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The purpose of this article is to investigate the rationality of two survey forecasts of selective U.S. macroeconomic performance measures that were widely followed in the financial markets during the 1990–2000 period. The research compares the rationality of survey forecast data from Money Market Services, Inc., and Thomson Financial. This article extends prior research that has evaluated the rationality of Money Market Services data for earlier time periods while also evaluating similar consensus forecast data from Thomson Financial that were widely reported in both *Barron's* and the *Wall Street Journal* during the 1990s.

I. Introduction

Prior research, beginning in the late 1970s, has evaluated the comparative forecasting accuracy of time series and survey forecasts of major U.S. macroeconomic indicators (see, e.g., Mullineaux 1978; Mankiw, Runkle, and Shapiro 1984; Hafer and Hein 1985; and Hafer, Hein, and MacDonald 1992). More recently, Aggarwal, Mohanty, and Song (1995), examined the rationality of survey forecasts of 11 U.S. macroeconomic indicators provided by Money Market Services, Inc. (MMS) for the November 1977–November 1993 period.[1] Building on earlier analysis, they first evaluate whether each series and its survey forecast are stationary or nonstationary, as inferences drawn from traditional regression analysis using nonstationary data can be incorrect. They find that the median survey forecasts and the announced time series of housing starts, the unemployment rate, and the trade balance are nonstationary as reported but stationary in first difference. These series are cointegrated with factor one

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1. More recently, Aggarwal and Mohanty (2000) provide a similar analysis of five Japanese macroeconomic indicators and their survey forecasts using MMS data. They find that the survey forecasts of the trade balance, retail sales, the M1 measure of the money stock, and housing starts are generally cointegrated with factor one with the actual announcements and are rational. The survey forecast for industrial production is found to be biased and inconsistent with rational expectations.

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and are generally consistent with rational expectations. Among the other eight stationary series as reported and their median forecasts, only survey forecasts for consumer prices and personal income are rational.

This article builds on earlier analysis in two dimensions. First, an additional source of consensus forecast of major U.S. macroeconomic indicators is evaluated from weekly issues of *Barron's* and the *Wall Street Journal*, which reported consensus forecast data from Thomson Financial (TF) during the May 1990–December 2000 period. The rationality of the TF survey data is compared to MMS forecast data for this recent period. Given the prior empirical studies that question the rationality of selective survey forecasts of U.S. macroeconomic indicators using the MMS survey data, examining the rationality of a second set of survey forecasts seems in order. Second, the rationality of the MMS survey forecast data for the May 1990–December 2000 time period is compared to the earlier findings of Aggarwal et al. (1995).

The organization of the article is as follows. Section II briefly reviews the use of survey forecasts in empirical studies of asset pricing and prior analysis of the rationality of MMS survey forecasts. The next section describes the data and research design. Section IV follows with presentation and discussion of the empirical results. Conclusions follow in Section V.

II. Testing the Rationality of Survey Forecasts

There has been considerable analysis and debate over the rationality of asset pricing in U.S. and other developed financial markets. Many studies have investigated the short-run adjustment of asset prices to information released in the periodic announcements of U.S. macroeconomic indicators (see, e.g., Pearce and Roley 1985; Frankel and Froot 1987; Hardouvelis 1987; and Aggarwal and Schirm 1992). These studies document equity, debt, and foreign exchange market reaction to new information in regular announcements of selective U.S. economic indicators for various periods during the 1970s and 1980s. The measure of market expectations for these various announcements frequently used in these studies is median survey forecast data provided by MMS. Given the documented reaction of asset prices to new information in announcements of U.S. economic indicators, evaluation of the rationality of MMS and other survey forecasts that could be used in similar studies seems appropriate.

As pointed out by Aggarwal et al. (1995), many studies have evaluated the rationality of survey forecast of macroeconomic indicators using regression analysis without prior consideration of the stability of the time series data of the actual indicator series and its forecast (see, e.g., Zarnowitz 1985; Frankel and Froot 1987; and Pearce 1987). Typically, the actual indicator series is regressed on its forecast series and an intercept, with inferences drawn on the rationality of the forecast based on the size and significance of the estimated coefficients, the equation's overall explanatory power, and the serial correlation characteristics of the equation's errors. It has been shown that inferences

drawn from regression estimations of unstable time series data can lead to erroneous conclusions, based on spurious regression results (Engle and Granger 1987).

