

Earnings Forecasts from Firm-Level Regressions: Implications for Research and Practice

Reginald Edwards
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Overview

Are analyst forecasts of earnings more accurate or more value-relevant than forecasts from statistical models of earnings?

- How can statistical models incorporate the same information set analysts use?
- How do we evaluate the performance of a given earnings forecast?
- When are earnings forecasts likely to perform poorly?

Preview of Results

Analyst forecasts of earnings suffers from three flaws:

- ① Analyst forecasts are more accurate at shorter horizons, but statistical forecasts outperform at longer horizons
- ② Analyst forecasts underperform statistical forecasts in the period prior to Reg-FD, consistent with a less favorable information environment
- ③ No clear relation between *ex ante* uncertainty and relative forecast performance
- ④ Analyst forecasts perform better in high-tech, manufacturing, and healthcare
- ⑤ Statistical forecasts associated with marginally better contemporaneous returns

Motivation: Demands for Forecasts of Earnings

- Valuation
- Implied cost of capital
- Equity risk premium estimates
- Returns-earnings relations
- Predictability studies

Motivation: Problems with Analyst Forecasts

- Misaligned incentives of analysts
- Biased in general (usually over-optimistic)
- Limited historical availability (late 1980s onward)
- Limited current availability (large, public firms)
- Poor performance at long horizons

A Brief History of Earnings Forecasting Research

- 1960s
 - ▶ Random walk models
- 1970s
 - ▶ ARIMA time-series models
- 1980s
 - ▶ Incorporating extra information beyond past earnings (eg price)
 - ▶ Using analyst forecasts
 - ▶ Comparing analysts to time series models
- 1990s
 - ▶ Incorporating management forecasts (“guidance”)
 - ▶ Assessing biases of analyst forecasts

A Brief History of Earnings Forecasting Research

- 2000s

- ▶ SP Kothari:

- "...[earnings forecasting] literature is fast becoming extinct. The main reason is the easy availability of a better substitute: analysts' forecasts are available at a low cost in machine-readable form for a large fraction of publicly traded firms"*

- 2010s (Today)

- ▶ We can do better.

Contribution

- 1 Most closely related to Bradshaw et al (2012); Hou, van Dijk, and Zhang (2012); Ball, Ghysels, and Zhou (2014).
- 2 Methodological innovations in data treatment, model building, and forecast evaluation
 - ▶ Appropriately map the forecasts to the earnings figures forecast by analysts
 - ▶ Build forecasts at a firm-level rather than from cross-sectional averages
 - ▶ Use a market-based evaluation of forecast performance
- 3 Demonstrates potential gains to market participants from using statistical forecasts over analyst forecasts

Methodology: Earnings Forecasts

Which “earnings” figure to use?

- Annual “pro-forma” EPS forecasts from IBES
- Forecasts of one-, two-, and three-year ahead earnings (FY1, FY2, FY3, resp.)
- Forecasts are made on the base-year announcement date

Methodology: Forecasting Framework

- Begin with firm-level, first-order autoregressive model and build out:

$$E_{i,t+\tau} = \alpha_{i,0} + \alpha_{i,1}E_{i,t} + \eta_{i,t+\tau}, \quad (1)$$

where $\tau = 1, 2, 3$.

- Add predictor variables to capture firm, market, and economy-wide information

$$E_{i,t+\tau} = \beta_{i,0} + \beta_{i,1}E_{i,t} + \sum_{k=2}^{\kappa} \beta_i^{(k)} X_{i,t}^{(k)} + \varepsilon_{i,t+\tau} \quad (2)$$

Methodology: Performance Evaluation

- Prior studies use bias, absolute error, or mean-square prediction error
- I use MSPE and buy-and-hold returns
- Buy-and-hold returns calculated on portfolios ranked by divergence between model and analyst forecasts

Methodology: Choosing Predictors

- Short earnings histories necessitate parsimony
- Use prior literature and in-sample correlation to motivate variable selection
- Be willing to sacrifice in-sample performance for potential out-of-sample performance

Methodology: Choosing Predictors

- Firm-level data: Earnings, indicator for negative earnings, assets, sales, ROE, dividends, changes in accruals
- Macroeconomic variables: unemployment, gdp, inflation (ppi)
- Market-based data: price-earnings ratio, year-over-year change in stock price

Methodology: Choosing Predictors

	mean	med
EPS_{t-1}	0.6694	0.7516
$\Delta Sales$	0.7678	0.8687
ROE	0.7535	0.8151
sales	0.7444	0.8100
return	0.7418	0.7834
$\Delta Price$	0.7313	0.7866
ΔAR	0.7195	0.7980
ΔAP	0.7190	0.7868
Inflation (PPI)	0.7032	0.7696
GDP	0.7046	0.7792
Unemployment	0.7065	0.7794
AP	0.6963	0.7648
AR	0.6925	0.7646
Accruals	0.6923	0.7505
Dividends	0.6953	0.7653
assets	0.6877	0.7636
PE Ratio	0.6843	0.7462
Negative Earnings	0.6797	0.7575

Table: Estimated R^2 values from regressions of the form
 $EPS_t = \alpha_0 + \alpha_1 EPS_{t-1} + \alpha_2 X_{t-1} + \varepsilon$.

