple regression models of Okun's Law and the Taylor Rule, as survey respondents themselves might have done.

2a. Estimates of Okun's Law using actual data

Table 1 reports estimates of the growth-rate version of Okun's Law, (3), produced using data from 1966 to 1985 and from 1979 to 1998, the twenty-year periods prior to our samples; we also show estimates for 1988-2007 for comparison. We use both real-time (unrevised) semi-annual data available

[3] Papers supporting the interest-rate smoothing version of the Taylor Rule include Judd and Rudebusch (1998) and Clarida *et al.* (2000). Duffy and Engle-Warnick (2006) find that the original Taylor Rule appears relatively stable for the 1987-2003 period, with coefficients of about .4 on the deviation of inflation from its target and about .85 on the GDP gap. They also estimate an interest-rate-smoothing version of the Rule, obtaining somewhat larger coefficients. Their paper focuses on structural breaks, finding some evidence of a break in 1996 for the interest-rate-smoothing version, with an insignificant response to inflation after 1996. For a critique of the interest-rate-smoothing model, see Rudebusch (2006) and Trehan and Wu (2007).

at the end of our sample periods and the latest revised data.[4] Because we use semi-annual data, we leave the real-GDP growth rate unannualized to produce Okun-coefficient estimates comparable to estimates produced by annual data; however, estimated constants produced from semi-annual data are half as large as estimates produced from annual data.

Estimates of (3) for the 1966-1985 period and the 1979-1998 period yield similar results for the Okun coefficient. A one-percent decrease in the unemployment rate is associated with about a 1.7 percent increase in the growth rate of real GDP, somewhat smaller than the textbook estimates of 2. Estimates with real-time or revised data are similar. For the twenty-year period from 1988 to 2007, the estimated coefficient falls to 1.35 and the relationship appears weaker as measured by the R^2s. If the WSJ survey respondents ran similar regressions, we would expect their forecasts of real GDP growth and unemployment changes to be roughly in accord with these estimates of Okun's Law. If the respondents updated their estimates, we should find somewhat lower estimates in the later period.

2b. Estimates of the Taylor Rule using actual data

Estimating the Taylor Rule on actual data is controversial, as economists disagree over whether the Rule describes data or prescribes Fed behavior. Taylor himself intended his Rule, (4), as a guide for improving the conduct of monetary policy; but he also found it fit the actual path of short-term interest rates surprisingly well. Some economists dispute this finding, claiming that the Rule's empirical support depends on the time period and data definitions employed.[5] Since the Rule concerns setting the federal funds rate, limiting the estimation period to a time when the Fed actually targeted the short rate seems appropriate; but economists dispute when interest-rate targeting began.[6] These issues lead us to present several estimates of (4) and (6) over different periods using different data definitions.

Our timing and data definition choices are also meant to produce Taylor Rule estimates compatible with the timing of the *Wall Street Journal* survey data, described below. Because the survey includes no forecasts of the real-GDP gap – a term on the right-hand side of the Taylor Rule, (4), and on the left-hand side of Okun's Law, (1) or (2), we assume Okun's Law holds – not necessarily with the textbook coefficient of 2 - and replace real-GDP gap in the Taylor Rule equation with its equivalent, the right-hand side the Okun's Law equation, $\gamma\ (u_t - u_t^*)$. We assume the natural

[4] The semi-annual real-GDP growth rates are second quarter over the previous fourth quarter and fourth quarter over the previous second quarter, and the six-month change in unemployment rate is the May level less the previous November's level and the November level less the previous May's level. We use these measures of unemployment-rate changes to match the forecast timing of the surveys. Revised data come from the St. Louis Fed website and real-time data come from the Philadelphia Fed's website (see Croushore and Stark, 2001).
[5] See, for example, Kozicki (1999).
[6] See Thornton (2006) for evidence from the FOMC transcripts.

rate of unemployment (u_t^*) remains constant, leaving u_t, for which six-month-ahead forecasts are available in the *WSJ* survey. Our reformulation of the original Taylor Rule is

$$i_t = \beta_0 + \beta_1 \pi_t + \beta_2 u_t + \varepsilon_t \qquad (4')$$

and its partial adjustment form is

$$i_t = \delta_0 + \delta_1 \pi_t + \delta_2 u_t + \delta_3 i_{t-1} + \varepsilon_t \qquad (6')$$

where $\delta_1 / (1-\delta_3) = \beta_1$ and $\delta_2 / (1-\delta_3) = \beta_2$, β_1 and β_2 being from (4)′.[7] In estimating (4′) and (6′) we measure the inflation rate, π_t, using the consumer price index (CPI), computing annualized inflation rates from May to May and November to November so as to match the forecast timing of the surveys. Similar reasoning leads us to use May and November observations of the unemployment rate, u_t.[8] For the short rate, i_t, we use the three-month Treasury-bill rate and the federal funds rate. Although Taylor envisioned his Rule's short rate as an average measured over some time interval, the *WSJ* survey asks respondents for short-rate forecasts for the last business days of June and December. Accordingly, we report estimated Taylor Rule models having as dependent variables either the average short rate for June and December or the short rate on the last business day in June and December. Because the CPI, unemployment rate, T-bill rate and federal funds rate are rarely revised after being announced, the revised and real-time data are virtually identical; we use the former.[9] Table 2 reports estimates of (4′) using actual semi-annual data for several sub-periods.

Similar to our treatment of Okun's law, we first estimate the Taylor Rule using the twenty-years of data prior to the 1986-88 survey data (equations 2.1 – 2.4). These estimates indicate no support for the Taylor Rule. While actual inflation was associated with an increase in short-term rates, the increase was well below that recommended by Taylor. An increase in observed inflation from May to November (November to May) of one percent raised the nominal short rate on the last day of December (June) by about 42 basis points for the T-bill rate and about 65 basis points for the funds rate. Using the average rate for December or June rather than the last business day gives similar results. Moreover this sample period produces estimates suggesting that short rates rose after unemployment increased. This counter-intuitive result may be due to the simultaneous increase in short rates and unemployment during the Volcker disinflation. To check this we also estimated (4') using data from 1966 to 1978, prior to the Volcker chairmanship (equations 2.5 – 2.8) . The estimated coefficients confirm that the Volcker period produced the apparent pro-cyclic reaction. For the 1966-78 period, an increase in unemployment of one percent was associated with a statistically significant

[7] δ_3 is also equal to (1-ρ) in (5) and (6).

[8] For example, the *WSJ* survey taken in December 2000 asks for forecasts of the inflation rate for May 2000 through May 2001and for the unemployment rate in May 2001.

[9] All data are from the St. Louis Fed's website.

fall in the short rate of 45 to 87 basis points depending on the short-rate measure used. The effect of inflation on short rates is slightly higher during this sub-period but still not as much as the Taylor Rule suggests.

If survey participants used the previous 20 years of data to estimate a Taylor-like rule prior to the 1999 survey, they would have found that short rates had risen with inflation but, as in the earlier period, by less than the amount recommended by Taylor and they would have found again the pro-cyclic response to unemployment (equations 2.9 – 2.12). If, however, they had estimated such a rule using the data available for the Greenspan chairmanship (1987II-1998), they would have found a strong counter-cyclic response of short-rates to unemployment, with an increase in unemployment of one percent causing rates to fall by 115 to 140 basis points (equations 2.13 – 2.16). This response is somewhat stronger than that recommended by Taylor under the assumption that the Okun coefficient is about 1.7. The response to inflation is also stronger than earlier periods with the estimated coefficient implying about a one-for-one impact of immediate past inflation on the short rate.