III. Data and Research Design

In this article I examine the rationality of 10 U.S. macroeconomic indicator series and survey forecasts of their announced values provided by MMS and TF for the May 1990–December 2000 period. The time series of announced values for each indicator and the MMS median forecast have been obtained directly from the firm, while the TF median forecast for each announcement has been obtained from weekly issues of *Barron's* and the *Wall Street Journal* during this time period.[2] The monthly macroeconomic indicator series evaluated in this article include the change in nonfarm payroll employment, the civilian unemployment rate, the percentage change in retail sales, the percentage change in the producer price index, the number of new housing starts, the percentage change in industrial production, the percentage change in the consumer price index, the monthly trade balance, the percentage change is durable goods orders, and the percentage change in personal income. Aggarwal et al. (1995) include all of the above except nonfarm payroll employment but also include weekly changes in the narrowly defined money stock, M1, and the monthly leading economic indicator series.[3]

In order to develop their survey forecast of macroeconomic indicators, both MMS and TF conduct a weekly survey every Friday, soliciting individual forecasts of U.S. macroeconomic indicators to be announced during the following 1–2 weeks. Survey participants include representatives primarily from the research departments of money center commercial banks and security houses and number close to 30 and 20 respondents each in the MMS and TF surveys, respectively. While the precise overlap of survey respondents could not be determined, as MMS will not reveal the institutions surveyed, it is expected that both surveys are dominated by representatives of the New York

2. Beginning with the June 11, 1990, issue of *Barron's*, a table labeled "Statistical Calendar" was included with forecast data for regularly announced macroeconomic indicator series provided by Technical Data, a predecessor of Thomson Financial Data. The March 16, 1992, issue labeled the forecasts as "consensus estimate" of the respective indicators. The source of the reported forecast data was Technical Data. With the May 8, 2000, issue, *Barron's* switched from Thomson to Bloomberg Data. The *Wall Street Journal* began reporting the Technical/Thomson consensus forecast data in its "Tracking the Economy" table in Monday's issue on March 16, 1992, having previously reported Money Market Services forecast data. The *Journal* continues to use the Thomson data source for its reported "consensus forecasts." I have used the *Wall Street Journal* Thomson data for the May 8, 2000–January 29, 2001 period (April 2000–December 2000 indicators) to complete the Thomson data series through December 2000. The Thomson survey data are not available in an easily accessible format from Thomson Financial.

3. The M1 and leading economic indicators series are not included because of limited financial market and Federal Reserve focus on M1 during the 1990–2000 time period, and the redundant nature of the leading economic indicators series, given the other component series under evaluation in this study. The nonfarm payroll employment indicator is included because it has received increasing market attention during the 1990s.

money center financial institutions.[4] In addition to surveying a larger number of respondents, the MMS survey includes representation from consulting firms and academic institutions, as well as banking and investment firms, the latter of which are the focus of the TF survey. Results of each survey are made available immediately to participants, service subscribers, and the financial press.

This study evaluates the rationality of these survey forecast following Aggarwal et al. (1995). They point out that tests of forecast unbiasedness have typically followed Muth (1961) and use a model of the following form:

$$Y_t = \beta_0 + \beta_1 Y_t^e + \varepsilon_t, \tag{1}$$

with $\beta_0 = 0$ and $\beta_1 = 1$; $E(\varepsilon_t) = 0$, where Y_t = actual series, Y_t^e = forecast of the series, and ε_t is a random error term. In addition, following Muth (1961), ε_t must be both uncorrelated with the expected value of the series Y_t^e and also exhibit no significant serial correlation. Failure to meet any of these conditions will reject the unbiasedness of the survey forecast data.

In order to examine the stationarity of both the announced series and the two survey forecasts of each announced series, an Augmented Dickey-Fuller (ADF) test for unit roots is specified with an OLS regression for each series (see Dickey and Fuller 1979):

$$Y_t - Y_{t-1} = \beta_0 + \beta_1 Y_{t-1} + \beta_2 \Delta Y_{t-1} + \beta_3 \Delta Y_{t-2} + \ldots + \beta_n \Delta Y_{t-n} + \varepsilon_t. \tag{2}$$

The ADF test evaluates $\hat{\beta}_1$ to determine if the estimated coefficient is significantly different from zero in order to reject the null hypothesis of a unit root. Hafer, Hein, and MacDonald (1992) apply a similar test to the residuals from equation (1) to test for the unbiasedness of survey forecasts as in equation (3):

$$\varepsilon_t - \varepsilon_{t-1} = \Phi_0 + \Phi_1 \varepsilon_{t-1} + \Phi_2 \Delta \varepsilon_{t-1} + \Phi_3 \Delta \varepsilon_{t-2} + \mu_t. \tag{3}$$

They conclude that an unbiased forecast should have stationary errors and thus $\hat{\Phi}_1$ should be significantly different from zero, rejecting the null hypothesis of a unit root.

