



AN UPDATE ON THE PERFORMANCE OF THE STARMINE SMARTESTIMATE AND PREDICTED SURPRISE

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Abstract

We present an investigation of the StarMine® SmartEstimates® and Predicted Surprise success rates for two different periods: from January 1, 1998 to November 30, 2008 and from December 1, 2008 to November 30, 2017. For the financial measures studied, we verify that the model performance remained essentially unchanged throughout the years for different sectors, capitalizations and regions. The SmartEstimate continues to demonstrate better accuracy than the analyst consensus, and the Predicted Surprise continues to accurately predict actual surprises. This enduring outperformance underlines how StarMine models are robustly formulated based on long-lasting behavioral anomalies, and how they continue to provide value to investors.

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1. Introduction

The goal of this paper is to present an updated version of the 2009 StarMine white paper: SmartEstimates and Predicted Surprise: Construction and Accuracy (Stauth and Bonne, 2009). That paper detailed the formulation of the SmartEstimate and Predicted Surprise, and examined their accuracy at forecasting surprises in actual reported earnings and other financial measures. The 2009 SmartEstimate white paper was in turn an update of the 2001 StarMine white paper: Creating and Profiting From More Accurate Earnings Estimates with StarMine Professional (Jha and Mozes, 2001). When we published the white paper in 2009, our test window contained nine years of out-of-sample performance.

Security universe. Number of securities included in the analysis by country or region, selected by largest market capitalization.

Country/Region	Number of Securities
U.S.	3,000
Canada	500
Developed Europe	2,000
Developed Asia ex-Japan	1,000
Japan	1,000
Emerging Markets	1,500
Total	9,000

In this update, we employ a test comparison period in the range January 1998 to November 2008. We then compare that test period with the more recent, post-Financial Crisis period, December 2008 to November 2017, providing nine years of additional out-of-sample performance. This allows us to examine how performance has changed since the 2009 publication. Along the lines of the 2009 paper, our analysis utilizes only fiscal year estimates for the then-current fiscal year period (FY1). We use a universe of 9,000 global securities with the largest U.S. dollar market capitalization with the distribution by region or country shown below. Market capitalizations were resampled each year to avoid look-ahead and survivorship bias.

The remainder of the paper is organized as follows: In Section 2, we compare the accuracy of the SmartEstimate to the consensus estimate for both periods of our study. We find that SmartEstimates are consistently more accurate than the consensus in all regions and financial measures investigated. In Section 3, we examine an intuitive measure of the predictive power of this model, namely, whether SmartEstimates predict the direction of actual earnings surprises. We find that SmartEstimates correctly predict the sign of earnings surprises 66% of the time. In Section 4, we show that SmartEstimates combined with consensus revisions in the same direction have an even higher success rate of 74%, as shown in the summary table below. These results are consistent across sectors and capitalizations in both periods.

January 1998 to November 2008

Country/Region	FY1 EPS Surprise Prediction Success Rate ($IPS \geq 2\%$)	FY1 EPS Surprise Prediction Success Rate ($IPS \geq 2\%$) with Corroborating Revisions
U.S.	67%	77%
Canada	64%	74%
Developed Europe	66%	74%
Developed Asia ex-Japan	65%	75%
Japan	66%	69%
Emerging Markets	67%	75%
Global	66%	74%

December 2008 to November 2017

Country/Region	FY1 EPS Surprise Prediction Success Rate ($IPS \geq 2\%$)	FY1 EPS Surprise Prediction Success Rate ($IPS \geq 2\%$) with Corroborating Revisions
U.S.	63%	73%
Canada	61%	72%
Developed Europe	65%	73%
Developed Asia ex-Japan	66%	75%
Japan	66%	73%
Emerging Markets	71%	77%
Global	66%	74%

Summary Table: FY1 EPS surprise prediction success rate by region. When the FY1 EPS SmartEstimate diverges from the consensus by 2% or more, the signal successfully predicts the direction of the surprise two-thirds of the time. With a success rate of 74%, SmartEstimates are even more likely to correctly predict surprises when they are accompanied by corroborating revisions (revisions in the same direction as the Predicted Surprise).