We also report estimates of the Taylor Rule for the entire Greenspan period (1987II-2005) and the resulting estimates are close to that prescribed by Taylor (equations 2.17 – 2.20). The estimated responses to past inflation are not significantly lower than that of the original Taylor Rule (1.5) and the response to unemployment is again close to the original Taylor Rule assuming an Okun coefficient of about 1.7.[10]

Table 3 presents estimates of the partial adjustment version of the Taylor Rule for the same sub-periods as Table 2. For the 1966-1985 period, the twenty years prior to the first sample of survey data, there is evidence consistent with some interest rate smoothing as δ_3 is significantly positive, with a median adjustment lag of about 1.4 periods or about 8 to 9 months (equations 3.1 – 3.4).[11] But the implied long-run responses to inflation are not much larger than the estimated immediate responses from the original model: for the end-of-period Treasury bill rate, for example, the implied long-run response to a one- percentage- point increase in inflation as 58 basis points versus 42 basis points in the original model. The estimated responses to unemployment are not significant. When the model is re-estimated for the pre-Volcker years (1966-78), there is no evidence of any interest rate smoothing and the estimated responses to inflation and unemployment are similar to those from the original model (equations 3.5 – 3.8).

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[10] If the Okun coefficient is about 1.7 then the coefficient for the Taylor rule would be (1.7 times -.5) or -.85.

[11] In a partial-adjustment model like (5) and (6), the median adjustment lag, the number of periods needed to accomplish one-half the adjustment towards the target, is measured as [$-\text{Ln}2 / \text{Ln}\,\delta_3$] where δ_3 is the estimated coefficient on the lagged dependent variable.

If prior to the 1999 survey, participants estimated the partial adjustment model for the previous twenty years (1979-1998), they would have found estimates similar to those for the 1966-85 period but with slightly higher long-run responses to inflation (equations 3.9 – 3.12). If, however, they restricted their sample to the Greenspan era (1987II-1998), they would have found that the implied long-run responses to inflation and unemployment were quantitatively quite similar to the estimated short-run responses for the same sample period given in Table 2 (equations 3.13 – 3.16). Three of the four measures of the short rate display some interest rate smoothing although somewhat less than the 1979-98 period, with median lags of 4-5 months The end- of-period funds rate shows no evidence of interest rate smoothing. This may be due to the end-of-quarter and end-of-year spikes in the funds rate that often occurred during this period.[12]

Looking at the estimates for the entire Greenspan era (equations 3.17 – 3.20), there is stronger evidence of interest rate smoothing, with median lags of about 18 months, but the implied long-run response of the short rate to inflation is not much different than that for the original version of the Taylor Rule.[13] In both cases interest rates are estimated to have risen more than the rise in inflation although the estimates are not precise enough to reject either the hypothesis that the coefficients are in accord with Taylor's prescription of 1.5 or the hypothesis that the increase is about one for one.

We conclude that survey respondents estimating the original Taylor Rule model on actual data would find little support for the Rule for data prior to 1986 but stronger support if they used data from the Greenspan chairmanship. For the Greenspan period up to 1999, the short rate moved in the counter-cyclic manner recommended by Taylor but the response to inflation was not as strong, with no evidence that the short rate was moved to change real rates. Only if data for the entire Greenspan period are used is there support for this component of the Taylor Rule. Most sub-periods suggest there was some interest rate smoothing but the estimated long-run responses to inflation- and unemployment-rate changes are similar to those estimated for the original Taylor-Rule model.[14]

[12] For the 23 observations in this sub-period, there were 10 cases when the end-of-June or end-of-December funds rate differed from the rates on the day before and the day after by more than 50 basis points. Some examples: the funds rate on December 31, 1990 was 5.53 while the rates on the days before and after were 7.54 and 7.85; the funds rate on June 30, 1992 was 4.53 while the rates on the days before and after were 3.80 and 3.89; the funds rate on June 30, 1994 was 5.96 while the rates on the days before and after were 4.15 and 3.82.

[13] Because we estimate our Taylor-Rule model on actual data, as did Taylor (1993), our estimated models are "backward–looking". Perez (2001) estimates a Taylor-Rule-like model using FOMC forecasts of inflation, rather than historical inflation, and finds evidence that the Fed responded aggressively to forecasted inflation in the 1983-93 period, but with long lags: estimates of δ_3 are about .8, implying a median lag of 18-19 months.

[14] As observed in Footnote 13, our estimated Taylor-Rule models are backward-looking because we estimate them on actual data. A recent paper by Orphanides and Wieland (2007) finds that the basic Taylor Rule without interest rate smoothing fits semi-annual data for 1988 – 2007 quite well if FOMC forecasts of inflation and unemployment are used. They find estimated coefficients larger than those prescribed by Taylor.

2c. The survey data and models.

Since 1981 the *WSJ* has published forecasts each January and July of a panel composed mainly of professional business economists.[15] The initial surveys consisted exclusively of interest-rate forecasts, however since 1986 forecasts of inflation, unemployment, and real output have been added. The surveys, conducted during the first and second weeks of June and December, ask respondents to forecast variables 6-months ahead, although different forecast-horizons are occasionally requested. Complete data on which to test whether economists' forecasts obey Okun's Law and the Taylor Rule exist for three periods: (i) 1986 - 1988, six surveys with six-month-ahead forecasts of the needed variables; (ii) 1999 - 2007, eighteen surveys with six-month-ahead forecasts; and (iii) 2003 - 2007, ten surveys with six-month-ahead forecasts for both the Treasury bill rate and the fed funds rate.[16]

To test whether the surveyed economists' time-t forecasts reflect Okun's Law, we use the growth-rate form of the law, (3), and estimate:

$$\text{predicted } (\Delta gdp_t/gdp_{t-1})_{jt} = k - \gamma \text{ predicted } (\Delta u_t)_{jt} + \varepsilon_{jt} \qquad (3'')$$

The dependent variable is the j^{th} respondent's percentage-growth-rate forecast of real GDP for the next six months. The predicted unemployment-rate change over the next six months is the respondent's six-month-ahead unemployment rate prediction less the most recent unemployment rate known at the time of the survey.[17] We assume the predicted unemployment-rate change embodies all information available to each respondent relevant to forecasting unemployment and real GDP, so that the error term reflects factors affecting a respondent's real-GDP growth predictions that are uncorrelated with factors affecting the respondent's unemployment-rate prediction. If survey respondents' predictions reflect Okun's Law, the constant and slope coefficient in (3″) have the same interpretations as in Okun's Law (3): the intercept, k, is the predicted (constant) growth rate of potential real-GDP and the absolute value of the slope coefficient, γ, is the Okun coefficient.[18]

To test whether the surveyed economists' time-t forecasts reflect the Taylor Rule, we estimate the following counterpart to (4) and (4′):

$$\text{predicted } i_{jt} = \beta_0 + \beta_1 \text{ predicted } \pi_{jt} + \beta_2 \text{ predicted } u_{jt} + \varepsilon_{jt} \qquad (4'')$$

[15] See Eisenbeis *et al.* (2002) for a description of the survey data.