Methodology: Forecast Estimation

- Regression necessitates relatively long estimation windows.
- For firms with at least 15 years of earnings history, use the full feature set:

$$\begin{aligned} E_{t+\tau} = & \beta_0 + \beta_1 E_t + \beta_2 assets_t + \beta_3 return_t \\ & + \beta_4 NegativeEarnings_t + \beta_5 PE_t \\ & + \beta_6 \Delta Sales_t + \beta_7 PE_t + \beta_8 \Delta AP_t + \\ & \beta_9 \Delta AR_t + \beta_{10} U_t \\ & + \beta_{11} GDP_t + \beta_{12} INFLATION_t + \varepsilon \end{aligned} \quad (3)$$

- For short-history firms, fall-back on the AR(1) model.
- Do not require firms to have positive base-year earnings

Forecast Evaluation

Relative MSPE by forecast target year

Year	1-Year Ahead	2-Years Ahead	3-Years Ahead
1993	0.76	0.08	-
1994	0.9	0.11	-
1995	3.81	1.04	-
1996	24.83	0.17	0.00
1997	15.33	0.00	0.49
1998	1.17	1.23	1.81
1999	8.71	0.93	1.83
2000	2.45	1.66	0.38
2001	2.01	1.25	0.09
2002	0.27	0.16	0.11
2003	3.8	0.7	0.59
2004	0.83	0.46	0.64
2005	0.27	0.69	0.02
2006	1.84	0.84	0.55
2007	2.37	0.97	0.77
2008	1.67	1.2	0.21
2009	0.69	0.55	0.63
2010	1.29	0.57	0.45
2011	1.6	0.79	-
2012	3.13	1.12	-
2013	2.01		-
Average	3.80	0.76	0.61

Table: Mean squared prediction error of model forecast, mean analyst (MEANEST) forecast. Forecasts are of FY1, FY2, and FY3 earnings.

Forecast Evaluation

Two Questions commonly posed of analyst forecasts

- ① Does private information give analysts an advantage? (Gintschel and Markov [2004])
- ② Does the amount of *ex ante* uncertainty decrease forecast performance?
- ③ Does industry affect forecast performance?

Results

Relative forecast accuracy after Regulation Fair Disclosure: the effect of private information on forecast performance.

Forecast horizon	Pre-Reg FD	Post-Reg FD
1-Year Ahead	3.21	1.57
2-Year Ahead	0.67	1.00
3-Year Ahead	0.43	0.46

Table: Relative mean squared prediction error comparison of “model” and “consensus” earnings forecasts.

Results

Relative forecast accuracy between high and low analyst forecast dispersion: the effect of ex ante uncertainty on forecast performance.

Forecast horizon	Low Dispersion	High Dispersion
1-Year Ahead	1.92	1.84
2-Year Ahead	1.03	0.97
3-Year Ahead	0.42	0.54

Table: Relative mean squared prediction error comparison of “model” and “consensus” earnings forecasts.

Results

Industries

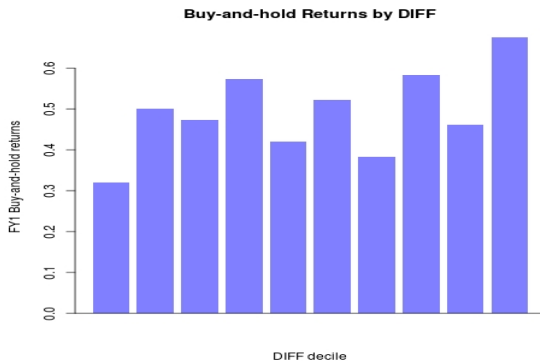
	1-Year Ahead	2-Years Ahead	3-Years Ahead
High-tech	1.2	1	0.9
Manufacturing	2.2	1.1	0.4
Wholesal/Retail	0.9	0.9	0.4
Healthcare	1.4	1.1	0.8
Enrgy/Oil/Gas	0.9	0.7	0.2
Con Durables	4.5	1.7	0.4
Cons Non-Durables	0.4	1.2	0.6
other	2	0.9	0.3

Table: Relative mean squared prediction error comparison of “model” and “consensus” earnings forecasts by Fama-French Industries.