Aggarwal et al. (1995) argue that stationary forecasts are a necessary, but not sufficient, condition for unbiased forecasts, particularly for nonstable indicator and forecast series. They suggest that if both the indicator series and its forecasted value are nonstationary and follow a unit root process, a cointegration test should be performed in order to evaluate the unbiased nature of the forecast. Following Engle and Granger (1987), the announced and forecast series are said to cointegrated if they are (1) nonstationary in levels,

4. Firms currently surveyed by TF include Thomson International Financial Research, Bank of Tokyo-Mitsubishi, Barclays, Canadian Imperial Bank of Commerce Wood Gundy, Stone-McCarthy Research, Daiwa, United Bank of Switzerland, ABN AMRO, Salomon Smith Barney, Goldman Sachs, JP Morgan Chase, Lehman, Merrill Lynch, Morgan Stanley, Nomura, Northern Trust, Scotiabank, and Aubrey Lanston.

(2) stationary in first differences, and (3) if there exists a linear combination of levels, $u_t = Y_t + \beta Y_t^e$, which is stationary. Aggarwal et al. (1995) assert that if both the actual and the forecasted series are cointegrated, the cointegrating factor is one, and the forecast errors follow a white noise process, then this suggests that the forecast is rational.

If both the actual indicator series and its survey forecast are stationary in first differences, a cointegrating regression can be estimated. Given the nonnormal nature of both the indicator series and the median survey forecasts, Aggarwal et al. (1995) follow a three-step procedure suggested by Engle and Yoo (1991). The procedure is as follows:

Step 1: The cointegration regression coefficient is estimated from equation (1),

$$Y_t = \beta_0 + \beta_1 Y_t^e + \varepsilon_t.$$

Step 2: Estimate γ from the following regression equation:

$$\Delta Y_t = \gamma(Y_t - \hat{\beta}_0 - \hat{\beta}_1 Y_t^e) + \beta_1 \Delta Y_t^e + \beta_2 \Delta Y_{t-1} + \beta \Delta Y_{t-1}^e + \varepsilon_t, \tag{4a}$$

and δ_1 from

$$\hat{\varepsilon}_t = \delta_0 + \delta_1(-\hat{\gamma} Y_{t-1}^e) + \mu_t. \tag{4b}$$

Step 3: The correct estimate of the cointegration regression coefficient (β_1) is

$$\beta_1 = \hat{\beta}_1 + \hat{\delta}_1, \tag{4c}$$

where the *t*-statistic is given by $t = \beta_1/\text{std}(\hat{\delta}_1)$.

Using this procedure, Engle and Yoo (1991) show that the estimated cointegrating vector and its standard error are asymptotically equivalent to Full Information Maximum Likelihood estimation.

Recent discussion in the financial press has suggested the possibility that the U.S. economy experienced a change in productivity transformation during the l990s.[5] In order to test for a change in the rationality of MMS and TF consensus forecasts during the 1990s, perhaps due to a productivity transformation, the stability of the estimated regression coefficients for both equation (1) and equation (4c) are evaluated for the pre- and post-1995 period.[6]

5. An anonymous referee suggested investigation of the stability of the pre- and post-1995 period rationality results in light of discussion of a change in productivity transformation in the U.S. economy in recent years. Additional research on this topic continues.

6. The specific tests employed are Chow (1960) test and the CUSUM and CUSUM of squares tests of Brown, Durbin, and Evans (1975). Hao and Inder (1996) find the CUSUM test to have nontrivial local power to detect structural change in cointegrated regression models.