[16] For the 2003 to 2007 period we obtained the forecasts from the *Journal's* website, which contains more details than are published in the paper (http://online.wsj.com/page/2_0891.html). Descriptive statistics on the survey data are given in the appendix.

[17] *WSJ* surveys are taken early in June (December) so respondents presumably know the unemployment rate for May (November) announced on the first Friday of June (December). Although there is little revision to unemployment rates, we use real-time data from the Philadelphia Federal Reserve Bank for the base unemployment rates; see Croushore and Stark (2001) for a description of the real-time data.

[18] The *WSJ* real-GDP forecasts are annualized growth rates; we de-annualize the annualized six-month growth rates to facilitate comparisons of estimated Okun coefficients across models estimated on six-month forecasts.

The dependent variable is the j^{th} respondent's six-month-ahead forecast measured of the three-month Treasury bill rate and, when available, the federal funds rate.[19] As noted above, the survey asks respondents for interest-rate forecasts for the last business-day in June or December. Predicted π is the respondent's prediction of annual CPI inflation six months hence taken from the survey's request for year-over-year inflation-rate forecasts measured from May to May or November to November. As noted above in Section 2b, predicted u appears in (4″) because the *WSJ* does not ask survey-respondents for their forecasts of the percentage gap between potential and actual real-GDP – the last term in the Taylor Rule, (4), and the left-hand side of Okun's Law, (1) and (2) – leading us to replace real-GDP gap in (4″) with the right-hand side of Okun's Law, $\gamma\ (u_t - u_t^*)$, and to assume a constant natural-rate of unemployment, u_t^*, leaving u_t, forecasts of which the *WSJ* does request. Respondents are asked for six-month-ahead forecasts of unemployment for May and November, similar to CPI inflation. Effectively, therefore, *WSJ*-survey respondents predict inflation and unemployment rates they expect the Fed to observe when setting the desired short rate six-months hence. If respondents' predictions reflect the original Taylor Rule, (4), the constant term in (4″), β_0, is a linear combination of terms in (4), specifically: $r^d - ½\pi^d + ½\gamma\ u^*$. For example, if the targets for the equilibrium real federal funds rate and the inflation rate are set at Taylor's values of 2% each (r^d and π^d), the NAIRU is about 5.5% (u^*), and the Okun coefficient is 2 (γ), then β_0 would be about 6.5. Also, if respondents' predictions reflect the original Taylor Rule, the coefficient of predicted inflation, β_1 in (4″), should equal the coefficient of inflation in (4), which is 1.5; and the coefficient of predicted unemployment, β_2 in (4″), should be proportional to the coefficient of real-GDP gap in (4), – ½γ, that is, about –1 assuming an Okun coefficient (γ) of 2.

Estimates of (4″) on survey-respondents' forecasts might fail to reflect their true belief in the Taylor Rule if respondents also believe the Fed smoothes interest rates. Accordingly, we use respondents' forecasts to estimate partial-adjustment versions of the Taylor Rule, counterparts to (6) and (6′):

$$\text{predicted } i_{jt} = \delta_0 + \delta_1 \text{ predicted } \pi_{jt} + \delta_2 \text{ predicted } u_{jt} + \delta_3\, i_{t-1} + \varepsilon_{jt} \qquad (6'')$$

where i_{t-1} is the value of the short rate observed at the time respondents make their forecasts. To compare the estimated coefficients of the predicted inflation and unemployment variables in the original Taylor-Rule model (β_1 and β_2) with the partial-adjustment version (δ_1 and δ_2) , we use estimates of δ_1, δ_2 and δ_3 from (6″) to compute implied estimates of β_1 and β_2 for (6″), where implied $\beta_1 = \delta_1 / (1-\delta_3)$ and implied $\beta_2 = \delta_2 / (1-\delta_3)$.

[19] The simple correlation between 6-month changes in the federal funds rate and the three-month T-Bill rate exceeds .95 for the 1986-2007 period.

3. Empirical results

We report OLS estimates of our Okun's Law formulation, (3″), in Table 4; the original Taylor Rule, (4″), in Table 5; and the partial-adjustment version of the Taylor Rule, (6″), in Table 6. Each table presents model estimates produced using data for all the surveyed economists in each sub-period and estimates for the subset of economists who participated in every survey in a period, yielding estimates for unbalanced and balanced panels. We compare estimates of (3″), (4″) and (6″) with the conventional parameter values to deduce whether respondents seem to believe Okun's Law and/or the Taylor Rule.

We note at the outset that our empirical results may reflect timing of the publication of Okun's and Taylor's seminal papers relative to the *WSJ* surveys: whereas Okun (1962) predates all *WSJ* surveys, Taylor (1993) falls between the first survey period (1986-1988) and the later surveys (1999-2006). Thus unless survey respondents believed the Fed used a Taylor-Rule-like reaction function prior to Taylor (1993), they are unlikely to have made forecasts consistent with the Rule in the 1986-1988 period. Interestingly, however, Taylor himself noted that his Rule produced federal-funds-rate forecasts near the actual funds-rates from 1987 to 1992, which includes our first estimation period. In any event, comparing estimates of (4″) and (6″) pre- and post-1993 will enable us to see whether publication of Taylor (1993) changed survey-respondents' perceptions of the link between short-term interest rates and levels of inflation and real activity.

3a. Do *WSJ* forecasts obey Okun's Law?

Table 4 presents estimates of (3″), our Okun's Law equation, on predictions from the *WSJ* surveys. [20] Equations 4.1 - 4.4 and 4.5 - 4.8 report estimates produced from forecasts of all surveyed economists and of economists who participated in every survey in the sample period, respectively.[21] As estimates from these unbalanced and balanced panels are similar, we focus on the former.

As equation 4.1 indicates, the surveyed economists' six-month-ahead forecasts of unemployment and real GDP growth for 1986-88 were negatively related, but the estimated slope coefficients are about 1.3, significantly less than either the textbook version of Okun's Law (with a

[20] As noted in Footnote 18, prior to estimating (3″) on 6-month-ahead forecasts of GDP growth and the unemployment rate we converted the annualized GDP growth rates respondents give the *WSJ* to 6-month growth rates, so as to preserve the interpretation of the estimated Okun coefficient. . Note that the estimated intercept is the unannualized growth rate of potential real output; it should be roughly doubled to get the estimate of the annualized growth rate.

[21] Equations 4.1 – 4.4 use forecasts of all respondents, even those who participated in just a few surveys. Restricting our sample to respondents who participated in at least six surveys over the entire period produced nearly identical results.

coefficient of 2) or our estimate of about 1.7 (from actual data for the twenty years prior to the survey sub-period, as given in Table 1, equation 1). Estimates of the constant – which measures the growth rate of potential real-GDP – imply annual growth rates of about 2.5%, somewhat below the 3.1% annual growth-rate from the previous decade estimated by the Congressional Budget Office. When we allow for respondent fixed-effects by adding respondent-dummies to the model and constraining the coefficients of the dummies to sum to zero (equation 4.2), there is little change in the estimated coefficients. The fixed effects permit variation across respondents of the potential GDP growth-rate, but these fixed effects are not significant for this sub-period.