Results

Buy and hold returns based on divergence between model and analyst forecasts

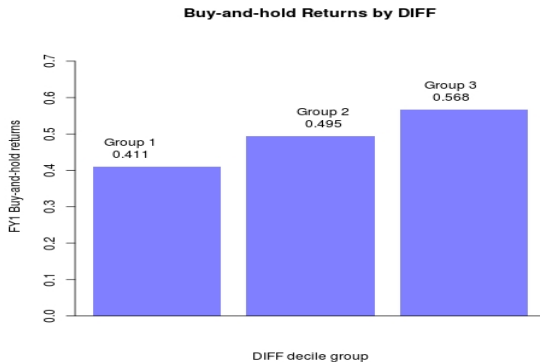
$$BAHR_{t+\tau} = \alpha_0 + \alpha_1 DIF F_i + \varepsilon. \quad (4)$$



Results

Buy and hold returns based on divergence between model and analyst forecasts

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Conclusions and Extensions

Analyst forecasts of earnings suffers from three flaws:

- ➊ Relatively simple to implement statistical models can beat analyst forecasts in terms of accuracy
- ➋ It is possible and useful to incorporate a wider information set than previous earnings into such models
- ➌ Statistical models may give market participants who use them an advantage over those who rely on analyst forecasts
- ➍ Unanswered: what do investors actually use to form expectations of firms' earnings?
- ➎ Unanswered: do more accurate earnings forecasts from statistical models lead to better estimates of implied cost of capital or equity risk premia?

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Thank you!

Summary Statistics

	mean	med	min	max	stdev
EPS	1.671	1.270	-13.940	89.610	2.429
EPS Growth	0.148	0.131	-246.500	549	6.659
Total Assets	11189.937	2859.255	0.808	797769	36046.376
Accruals	-0.034	-0.037	-5.224	1.864	0.115
Dividends	4.294	0.333	0	18000	257.570
Dividend Payer	0.241	0	0	1	0.428
Negative Earnings	0.042	0	0	1	0.201
Delta Price	0.095	0.050	-2.033	9.529	0.510
return	0.004	0.049	-3.501	2.354	0.428
PE Ratio	75.219	25	-57200	151250	1896.962
GDP	0.047	0.048	-0.032	0.124	0.024
ROE	0.739	0.159	-312.626	5822.013	58.999
Unemployment	0.062	0.056	0.038	0.108	0.018
Inflation (PPI)	0.003	0.003	-0.053	0.030	0.011
ales	9900.868	2735.200	-7.237	470171	27674.290
AR	1900.042	363.594	0	418777	12828.263
AP	980.353	182.422	0	149813	4173.909
Age	18.231	17	5	32	8.479
$\Delta Sales$	1023.698	203	-172892	278188	7136.501
ΔAR	169.321	24.626	-40708	60942	1778.590
ΔAP	98.385	12.103	-83588	71555	1376.945

Table: Summary statistics of EPS and independent variables. *Age* is number of years company is in the sample.

Methodology: Choosing Predictors

	mean	med	min	max	stdev
EPS_{t-1}	0.8365	0.8903	-0.1384	1.2728	0.2621
assets	0.0316	0.0225	-0.8275	0.3838	0.0877
Accruals	1.0163	0.1647	-27.7192	50.3953	5.7010
Dividends	-3.3222	0.0219	-868.1679	21.1498	56.1218
Negative Earnings	0.5258	0.2546	-4.6542	7.1198	1.4530
$\Delta Price$	0.4812	0.2580	-1.1649	5.5304	0.7044
return	0.5376	0.2766	-1.1905	9.9263	0.8845
PE Ratio	-0.0044	-06	-0.2647	0.0760	0.0213
GDP	3.9724	1.8984	-37.5517	144.6891	13.6927
ROE	1.9134	0.8492	-7.8009	18.1838	3.3770
Unemployment	-1.0157	0.1596	-192.9481	678	21.0969
Inflation (PPI)	10.4296	4.8584	-108.8861	157.9932	22.9823
sales	0.6885	0.4160	-2.7407	7.1705	1.0305
AR	0.0598	0.0324	-0.7462	0.6187	0.1225
AP	0.0656	0.0444	-0.9054	0.6850	0.1384
$\Delta Sales$	04	01	-0.0018	0.0066	08
ΔAR	0.0014	04	-0.0107	0.0359	0.0041
ΔAP	0.0020	06	-0.0202	0.0523	0.0069

Table: Estimated coefficients from regressions of the form

$$EPS_t = \alpha_0 + \alpha_1 EPS_{t-1} + \alpha_2 X_{t-1} + \varepsilon.$$