TABLE 1 Summary Statistics for Macroeconomic Forecasts and Announcements, May 1990–December 2000

Survey	Mean Ann.[a]	Mean Fore.[b]	Mean Error[c]	SD Ann.[d]	SD Fore.[e]	SD Error[f]	No. Obs.[g]
Nonfarm payroll:[h]							
MMS	145.148	156.230	11.082	163.911	99.632	117.527	122
TF		156.828	11.681		107.778	118.596	122
Unemployment (%):							
MMS	5.576	5.613	.037	1.106	1.112	.147	127
TF		5.613	.037		1.115	.152	127
Retail sales:[i]							
MMS	.299	.343	.044	.541	.351	.414	128
TF		.311	.012		.408	.399	128
Producer prices:[i]							
MMS	.140	.194	.054	.392	.226	.259	128
TF		.188	.048		.231	.246	128
Housing starts:[j]							
MMS	1.395	1.386	−.009	.213	.202	.069	127
TF		1.388	−.007		.204	.070	127
Industrial production:[i]							
MMS	.214	.169	−.045	.486	.351	.249	126
TF		.162	−.052		.373	.253	126
Consumer prices:[i]							
MMS	.232	.254	.021	.166	.116	.115	127
TF		.253	.020		.117	.115	127
Trade balance:[k]							
MMS	−12.639	−12.366	.273	7.455	7.242	1.513	126
TF		−12.196	.443		7.282	1.749	126
Durable goods:[i]							
MMS	.361	.286	−.075	3.381	1.277	2.788	127
TF		.178	−.183		1.451	2.685	127
Personal income:[i]							
MMS	.430	.396	−.034	.342	.211	.234	125
TF		.390	−.006		.239	.105	125

NOTE.—MMS = Money Market Services; TF = Thomson Financial. While 128 announcement dates occurred during the May 1990–December 2000 period, there were a few occasions when forecasted values were not reported in the *Wall Street Journal*/*Barron's* for the Thomson Financial data. Money Market Services data were dropped for these dates as well.

[a] Mean value of the announced series.
[b] Mean value of the survey forecast.
[c] Mean value of the forecast less the actual series.
[d] Standard deviation of the announced series.
[e] Standard deviation of the survey forecast.
[f] Standard deviation of the forecast less the actual series.
[g] Number of observations available for the survey forecasts for May 1990–December 2000.
[h] Change, in thousands.
[i] % change.
[j] Millions.
[k] $ billions.

IV. Empirical Results

Table 1 provides mean and standard deviation statistics for each of the 10 macroeconomic indicator series, the MMS and TF survey forecasts, and the forecast errors for the survey forecast for the May 1990–December 2000 period. Examination of table 1 indicates that the accuracy of the survey forecasts for particular indicator series varies with the two surveys. For the sample

period, MMS has smaller average forecasting errors for nonfarm payroll employment, industrial production, the monthly trade balance and durable goods orders. The TF has smaller average forecasting error for retail sales, the producer price index, and personal income, while both MMS and TF forecasts of unemployment, housing starts, and the consumer price index exhibit similar accuracy. In all cases, the sign of the average forecast error for both surveys is the same. With the exception of the civilian unemployment rate, all series forecasts exhibited smaller standard deviations than the announced indicator series. The patterns of standard deviations of forecasting errors mirror, to some extent, the patterns of mean errors for MMS and TF. It is also interesting to note that the sum of the standard deviations of the forecasts and the errors for each series exceeds the standard deviation of the actual series.[7]

The results of the Augmented Dickey-Fuller (ADF) tests are presented in table 2. Three of the 10 indicator series and both their MMS and TF forecasts exhibit a unit root in the original series, and no unit root in the first difference of the original series for the May 1990–December 2000 period.[8] They include the civilian unemployment rate, housing starts, and the monthly trade balance, the same U.S. indicator series identified by Aggarwal et al. (1995) as nonstationary for the 1980–93 period. Note that both housing starts and the monthly trade balance are measured in levels and the civilian unemployment rate is measured as a percentage of the labor force. The other seven series that are stationary as reported are in fact measured as percentage changes or changes—for example, the change in nonfarm payroll employment, the percentage change in the consumer or producer price index, the percentage change in durable goods orders, and so on. The fact that the latter seven stable series and their forecasts are measured in changes or percentage changes, and not levels, raises the issue of how the dimension of indicator measurement may be related to the apparent stability in the indicator series.[9]

Given the statistical problems associated with inferences drawn from regression estimates of equation (1) in the presence of nonstationary time series data and the results from the ADF tests reported in table 2, cointegration tests are performed for the forecasts errors or residuals from equation (1) for the civilian unemployment rate, housing starts, and the monthly trade balance. If the announced series and its forecast are cointegrated, then the residuals for equation (1) should not exhibit a unit root. Table 3 indicates that ADF results for the residuals from equation (1) reject the hypothesis of no cointegration at the 1% level. This evidence of cointegration suggests a long-run stable

7. The MMS and TF median forecasts for each indicator are highly correlated, with correlation coefficients ranging from .89 for personal income to .99 for the civilian unemployment rate.