Equations 4.3 and 4.4 give the estimates of Okun's law using the eighteen surveys from 1999 through 2007 without and with fixed effects. The estimates of the Okun coefficient are similar to those from the earlier surveys but the estimates of the constant, representing the growth rate of potential GDP, are higher and imply annual growth rates of about 3.2. While respondent fixed effects are significant in this sub-period, they do not have much effect on the other coefficients. The estimates of the Okun coefficient again are significantly smaller than the textbook value of 2 or our estimate of about 1.7 for the twenty-years prior to the surveys (equation 1.2). As noted above, estimates of Okun's Law for the period 1988-2007 indicate a smaller Okun coefficient (equation 1.3) and the estimate for the survey respondents for this period is closer to this point estimate, perhaps reflecting respondents noticing the apparent decline over time. Estimates for the balanced panels (equations 4.5 – 4.8) give very similar results.

In summary, survey respondents' forecasts do reflect the negative relationship between unemployment changes and real GDP growth that Okun publicized but the estimated coefficients are significantly less than both the textbook versions of Okun's Law and estimates from data prior to the start of the surveys. The results for the 1999-2007 surveys are closer to the estimates using actual data that include this period (equation 1.3).

3b. Do *WSJ* forecasts follow the Taylor Rule?

Table 5 presents estimates of (4″), our original Taylor-Rule model, on forecasts from the *WSJ* survey. If respondents' forecasts reflect the Taylor Rule, the estimated constant term – a linear combination of the Fed's real-federal-funds-rate and inflation-rate targets, NAIRU, and the Okun coefficient – should be 6.50 for an Okun coefficient of 2. If respondents believed the Okun coefficient to be about 1.25, however, as suggested by the Okun-coefficient estimates reported in Table 4, the estimated constant term should be about 4.44. In addition, the estimated coefficient on the predicted inflation rate should be 1.5 and the estimated coefficient on the predicted unemployment rate should be negative and one-half the Okun coefficient, that is –1 or –.625 for Okun coefficients of 2 and 1.25 respectively. Estimates of (4″) produced from all respondents' forecasts (equations 5.1 – 5.8) resemble estimates produced from forecasts of respondents who participated in all surveys for a given period (equations 5.9 – 5.16); hence we focus on the former.[22]

Estimated models on all respondents' forecasts from 1986 to 1988 show little evidence respondents believed in a Fed reaction-function like that proposed by Taylor (1993). Equations 5.1 and 5.2 present estimates of the original Taylor-Rule model for six-month-ahead forecasts, without and with respondent fixed effects.[23] Survey respondents reacted to a one-percentage-point increase in predicted inflation by raising their predictions of the three-month Treasury bill rate an estimated 35 basis points without fixed effects and by 23 basis points with fixed effects, much less than the 150-basis-point increase consistent with the Taylor Rule. A predicted increase of one percentage point in the unemployment rate was accompanied by a predicted decrease in the short-term interest rate of from 23 to 38 basis points, less than the 100-basis-point decrease consistent with the Taylor Rule and an Okun coefficient of 2 or the 62.5 basis-point decrease expected with an Okun coefficient of 1.25.[24] The estimated constant is larger than that predicted by the Taylor Rule.[25] Thus we conclude for the 1986-1988 period that forecasts of respondents to the *WSJ* survey do not reflect the Taylor Rule, particularly the Taylor principle that short rates should rise by more than past inflation.

The failure of respondents' forecasts to reflect the Taylor Rule during the earlier sub-period is unsurprising: not only does this period predate Taylor (1993) but, as noted earlier, the estimated coefficients using actual data prior to the survey also indicate that short rates did not keep up with past inflation. For the Greenspan period prior to the second set of surveys, 1987II-1998, there is evidence of substantially stronger responses of short rates to both inflation and unemployment. If forecasters recognized this change in Fed behavior, we should see the evidence reflected in forecasters' inflation, unemployment and interest-rate predictions.

Equations 5.3 and 5.4 present estimates of the Taylor Rule model for forecasts from the eighteen surveys from 1999 to 2007. While the estimates indicate that survey respondents believed that higher inflation or lower unemployment would raise short rates, the estimated response to inflation is even less than for the earlier surveys, with a predicted one-percentage-point increase in inflation raising the predicted short term rate by only 13 to 16 basis points. The predicted response of the short rate to an increase in the unemployment rate is much larger than for the earlier surveys. A predicted

[22] Estimates of the models in Table 5 on data for respondents who participated in at least six surveys produced nearly identical results.

[23] Again we constrain the coefficients on the respondent-dummies to sum to zero.

[24] The estimate of β_2 with fixed effects is within two standard errors of .625.

[25] This could reflect larger estimates of r^d and u^* or a smaller estimate of π^d.

increase in the unemployment rate of one percentage point lowers the predicted short rate by about 200 basis points, compared to about 23-38 basis points for the earlier surveys. This response to predicted unemployment is roughly twice that prescribed by Taylor even with an Okun coefficient of 2 and substantially higher than the estimated coefficient using actual data for the Greenspan period that preceded the surveys (see Table 2, equations 2.13 and 2.14).

Equations 5.5 through 5.8 are Taylor-Rule-model estimates on forecasts for the shorter period, 2003-2007, when respondents were also asked for their forecasts of the federal funds rate. Allowing for respondent fixed effects, which are supported by the data, lower the estimated impact of inflation on short rates but the estimated effect of unemployment is even larger. The estimates using the predicted funds rate are very similar to those using the predicted Treasury bill rate. Respondents apparently believed that the Federal Reserve would respond very aggressively to unemployment but not to inflation. This belief is not supported by estimates using actual data for the entire Greenspan period (table 2, equations 2.17-2.20) during which the Federal Reserve appeared to follow the original Taylor Rule.[26]

Table 6 presents estimates of the partial-adjustment version of the Taylor Rule, (6″), which adds to the original model a lagged short rate measured as the average short rate during the week of the *WSJ* survey.[27] We present estimates with and without respondent fixed effects for each sample period. The top part (bottom part) of Table 6 presents estimates produced using data from all survey respondents (respondents who participated in every survey during a period). Since both respondent groups produce similar estimates, we describe in detail estimates for the larger group (6.1 – 6.8).

Estimates of the partial-adjustment-version of the Taylor-Rule model on 1986-1988 forecasts produce estimated models that exhibit considerable interest-rate smoothing, with a weight on the target of only about .15, implying a median lag of over two years. The immediate effects of inflation and unemployment on the predicted short rate are similar to those for the original Taylor Rule (equations 5.1 and 5.2) but the implied long-run effects are substantially larger. If respondent fixed effects are omitted, the long-run estimate of β_1 is above the 1.5 recommended by Taylor and the long-run estimate of β_2 is also greater than that suggested by Taylor if one assumes that the Okun coefficient is 2 or less. Allowing for fixed effects, which are supported by the data, lowers these long-run estimates, particularly for inflation. The estimated degree of interest-rate smoothing for the survey data is much higher than that estimated on actual data for the twenty years prior to the surveys (equations 3.1 – 3.4). Comparing these estimates to those for the data prior to the Volcker chairmanship (equations 3.5-3.8),

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[26] The estimated constants are also much greater than those implied by the Taylor Rule.
[27] Using the average interest rate for the second week of the survey month produces similar results.

we find that the actual data display no interest rate smoothing and larger short-run effects of inflation and unemployment on interest rates.