2. SmartEstimate accuracy

In Table 1, we display the median error of the SmartEstimate and the consensus estimate for FY1 EPS in various global markets. The error metrics in Table 1 were obtained by comparing the reported EPS actual with the EPS estimate every month end throughout the entire fiscal period, in contrast with studies that consider only estimate data from one fixed time point, such as the day before the report. We measure error in two ways. To

measure the typical magnitude of error, we calculate the median absolute error of the consensus and SmartEstimate relative to the actual reported value. To gauge whether the estimates are typically too high or too low and by how much, we use the median bias (signed error) on the consensus or SmartEstimate relative to the actual reported value.

January 1998 to November 2008

Country/Region	Median Absolute Consensus Error ^a	Median Consensus Bias ^b	Median Absolute SmartEstimate Error ^a	Median SmartEstimate Bias ^b	Improvement with SmartEstimate ^c
U.S.	7.1%	-0.1%	6.9%	-0.1%	3.4%
Canada	14.2%	2.6%	13.6%	2.2%	5.0%
Developed Europe	12.3%	0.0%	11.6%	-0.1%	5.9%
Developed Asia ex-Japan	13.7%	1.4%	13.0%	1.0%	5.1%
Japan	22.2%	10.7%	20.8%	9.1%	6.9%
Emerging Markets	16.1%	3.6%	14.8%	2.9%	9.1%
Global	11.9%	1.1%	11.3%	0.8%	5.6%

December 2008 to November 2017

Country/Region	Median Absolute Consensus Error ^a	Median Consensus Bias ^b	Median Absolute SmartEstimate Error ^a	Median SmartEstimate Bias ^b	Improvement With SmartEstimate ^c
U.S.	6.6%	-0.7%	6.4%	-0.7%	2.5%
Canada	13.6%	2.8%	13.5%	2.6%	1.3%
Developed Europe	9.6%	0.2%	9.2%	0.0%	5.0%
Developed Asia ex-Japan	10.7%	2.7%	10.2%	2.1%	5.7%
Japan	13.4%	0.3%	12.8%	0.2%	4.7%
Emerging Markets	13.3%	5.7%	12.1%	4.6%	10.0%
Global	9.7%	0.5%	9.2%	0.4%	4.9%

Table 1: Comparison of median absolute error and median bias of the consensus estimate and the SmartEstimate for FY1 EPS in various global markets, January 1998 to November 2008 and December 2008 to November 2017. We also show the percent improvement in the median absolute error obtained with the SmartEstimate. The SmartEstimate has a smaller median absolute error than the consensus in every region for both periods considered.

Globally, the SmartEstimate provides a 5.6% reduction in median absolute error over the consensus for the period of January 1998 to November 2008 and 4.9% reduction for the period of December 2008 to November 2017. The SmartEstimate bias (signed error) is also smaller than the consensus bias in almost every region.

StarMine offers SmartEstimates for a number of financial measures besides earnings. In Table 2, we show the median absolute error for the consensus and SmartEstimates and the percent improvement offered by SmartEstimates for EPS and two other measures, Revenue and EBITDA. Consistent with the results in Table 1, the SmartEstimates for each of these measures are more accurate than the consensus, with the largest benefit achieved for Revenue.

a We define the median absolute error as the median of $|(\text{Consensus} - \text{Actual})|/\max(\text{min divisor}, |\text{Actual}|)$ or $|(\text{SmartEstimate} - \text{Actual})|/\max(\text{min divisor}, |\text{Actual}|)$ respectively for columns 1 and 3.

b We define the median bias (signed error) as the median of $(\text{Consensus} - \text{Actual})/\max(\text{min divisor}, |\text{Actual}|)$ or $(\text{SmartEstimate} - \text{Actual})/\max(\text{min divisor}, |\text{Actual}|)$ respectively for columns 2 and 4.

c We define the Improvement with SmartEstimate as the percent difference between the median absolute consensus error and the median absolute SmartEstimate error.