8. For the ADF test, lags were added as long as they provided statistically significant information at the 5% level.

9. Aggarwal and Mohanty (2000), in their study of Japanese macroeconomic indicators, find that percentage changes in M1, housing starts, and retail sales, and the currency value of the trade balance are unstable as reported and forecast by MMS. These results for the first three series, reported as percentage changes, suggests that the unit of measurement has not eliminated the instability in these series.

TABLE 2 Test for Stationarity (Augmented Dickey-Fuller Tests),[a] May 1990–December 2000

Variable (Y_t)	Announced Series[b]	Announced Series First Difference	Survey	Forecast Series	Forecast Series First Difference
Nonfarm payroll	−.402**		MMS	−.295**	
	(−3.643)			(−3.733)	
			TF	−.247*	
				(−2.970)	
Unemployment	.001	−1.084**	MMS	−.005	−.651**
	(.033)	(−7.941)		(−.447)	(−4.755)
			TF	−.005	−.632**
				(−.488)	(−4.559)
Retail sales	−1.182**		MMS	−1.038**	
	(−8.651)			(−8.001)	
			TF	−.961**	
				(−7.531)	
Producer price index	−.790**		MMS	−.637**	
	(−7.47)			(−6.865)	
			TF	−.691**	
				(7.118)	
Housing starts	−.059	−1.532**	MMS	−.032	−1.157**
	(−1.707)	(−10.528)		(−1.520)	(−8.669)
			TF	−.034	−1.245**
				(−1.527)	(−9.067)
Industrial production	−.662**		MMS	−.567**	
	(−5.802)			(−5.023)	
			TF	−.596**	
				(−5.203)	
Consumer price index	−.878**		MMS	−.508**	
	(−7.599)			(−5.582)	
			TF	−.661**	
				(−6.653)	
Trade balance	.035	−1.533**	MMS	.029	−1.029**
	(1.537)	(−10.791)		(2.196)	(−7.698)
			TF	.024	−1.171**
				(1.594)	(−8.353)
Durable goods orders	−1.772**		MMS	−1.201**	
	(−12.105)			(−8.944)	
			TF	−1.304**	
				(9.305)	
Personal income	−1.356**		MMS	−.548*	
	(−9.341)			(−3.416)	
			TF	−1.523**	
				(−10.367)	

NOTE.—MMS = Money Market Services; TF = Thomson Financial.

[a] The Augmented Dickey-Fuller test is based on the following regression: $Y_t - Y_{t-1} = \Phi_0 + \Phi_1 Y_{t-1} + \Phi_2 \Delta Y_{t-1} + \Phi_3 \Delta Y_{t-2} + \mu_t$. Terms added until additional lags provide no new information significant at the 5% level.

[b] Value of the *t*-ratio in parentheses.

* Indicates evidence of rejection of a unit root at the 5% level (following MacKinnon 1991).

** Indicates evidence of rejection of a unit root at the 1% level (following MacKinnon 1991).

TABLE 3 **Cointegration Tests, May 1990–December 2000 Cointegration Regression:** $Y_t = \beta_0 + \beta_1 Y_t^e + \varepsilon_t$, $H_0 : \beta_1 = 1$

Survey	Augmented Dickey-Fuller Tests[a]	Estimated β_1[b]	Corrected β_1[c]	*Q*-Statistics[d] *Q* (4)	*Q* (8)	*Q* (12)
Unemployment:						
MMS	−1.016**	.986**	.984**	1.434	12.805	18.122[e]
	(−8.047)	(84.021)	(193.155)			
			[3.141]#			
TF	−.934**	.982**	.981**	.888	7.803	10.355
	(−7.558)	(81.474)	(167.010)			
			[3.235]#			
Housing starts:						
MMS	−1.187**	1.001**	1.032**	3.031	7.584	12.573
	(−8.659)	(32.702)	(83.626)			
			[2.593]#			
TF	−1.156**	.991**	1.023**	3.543	7.761	12.100
	(−8.467)	(32.275)	(78.401)			
			[1.763]			
Trade balance:						
MMS	−1.186**	1.008**	.988**	2.460	7.499	14.180
	(−8.917)	(53.786)	(129.804)			
			[1.577]			
TF	−.857**	.995**	.972**	3.812	6.451	13.594
	(−6.992)	(46.155)	(75.948)			
			[2.188]#			

NOTE.—MMS = Money Market Services; TF = Thomson Financial.