For the 1999-2007 surveys, respondents appear to have believed that interest rate smoothing had decreased somewhat: the estimated weight on the target was about one-third, implying a median lag of about 10 months (equations 6.3 and 6.4). While the predicted short rate was significantly related to predicted inflation and unemployment, the long-run estimated effects were smaller than in the earlier survey period. The long-run effect on the short rate of a one percentage point increase in inflation is estimated to be 62 to 70 basis points, lower than the 150 points suggested by Taylor. The long-run effect of an increase in the unemployment rate of one percentage point remains higher than that prescribed by Taylor, with the predicted short rate falling by 167 to 174 basis points.

Estimates of the partial adjustment model for the 2003-2007 surveys include estimates for both the Treasury bill rate and the federal funds rate (equations 6.5 - 6.8). Similar to the estimates of the original Taylor Rule for these data, the responses of predicted short rates to the predicted unemployment rate are largest for this period. The predicted short rate falls by 82 to 123 basis points in the short run and 257 to 310 basis points in the long run when the predicted unemployment rate rises by one percentage point. The response of predicted short rates to predicted inflation is smaller, with a predicted increase in inflation of one percentage point raising the predicted short rate by 22 to 25 basis points in the short run and by 54 to 79 basis points in the long run. Comparing these results with the estimated partial adjustment model for actual data for the Greenspan era (equations 3.13 – 3.20), the response to inflation is greater for the actual data and the response to unemployment is smaller.

We conclude from our estimates that forecasts made by professional economists included in the *WSJ* survey do not follow the Taylor Rule as originally formulated by Taylor (1993). Economists' interest-rate predictions do not reflect the Taylor-Rule prescription that the Fed raise real interest rates when inflation increases, either before publication of the Taylor Rule or thereafter.[28] For the surveys starting in 1999, the response of predicted short rates to predicted unemployment is substantially larger than that implied by the Taylor Rule. There is empirical support for view that economists believed the Fed used a partial adjustment version of the Taylor Rule in that the coefficients on the lagged interest rate are always statistically significant. In general, however, the implied long-run impact of predicted inflation on predicted short rates indicated that respondents did not believe that the Fed would raise the

[28] Inflation was, on average, predicted to be relatively low for much of the 1999-2007 period. Survey respondents may have believed the Fed would move aggressively only if inflation fell outside some comfort zone. We estimated models that allowed the coefficients on predicted inflation to be larger if predicted inflation was either above 3 percent or below 1 percent. None of these estimated threshold models were consistent with the Taylor Rule.

short rate by enough to raise real rates. The implied long-run response of predicted short rates to predicted unemployment were again larger than that recommended by Taylor.

4. Conclusion

This article has examined whether forecasts from the highly-publicized, semi-annual *Wall Street Journal* survey of professional economists are consistent with two well-known macroeconomic relationships: Okun's Law and the Taylor Rule. Regarding Okun's Law, we found economists' predictions of unemployment and real growth move in opposite directions, as per Okun's Law, but a change in predicted unemployment produces a smaller change in predicted real-growth than consistent with the textbook Okun coefficient of 2 or the Okun coefficient estimated with actual data prior to the surveys. Survey respondents do not appear to believe that the Federal Reserve sets short-term interest rates according to the basic Taylor Rule. In the surveys following publication of Taylor (1993), economists predicted stronger Fed responses to deviations from target unemployment than prescribed by the Taylor Rule, and weaker Fed responses to deviations from target inflation. Estimates using actual data indicate that short rates responded to inflation and unemployment more in accord with the Taylor Rule than is evident in the predictions of the survey respondents. While the Fed may use the Taylor Rule, our results indicate that business economists did not apply it or Okun's Law when making their macro-economic forecasts.

References

Abel, Andrew B. and Ben S. Bernanke, 2005. *Macroeconomics*, 5th edition, Addison-Wesley, Boston.

Blinder, Alan S., 1997, Is there a core of practical macroeconomics that we should all believe? *The American Economic Review*, 87, 240-243.

Clarida, Richard, Jordi Gali, and Mark Gertler, 2000, Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory, *Quarterly Journal of Economics,* 115, 147-180.

Croushore, Dean and Tom Stark, 2001, A real-time data set for macroeconomists, *Journal of Econometrics*, 105, 111-130.

Cuaresma, Jesús Crespo, 2003, Okun's law revisited, *Oxford Bulletin of Economics and Statistics,* 65, 439-451.

Duffy, John and Jim Engle-Warnick, 2006, Multiple regimes in U.S. Monetary Policy? A non-parametric approach, *Journal of Money, Credit and Banking*, 38, 1363-1377.

Eisenbeis, Robert, Daniel Waggoner, and Tao Zha, 2002, Evaluating *Wall Street Journal* survey forecasters: A multivariate approach, *Business Economics,* 37, 11-21.

Gordon, Robert J., 1978. *Macroeconomics,* 1st edition, Little-Brown, London.

Gordon, Robert J., 1984, Unemployment and potential output in the 1980s, *Brookings Papers on Economic Activity*, 537-568.

Gordon, Robert J., 2006. *Macroeconomics,* 10th edition, Addison-Wesley, Boston.

Judd, John P., and Glenn D. Rudebusch, 1998, Taylor's rule and the Fed: 1970 – 1997, *Federal Reserve Bank of San Francisco Economic Review,* 3-16.

Kozicki, Sharon, 1999, How Useful Are Taylor Rules for Monetary Policy? *Economic Review*, Federal Reserve Bank of Kansas City, Second Quarter, 5-33.

Lee, Jim, 2000, The robustness of Okun's law: Evidence from OECD Countries, *Journal of Macroeconomics,* 22, 331-356.

Mankiw, N. Gregory, *Macroeconomics,* 6th edition, Worth, New York.

Mitchell, Karlyn, and Douglas K. Pearce, 2007, Professional forecasts of interest rates and exchange rates: Evidence form the *Wall Street Journal*'s panel of economists, *Journal of Macroeconomics*, 29, 840-854.

Meyer, Laurence H., 2002, Rules and discretion, speech presented at the Owen Graduate School of Management, Vanderbilt University, Nashville, Tennessee, January 16.

Okun, Arthur M., 1962, Potential GNP: Its measurement and significance, *Proceedings of the Business and Economic Statistics Section of the American Statistical Association*, 1962, reprinted in

Martin N. Baily and Arthur M. Okun, (eds.), 1982, *The Battle Against Unemployment and Inflation*, 3rd third edition, W.W. Norton, New York.

Orphanides, Athanasios and Volker Wieland, 2007, Economic Projections and Rules-of-Thumb for Monetary Policy, paper prepared for the Conference on "Monetary Policy under Uncertainty," Federal Reserve Bank of St. Louis.