[a] Augmented Dickey-Fuller test: $\Delta\varepsilon_t = \Phi_0 + \Phi_1\varepsilon_{t-1} + \Phi_2\Delta\varepsilon_{t-1} + \Phi_3\Delta\varepsilon_{t-2} + \mu_1$.

[b] Estimated and corrected coefficient based on three-step error correction model, *t*-ratios in parentheses.

[c] Estimated and corrected coefficient based on three-step error correction model, *t*-ratios in brackets.

[d] *Q*-statistics for the forecast errors ($Y - Y_e$). None of the statistics are significant at the 5% level for lags up to 36 months except for the unemployment equation using the MMS survey data.

[e] For lags greater than 21 months the *Q*-statistics are significant at the 5% level or less in the unemployment rate equation using the MMS survey data.

** Significant at the 5% level or less (following MacKinnon 1991).

$\hat{\beta}_1$ is significantly different from one at the 5% level or less.

relationship between both the MMS and TF forecasts and the civilian unemployment rate, housing starts, and the monthly trade balance.

Following the three-step procedure of Engle and Yoo (1991), estimated and corrected β_1 coefficients for equation (1) are reported in table 3. All β_1 coefficients are significant at the 1% level, with the *Q*-statistics for the forecasting errors for equation (1) for lags up to 36 months indicating no evidence of serial correlation at the 5% level or less for both MMS and TF survey data for housing starts and the monthly trade balance, and for the TF survey data for the civilian unemployment rate. There is evidence of serial correlation in the forecasting errors for equation (1) at the 5% level or less for the MMS survey forecast of the civilian unemployment rate for lags greater than 21 months for the 1990–2000 period. The bracketed *t*-statistics identified by a pound sign indicate that the corrected β_1 for both MMS and TF surveys for the civilian unemployment rate, the MMS survey of housing starts, and the TF survey of the monthly trade balance are significantly different from one.

The small magnitude of these differences from one calls into question whether these are significant economic differences.

In order to test the stability of the estimated and corrected β_1 coefficients for equation (1) reported in table 3 for the post-1995 period, the regression results were evaluated using a Chow test with identified break points, and CUSUM and CUSUM of squares tests without identified break points. In all cases there is no evidence of significant change at the 10% significance level or less in the regression results, suggesting no change in the rationality of the MMS or TF forecasts of housing starts, the monthly trade balance, or the unemployment rate during the 1990–2000 period.

Tests for the unbiasedness of the survey forecasts for the seven stationary macroeconomic indicator series are reported for equation (1) in table 4. The χ^2-statistic for H_0 indicates that the null hypothesis of unbiasedness cannot be rejected for both the MMS and TF survey forecasts for nonfarm payroll employment, retail sales, the consumer price index, and the TF survey forecast of personal income. The MMS and TF survey forecasts for the producer price index, industrial production, durable goods orders, and the MMS survey forecast for personal income are biased. In all cases, the biased forecasts tend to underpredict the actual indicator as evidenced by $\hat{\beta}_1$ coefficients significantly greater than one and $\hat{\delta}_0$ coefficients not significantly different from zero with the exception of producer price index forecasts.

The regression results reported in table 4 also appear to be stable throughout the 1990–2000 period. There is no evidence of significant change in the bias of the MMS or TF consensus forecasts of the various U.S. indicators at 10% significance level or less, based on either Chow or CUSUM and CUSUM of squares tests. In combination with the very similar stability tests results for table 3, there appears to be no evidence of a significant change in the rationality of consensus forecasts in the post-1995 period.[10]

Table 5 summarizes the findings from tables 3 and 4 for the rationality of the MMS and TF consensus forecasts for the May 1990–December 2000 period. Both surveys appear not to provide rational forecasts for the producer price index, industrial production, and durable goods orders. In addition the MMS forecast for personal income was also not rational. In contrast, both surveys appear to have rational forecasts of nonfarm payroll employment, retail sales, and the consumer price index. The MMS and TF forecasts and the actual series for the unemployment rate, housing starts, and the monthly trade balance were not stationary as reported but were cointegrated in first difference with a factor close to one, providing support for the rationality of both survey forecasts of these economic indicators.

A comparison of the results for the MMS data for the May 1990–December 2000 with the earlier analysis for the 1977–93 period by Aggarwal et al.

10. The many graphical plots for the CUSUM and CUSUM of squares tests and *F*-statistics and associated probability values for the Chow tests are not reported in this article but are available from the author on request.

TABLE 4 **Test for Unbiasedness, May 1990–December 2000**
$Y_t = \beta_0 + \beta_1 Y_t^e + \varepsilon_t$, $H_0 : \beta_0 = 0$ **and** $\beta_1 = 1$

Survey	β_0[a]	β_1[a]	Adjusted R^2	D-W	χ^2 for H_0[b]
Nonfarm payroll:					
MMS	−35.69	1.16**	.49	2.10	3.27
	(1.81)	(10.85)			[.19]
TF	−19.68	1.05**	.47	2.13	1.43
	(1.03)	(10.47)			[.48]
Retail sales:					
MMS	−.04	.99**	.41	2.48	1.45
	(.80)	(9.44)			[.48]
TF	.02	.90**	.46	2.27	1.42
	(.43)	(10.37)			[.49]
Producer price index:					
MMS	−.12**	1.36**	.62	1.81	20.96**
	(4.41)	(14.31)			[.00]
TF	−.12**	1.38**	.65	1.80	23.83**
	(4.54)	(15.55)			[.00]
Industrial production:					
MMS	.01	1.21**	.76	2.34	15.93**
	(.41)	(19.79)			[.00]
TF	.03	1.12**	.74	2.21	9.48**
	(1.36)	(18.67)			[.01]
Consumer price index:					
MMS	−.03	1.04**	.52	2.56	4.55
	(1.29)	(11.73)			[.10]
TF	−.03	1.03**	.52	2.49	4.09
	(1.12)	(11.66)			[.13]
Durable goods orders:					
MMS	−.10	1.62**	.37	2.21	11.07**
	(.42)	(8.65)			[.01]
TF	.09	1.50**	.41	2.07	10.57**
	(.41)	(9.43)			[.01]
Personal income:					
MMS	−.04	1.20**	.54	2.37	6.86**
	(1.00)	(12.22)			[.03]
TF	.02	1.06**	.54	2.33	4.27
	(.48)	(12.10)			[.12]

NOTE.—MMS = Money Market Services; TF = Thomson Financial. The variable Y_t = announced value of macroeconomic series; Y_t^e expectations data based on MMS or TF surveys; ε_t = random error term. Adjusted R^2 = adjusted coefficient of determination corrected for degrees of freedom; D-W = Durbin-Watson statistic.
[a] *t*-ratio in parentheses.
[b] Probability value in brackets.
** Significant at the 1% level.

(1995) is summarized in table 6. For the nine series evaluated in both studies, the stationarity tests produce similar results, namely, that the civilian unemployment rate, housing starts, and the monthly trade balance are stationary in first differences of both the announced series and the consensus forecasts. These same series have cointegrating factors close to, but significantly different from one. The other six series, the percentage change in retail sales, producer price index, industrial production, consumer price index, durable goods orders, and personal income are stationary in levels for both time periods. While the test results for bias in the survey forecasts are generally very similar for both studies, two exceptions are the percentage change in retail sales and durable

TABLE 5 Comparison of Money Market Service and Thomson Financial Services Consensus Forecasts, May 1990–December 2000

Series	Stationarity in Levels	Cointegrating Factor	Bias	Support for the Rational Expectations Hypothesis
Nonfarm payroll:				
MMS	Yes		No	Yes
TF	Yes		No	Yes
Unemployment:				
MMS	No	1[a,b]	No	Yes
TF	No	1[a]	No	Yes
Retail sales:				
MMS	Yes		No	Yes
TF	Yes		No	Yes
Producer price index:				
MMS	Yes		Yes	No
TF	Yes		Yes	No
Housing starts:				
MMS	No	1	No	Yes
TF	No	1	No	Yes
Industrial production:				
MMS	Yes		Yes	No
TF	Yes		Yes	No
Consumer price index:				
MMS	Yes		No	Yes
TF	Yes		No	Yes
Trade balance:				
MMS	No	1	No	Yes
TF	No	1[a]	No	Yes
Durable goods orders:				
MMS	Yes		Yes	No
TF	Yes		Yes	No
Personal income:				
MMS	Yes		Yes	No
TF	Yes		No	Yes

NOTE.—MMS = Money Market Services; TF = Thomson Financial.
[a] Cointegrating factor not one but close to one.
[b] Evidence of serial correlation in error terms for lags greater than 21 months.

goods orders. Aggarwal et al. (1995) find the MMS retail sales forecast to be biased and the durable goods orders' forecast to be unbiased for the 1977–93 period. In contrast, the more recent data for the 1990–2000 period suggest that the MMS forecast for retail sales is unbiased and their forecast for durable goods is biased.