Perez, Stephen J., 2001, Looking back at forward-looking monetary policy, *Journal of Economics and Business*, 53, 509-521.

Poole, William, 2005, The Fed's monetary policy rule, *Federal Reserve Bank of St. Louis Review*, 88(1), 1-12.

Rudebusch, Glenn D. 2006, Monetary Policy Inertia: Fact or Fiction, *International Journal of Central Banking*, 2, 85-135.

Taylor, John, 1993, Discretion versus policy rules in practice, *Carnegie Rochester Conference Series on Public Policy*, 39, 195-214.

Thornton, Daniel. 2006, When Did the FOMC Begin Targeting the Federal Funds Rate? What the Verbatim Transcripts Tell Us, *Journal of Money, Credit, and Banking*, *38*, 2039-71.

Trehan Bharat and Tao Wu, 2007, Time-varying equilibrium real rates and monetary policy analysis, *Journal of Economic Dynamics & Control*, 31, 1584-1609.

Table 1
Estimates of Okun's Law using Actual Data

$$\Delta\, gdp_t / gdp_{t-1} = k - \gamma\, \Delta\, u_t + \varepsilon_t$$

Equation #	Time Period	k	γ	R^2	# of obs
Revised data					
1.1	1966-1985	1.73 (.14)	1.70 (.18)	.69	40
1.2	1979 - 1998	1.43 (.10)	1.68 (.13)	.73	40
1.3	1988-2007	1.39 (.103)	1.35 (.29)	.38	40
Real time data					
1.3	1966-1985	1.44 (.14)	1.65 (.167)	.68	40
1.4	1979-1998	1.23 (.10)	1.69 (.15)	.71	40

Newey-West standard errors in parentheses

Table 2
Estimates of the Taylor Rule using Actual Data

$$i_t = \beta_0 + \beta_1 \pi_t + \beta_2 u_t + \varepsilon_t$$

Eqn. #	Dep Var	β_0	β_1	β_2	R^2	Nobs
1966-85						
2.1	TB	1.92 (1.31)	.42 (.13)	.42 (.21)	.39	40
2.2	TBave	1.83 (1.37)	.43 (.14)	.42 (.22)	.38	40
2.3	FFR	-.296 (2.08)	.64 (.23)	.72 (.29)	.37	40
2.4	FFRave	1.81 (1.80)	.66 (.17)	.36 (.28)	.41	40
1966-1978						
2.5	TB	5.34 (.57)	.53 (.13)	-.45 (.09)	.66	26
2.6	TBave	5.28 (,61)	.53 (.11)	-.48 (.07)	.73	26
2.7	FFR	4.93 (1.34)	.69 (.24)	-.55 (.20)	.39	26
2.8	FFRave	6.70 (.88)	.85 (.12)	-.87 (.11)	.81	26
1979-98						
2.9	TB	1.13 (1.21)	.61 (.13)	.45 (.21)	.58	40
2.10	TBave	1.17 (1.16)	.61 (.14)	.45 (.20)	.56	40
2.11	FFR	.083 (1.33)	.78 (.20)	.73 (.23)	.49	40
2.12	FFRave	.90 (1.30)	.81 (.18)	.48 (.22)	.59	40
1987II-1998						
2.13	TB	8.84 (.93)	1.00 (.14)	-1.18 (.16)	.84	23
2.14	TBave	8.56 (.90)	1.02 (.13)	-1.15 (.16)	.84	23
2.15	FFR	10.70 (1.45)	1.01 (.28)	-1.40 (.23)	.66	23
2.16	FFRave	9.93 (1.05)	1.24 (.18)	-1.44 (.20)	.87	23
1987II-2005						
2.17	TB	5.29 (1.40)	1.23 (.23)	-.84 (.23)	.54	37
2.18	TBave	5.03 (1.41)	1.25 (.23)	-.81 (.23)	.54	37
2.19	FFR	5.59 (2.02)	1.29 (.34)	-.85 (.30)	.42	37
2.20	FFRave	5.76 (1.55)	1.45 (.27)	-.989 (.25)	.57	37

Note: i, π, u, and ε are the short rate, inflation rate, unemployment rate and error term, respectively. i is measured by TB, FF, TBAve or FFave. TB and FF are the 3-month T-Bill and federal-funds rate at the ends of June and December. TBave and FFave are the monthly average 3-month T-Bill and federal-funds rates for June and December. Nobs is number of observations. Standard errors, reported in parentheses, are corrected for heteroskedasticity and autocorrelation using the Newey-West method.

Table 3
Estimates of the partial Adjustment Version of the Taylor Rule

$$i_t = \delta_0 + \delta_1 \pi_t + \delta_2 u_t + \delta_3 i_{t-1} + \varepsilon_t$$

Eqn. #	Dep Var	δ_0	δ_1	δ_2	δ_3	Implied β_1	Implied β_2	R^2	Nobs
1966-1985									
3.1	TB	1.49 (.68)	.21 (.12)	-.026 (.15)	.64 (.14)	.58	-.07	.62	40
3.2	TBave	1.52 (.78)	.24 (.14)	.01 (.18)	.57 (.16)	.56	.02	.57	40
3.3	FFR	.73 (1.38)	.31 (.232)	.18 (.19)	.55 (.10)	.69	.40	.53	40
3.4	FFRave	2.00 (1.13)	.33 (.18)	-.12 (.20)	.60 (.13)	.83	-.30	.61	40
1966-1978									
3.5	TB	4.88 (.82)	.46 (.17)	-.43 (.11)	.11 (.16)	NA	NA	.66	26
3.6	TBave	5.29 (.67)	.54 (.15)	-.48 (.07)	-.005 (.15)	NA	NA	.73	26
3.7	FFR	6.72 (2.40)	1.11 (.28)	-.81 (.37)	-.49 (.29)	NA	NA	.45	26
3.8	FFRave	7.16 (1.45)	1.02 (.17)	-.96 (.17)	-.22 (.22)	NA	NA	.82	26
1979-1998									
3.9	TB	1.38 (.74)	.31 (.13)	.01 (.18)	.58 (.16)	.74	.02	.72	40
3.10	TBave	1.38 (.77)	.35 (.16)	.06 (.30)	.50 (.19)	.70	.12	.67	40
3.11	FFR	.52 (.92)	.53 (.19)	.33 (.27)	.38 (.14)	.85	.53	.56	40
3.12	FFRave	1.56 (.80)	.45 (.19)	-.02 (.20)	.54 (.16)	.98	-.04	.72	40
1987II-1998									
3.13	TB	6.37 (1.40)	.64 (.24)	-.86 (.18)	.33 (.16)	.96	-1.28	.86	23
3.14	TBave	5.99 (1.38)	.62 (.23)	-.81 (.18)	.37 (.16)	.98	-1.29	.87	23
3.15	FFR	11.52 (1.88)	1.09 (.35)	-1.50 (.31)	-.08 (.16)	NA	NA	.66	23
3.16	FFRave	6.54 (1.24)	.71 (.27)	-.96 (.18)	.42 (.12)	1.22	-1.66	.91	23
1987II-2005									
3.17	TB	1.82 (.91)	.23 (.13)	-.30 (.14)	.80 (.06)	1.15	-1.50	.85	37
3.18	TBave	1.76 (.90)	.23 (.12)	-.30 (.14)	.81 (.05)	1.21	-1.58	.86	37
3.19	FFR	2.25 (1.30)	.48 (.23)	-.37 (.18)	.64 (.11)	1.33	-1.03	.68	37
3.20	FFRave	2.18 (.95)	.33 (.14)	-.40 (.15)	.78 (.05)	1.50	-1.82	.87	37

Notes: See notes for Table 2. Implied $\beta_1 = \delta_1 / (1-\delta_3)$ and implied $\beta_2 = \delta_2 / (1-\delta_3)$.