V. Conclusions

Using the methods of unit roots and cointegration analysis, Aggarwal et al. (1995) find evidence that MMS consensus forecasts of some U.S. macroeconomic indicators are not rational during the November 1977–November 1993 period. Given the availability of alternative consensus forecast data for se-

TABLE 6 Comparison with Aggarwal et al. (1995) for Money Market Services Consensus Forecasts, 1977–93 versus 1990–2000

Series	Stationarity in Levels	Cointegrating Factor	Bias	Support for the Rational Expectations Hypothesis
Unemployment:				
AMS	No	1	No	Yes
S	No	1	No	Yes
Retail sales:				
AMS	Yes		Yes	No
S	Yes		No	Yes
Producer price index:				
AMS	Yes		Yes	No
S	Yes		Yes	No
Housing starts:				
AMS	No	1	No	Yes
S	No	1	No	Yes
Industrial production:				
AMS	Yes		Yes	No
S	Yes		Yes	No
Consumer price index:				
AMS	Yes		No	Yes
S	Yes		No	Yes
Trade balance:				
AMS	No	1	No	Yes
S	No	1	No	Yes
Durable goods orders:				
AMS	Yes		No	Yes
S	Yes		Yes	No
Personal income:				
AMS	Yes		No	Yes
S	Yes		No	Yes

NOTE.—AMS: Aggarwal et al. (1995); S: Schirm, this study.

lective U.S. indicators in *Barron's* and the *Wall Street Journal* provided by TF, this article provides a comparative analysis of the rationality of survey forecasts of both MMS and TF for the May 1990–December 2000 period. In addition, the article also compares the rationality of the more recent MMS forecast data with the earlier data evaluated by Aggarwal et al. (1995). While it is likely that there is some overlap in survey respondents in the MMS and TF weekly surveys, the apparent difference in size and institutional coverage of the two samples suggests possible differences in median survey forecast performance.

An examination of both MMS and TF average forecast errors for each of the 10 indicator series indicates some differences in the accuracy of the forecasts during the 1990s. The MMS has smaller average forecasting errors for nonfarm payroll employment, industrial production, the monthly trade balance and durable goods orders. The TF has smaller average forecasting error for retail sales, the producer price index, and personal income, while both MMS

and TF forecasts of unemployment, housing starts, and the consumer price index exhibit similar accuracy. The sign of the forecasting errors for both MMS and TF are the same for all indicator series.

While the stationarity and cointegration characteristics of the actual U.S. indicator series and both the MMS and TF median survey forecasts are similar for the May 1990–December 2000 period, there are a few differences. The forecast and announcement by TF for housing starts and MMS for the monthly trade balance are cointegrated with factor one and consistent with strict rationality. The MMS median forecast and announcement of both the civilian unemployment rate and housing starts are cointegrated with a factor close to but significantly different from one. Similarly, the TF median forecast of the unemployment rate and the monthly trade balance are cointegrated with a factor close to but significantly different from one. These differences from factor one, while strictly inconsistent with rational expectations, are small and amount to 3% or less.

The other seven indicator series and their forecast are stationary as reported. Both the MMS and TF forecasts for nonfarm payroll employment, retail sales, and the consumer price index are unbiased, while both forecasts of the producer price index, industrial production, and durable goods orders are biased. The TF, but not the MMS, forecast of personal income is also unbiased during the May 1990–December 2000 period. These stationary indicators are all reported in percentage changes or a first difference, thus suggesting that the units of measurement of the respective indicators may explain, in part, the results of the stability tests. Stability tests of the regression results for both the MMS and TF forecasts for all indicators for the 1990–2000 period reveal no evidence of significant change in the rationality of these forecasts in the post-1995 period.

A comparison of the rationality of the MMS survey median forecast for the more recent period with the earlier analysis of Aggarwal et al. (1995) finds that of the nine U.S. macroeconomic series evaluated in both studies, only retail sales and durable goods orders differ for the two periods. The MMS forecast of retail sales is unbiased for the more recent period in contrast to evidence of biased forecasts during the February 1980–October 1993 period. In contrast, the MMS forecast of durable goods is biased for the more recent period yet appears to be unbiased for the February 1980–October 1993 period. Thus there is some evidence of time instability in the rationality of MMS median survey forecast data over the longer 1980–2000 period.

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