Table 4
Estimates of Okun's Law Using *Wall Street Journal* Forecasts
predicted $(\Delta\ gdp_t / gdp_{t-1})_{jt} = k - \gamma$ predicted $(\Delta u_t)_{jt} + \varepsilon_{jt}$

Eqn. #	Forecast Horizon	k	γ	R^2	F test for respondent fixed-effects	# of observations # of respondents
1986-1988 – All participants (unbalanced panel)						
4.1	Next 6 months	1.23 (.024)	1.28 (.082)	.594	No	199 47
4.2	Next 6 months	1.24 (.020)	1.31 (.098)	.714	Yes F=1.38	199 47
1999-2007 – All participants (unbalanced panel)						
4.3	Next 6 months	1.60 (.011)	1.27 (.059)	.556	No	992 102
4.4	Next 6 months	1.56 (.012)	1.19 (.053)	.666	Yes F=2.89**	992 102
1986-88 Participants in all 6 surveys (balanced panel)						
4.5	Next 6 months	1.22 (.055)	1.23 (.080)	.671	No	102 17
4.6	Next 6 months	1.22 (.034)	1.22 (.093)	.710	Yes F=0.80	102 17
1999-2007 – Participants in all 18 surveys (balanced panel)						
4.7	Next 6 months	1.55 (.017)	1.23 (.068)	.556	No	378 21
4.8	Next 6 months	1.55 (.016)	1.24 (.069)	.609	Yes F=2.38**	378 21

Notes: gdp is real gross domestic product, u is the unemployment rate, and ε is an error term. ** denotes statistical significance at the .01 level. Standard errors, corrected for heteroskedasticity, in parentheses.

Table 5
Estimates of the Taylor Rule Using *Wall Street Journal* Forecasts
predicted $i_{jt} = \beta_0 + \beta_1$ predicted $\pi_{jt} + \beta_2$ predicted $u_{jt} + \varepsilon_{jt}$

Eqn. #	Horizon, Dep. Var.	β_0	β_1	β_2	R^2	F test for respondent fixed-effects	# of observations # of respondents
1986-1988 – All participants (unbalanced panel)							
5.1	6 months TB6	6.14 (.828)	.348 (.070)	-.231 (.097)	.266	No	199 47
5.2	6 months TB6	7.64 (1.18)	.232 (.110)	-.383 (.127)	.455	Yes F=1.13	199 47
1999-2007 – All participants (unbalanced panel)							
5.3	6 months TB6	13.52 (.236)	.164 (.040)	-2.03 (.039)	.810	No	977 103
5.4	6 months TB6	13.98 (.289)	.132 (.048)	-2.10 (.045)	.839	Yes F=1.55**	977 103
2003-2007 – All participants (unbalanced panel)							
5.5	6 months TB6	16.35 (.572)	.198 (.046)	-2.60 (.092)	.823	No	551 80
5.6	6 months TB6	17.81 (.389)	.093 (.046)	-2.82 (.063)	.876	Yes F=2.56**	551 80
5.7	6 months FF6	17.38 (.557)	.163 (.048)	-2.77 (.099)	,817	No	560 80
5.8	6 months FF6	18.99 (.411)	.044 (.048)	-3.01 (.067)	.869	Yes F=2.39**	560 80
1986-1988 – Participants in all 6 surveys (balanced panel)							
5.9	6 months TB6	6.03 (1.16)	.359 (.096)	-.211 (.135)	.317	No	90 15
5.10	6 months TB6	6.10 (1.35)	.301 (.113)	-.187 (.157)	.406	Yes F=1.00	90 15
1999-2007 – Participants in all 16 surveys (balanced panel)							
5.11	6 months TB6	13.36 (.376)	.278 (.061)	-2.06 (.063)	.811	No	360 20
5.12	6 months TB6	13.69 (.453)	.228 (.081)	-2.10 (.068)	.822	Yes F=.98	360 20
2003-2007 – Participants in all 8 surveys (balanced panel)							
5.13	6 months TB6	16.88 (1.17)	.253 (.133)	-2.73 (.185)	.842	No	330 33
5.14	6 months TB6	18.03 (.468)	.105 (.056)	-2.88 (.076)	.867	Yes F=1.78**	330 33
5.15	6 months FF6	17.92 (.543)	.225 (.058)	-2.91 (.088)	.835	No	330 33
5.16	6 months FF6	19.21 (.505)	.065 (.060)	-3.08 (.083)	.860	Yes F=1.67*	330 33

Notes: i, π, u, and ε are the short rate, inflation rate, unemployment rate and error term, respectively. Predicted i is measured by TB6 or FF6, 6-month forecasts of the three-month T-Bill and federal-funds rates for the last business days in June and December. **, * denote statistical significance at the .01 and .05 levels. Standard errors, corrected for heteroskedasticity, in parentheses.

Table 6
Partial Adjustment Version of the Taylor Rule using *Wall Street Journal* Forecasts
Predicted $i_{it} = \delta_0 + \delta_1$ predicted $\pi_{it} + \delta_2$ predicted $u_{it} + \delta_3 i_{t-1} + \varepsilon_{jt}$

Eqn. #	Horizon, Dep. Var.	δ_0	δ_1	δ_2	δ_3	$Rbar^2$	Implied β_1	Implied β_2	F test for respondent fixed-effects	# of observations # of respondents
1986-1988 – All participants (unbalanced panel)										
6.1	6 months TB6	2.19 (.579)	.234 (.042)	-.385 (.069)	.866 (.050)	.730	1.746	-2.873		199 47
6.2	6 months TB6	3.209 (.704)	.137 (.061)	-.460 (.073)	.842 (.047)	.840	.867	-2.026	2.23**	199 47
1999-2007 – All participants (unbalanced panel)										
6.3	6 months TB6	3.53 (.269)	.228 (.024)	-.543 (.041)	.675 (.016)	.937	.701	-1.671		977 102
6.4	6 months TB6	3.73 (.359)	.205 (.027)	-.574 (.054)	.671 (.020)	.945	.623	-1.744	1.20	977 102
2003-2007 – All participants (unbalanced panel)										
6.5	6 months TB6	4.94 (.426)	.251 (.027)	-.816 (.069)	.682 (.021)	.959	.789	-2.566		551 80
6.6	6 months TB6	5.99 (.512)	.230 (.024)	-.989 (.078)	.646 (.023)	.969	.650	-2.794	1.92**	551 80
6.7	6 months FF6	6.13 (.490)	.246 (.030)	-1.012 (.079)	.627 (.021)	.957	.660	-2.713		560 80
6.8	6 months FF6	7.47 (.521)	.216 (.030)	-1.23 (.079)	.597 (.021)	.965	.536	-3.102	1.54**	560 80
1986-1988 – Participants in all 6 surveys (balanced panel)										
6.9	6 months TB6	2.654 (.803)	.251 (.050)	-.411 (.082)	.811 (.068)	.761	1.328	-2.175		90 15
6.10	6 months TB6	3.040 (.852)	.158 (.081)	-.415 (.094)	.812 (.061)	.848	.840	-2.196	2.97**	90 15
1999-2007 – Participants in all 18 surveys (balanced panel)										
6.11	6 months TB6	3.53 (.509)	.241 (.043)	-.544 (.082)	.671 (.032)	.929	.733	-1.653		360 20
6.12	6 months TB6	3.58 (.639)	.249 (.048)	-.555 (.088)	.666 (.034)	.932	.746	-1.662	.69	360 20
2003-2007 – Participants in all 10 surveys (balanced panel)										
6.13	6 months TB6	5.81 (.492)	.273 (.035)	-.970 (.029)	.636 (.025)	.958	.750	-2.665		330 33
6.14	6 months TB6	6.57 (.467)	.236 (.037)	-1.082 (.102)	.611 (.029)	.964	.607	-2.781	1.55*	330 33
6.15	6 months FF6	6.99 (.532)	.266 (.040)	-1.171 (.084)	.604 (.024)	.956	.672	-2.957		330 33
6.16	6 months FF6	7.86 (.708)	.222 (.040)	-1.30 (.109)	.577 (.028)	.961	.525	-3.073	1.17	330 33

Notes: i, π, u, and ε are the short rate, inflation rate, unemployment rate and error term, respectively . Predicted i is measured by TB6, TB12, FF6, or FF12, 6 and 12 month forecasts of the three-month T-Bill and federal-funds rates for the last business days in June and December. Implied $\beta_1 = \delta_1 / (1-\delta_3)$ and implied $\beta_2 = \delta_2 / (1-\delta_3)$. **, * denote statistical significance at the .01 and .05 levels. Standard errors, corrected for heteroskedasticity and contemporaneous correlation, in parentheses.

Appendix

Descriptive Statistics for Each Survey

A. January 1986 Survey to July 1988 Survey

	Jan – 86	Jul – 86	Jan -87	Jul – 87	Jan -88	Jul - 88
Predicted Variable	Mean Range	Mean Range	Mean Range	Mean Range	Mean Range	Mean Range
Real GDP growth Next 6 months	2.82 1 to 4.3	3.39 1.5 to 4.6	1.95 -2 to 4.5	2.74 .6 to 4.3	1.54 -2.5 to 4.2	2.65 -.2 to 4.2
T-Bill rate 6 months ahead	6.96 5.5 to 7.75	6.01 5 to 7	4.98 4.1 to 6	5.91 4.25 to 6.63	5.70 4 to 6.6	6.77 5.75 to 7.75
CPI inflation 6 months ahead	3.79 2.5 to 5.9	3.20 1.5 to 5.2	3.46 1.7 to 4.8	4.47 3.4 to 6.3	3.8 1 to 5.5	4.77 3.6 to 6.1
Unemployment rate 6 months ahead	7.06 6.6 to 7.5	7.04 6.8 to 7.5	7.05 6.6 to 7.5	6.29 5.9 to 6.7	6.22 5.4 to 8	5.44 4.9 to 6.2
Number of forecasters	25	30	35	35	36	38 32*

B. January 1999 Survey to July 2007 Survey

Predicted Variable	Jan-99	Jul-99	Jan-00	Jul-00	Jan-01	Jul-01	Jan-02	Jul-02
Real GDP growth Next 6 months	1.91 0 to 3.55	2.95 -.85 to 4.75	2.83 -3.75 to 4.15	3.31 -1.5 to 5.4	2.07 -2.9 to 3.9	2.15 -2.4 to 4.5	1.66 -2.7 to 1.2	3.48 .5 to 5.5
T-Bill rate 6 months ahead	4.20 3.5 to 5	4.89 3.7 to 5.6	4.89 3.7 to 5.6	6.11 5 to 6.9	5.36* 4.3 to 6.4	3.39 2.7 to 5.35	1.89 1.25 to 2.5	2.19* 1.5 to 3
CPI inflation 6 months ahead	1.85 .5 to 2.5	2.25 .4 to 2.8	2.25 .4 to 2.8	3.12 2.1 to 4.1	2.75 1.9 to 3.8	2.95 1.8 to 4.4	1.36 -.5 to 2.9	2.17* .5 to 3
Unemployment rate 6 months ahead	4.64 4.2 to 5.3	4.22 3.7 to 5.5	4.22* 3.7 to 5.5	4.07* 3.6 to 5.3	4.35 3.9 to 5	4.96 4.4 to 5.5	6.22 5.5 to 6.8	5.79 4.7 to 6.5
Number of forecasters	54	54	53 *52	53 *52	54 *52	54	55	55 *54

Predicted Variable	Jan-03	Jul-03	Jan-04	Jul-04	Jan-05	Jul-05	Jan-06	Jul-06	Jan-07	Jul-07
Real GDP growth Next 6 months	2.93 -2 to 4.3	3.64 -1.8 to 6.1	4.38 2.9 to 6.2	4.26 3.1 to 5.7	3.54 2 to 5.4	3.48 2.4 to 5.6	3.43 2.1 to 4.5	2.89 1 to 4.1	2.32 .4 to 3.35	2.62 1 to 3.55
T-Bill rate 6 months ahead	1.41 .75 to 2.25	1.01* .7 to 1.8	1.32 .95 to 2.5	2.08* 1.4 to 3	3.04* 2.3 to 3.7	3.81* 3.1 to 4.3	4.63* 4 to 5.2	5.21* 4.6 to 5.95	4.82* 2.95 to 5.7	4.90* 2.48 to 5.75
CPI inflation 6 months ahead	2.16 .9 to 3.3	1.90 1 to 2.6	1.93 1.2 to 2.6	2.86 1.4 to 4	2.47 -.9 to 4	2.77 1.1 to 3.6	3.06 -.9 to 4.3	3.06* -1.6 to 4.5	1.75 .2 to 3.4	3.09 .9 to 4.3
Unemployment rate 6 months ahead	5.95 5.5 to 7.3	6.09 5.5 to 7.7	5,71 5.4 to 6.2	5.33 4.7 to 5.8	5.25 4.7 to 5.6	5.06 4.7 to 5.4	4.9 4.5 to 5.3	4.69 4.1 to 5.2	4.77 4.3 to 5.2	4.67 4.2 to 5.3
Federal-funds rate 6 months ahead	1.36 .75 to 2	.99 .75 to 1.5	1.31 1 to 2.5	1.99 1.5 to 2.5	3.02 2.3 to 3.5	3.83 3.3 to 4.3	4.75 4.5 to 5.3	5.37 5 to 5.75	5.01 3.0 to 5.75	5.16 2.5 to 6.0
Number of forecasters	55	54 *53	54	55 *53	56 *55	56 *55	56 *54	56 *55	60 *59	60 *59

Note: * indicates that there were fewer forecasters for that variable. The numbers of forecasters for these variables are marked with an asterisk in the last row.