Median Absolute Consensus Error – January 1998 to November 2008

Country/Region	Revenue	EPS	EBITDA
U.S.	3.2%	7.1%	6.3%
Canada	4.9%	14.2%	7.2%
Developed Europe	4.2%	12.3%	7.9%
Developed Asia ex-Japan	6.7%	13.7%	13.5%
Japan	2.6%	22.2%	6.4%
Emerging Markets	8.5%	16.1%	15.0%
Global	4.0%	11.9%	8.6%

Median Absolute SmartEstimate Error – January 1998 to November 2008

Country/Region	Revenue	EPS	EBITDA
U.S.	2.9%	6.9%	6.1%
Canada	4.6%	13.6%	7.0%
Developed Europe	3.6%	11.6%	7.4%
Developed Asia ex-Japan	6.3%	13.0%	13.0%
Japan	2.2%	20.8%	6.2%
Emerging Markets	7.9%	14.8%	14.6%
Global	3.6%	11.3%	8.2%

Improvement with SmartEstimate – January 1998 to November 2008

Country/Region	Revenue	EPS	EBITDA
U.S.	8.2%	3.4%	3.5%
Canada	5.4%	5.0%	3.0%
Developed Europe	15.9%	5.9%	6.0%
Developed Asia ex-Japan	6.5%	5.1%	3.6%
Japan	14.9%	6.9%	3.5%
Emerging Markets	7.1%	9.1%	3.0%
Global	11.1%	5.6%	4.1%

Median Absolute Consensus Error – December 2008 to November 2017

Country/Region	Revenue	EPS	EBITDA
U.S.	2.1%	6.6%	5.2%
Canada	3.5%	13.6%	7.9%
Developed Europe	2.7%	9.6%	5.8%
Developed Asia ex-Japan	5.0%	10.7%	9.2%
Japan	2.1%	13.4%	6.0%
Emerging Markets	5.4%	13.3%	11.6%
Global	2.9%	9.7%	6.6%

Median Absolute SmartEstimate Error – December 2008 to November 2017

Country/Region	Revenue	EPS	EBITDA
U.S.	2.1%	6.4%	5.1%
Canada	3.5%	13.5%	7.7%
Developed Europe	2.4%	9.2%	5.5%
Developed Asia ex-Japan	4.6%	10.2%	8.9%
Japan	1.9%	12.8%	5.8%
Emerging Markets	4.8%	12.1%	11.0%
Global	2.7%	9.2%	6.4%

Improvement with SmartEstimate – December 2008 to November 2017

Country/Region	Revenue	EPS	EBITDA
U.S.	3.0%	2.5%	2.1%
Canada	2.2%	1.3%	2.7%
Developed Europe	9.7%	5.0%	5.4%
Developed Asia ex-Japan	8.4%	5.7%	3.3%
Japan	8.5%	4.7%	3.1%
Emerging Markets	11.9%	10.0%	5.7%
Global	7.1%	4.9%	3.3%

Table 2: Median absolute consensus error (top panel), median absolute SmartEstimate error (middle panel) and the improvement with the SmartEstimate (bottom panel) for FY1 estimates, for January 1998 to November 2008 and December 2008 to November 2017. The SmartEstimate is more accurate in every measure and region.

3. Using Predicted Surprise to anticipate earnings surprises

The Predicted Surprise is defined as the percent difference between the SmartEstimate and the consensus. We adjust for small consensus numbers in the denominator by placing a lower bound, or minimum divisor, on the absolute value of the consensus.

$$\text{Predicted Surprise} = \frac{(\text{SmartEstimate} - \text{Consensus})}{\text{Max}(\text{min divisor}, |\text{Consensus}|)}$$

We examine the Predicted Surprise at every month-end throughout the entire fiscal year in our analysis. Table 3 shows the percent of cases in which the Predicted Surprise accurately reflects the direction of earnings surprises across regions as a function of the magnitude of the signal.

January 1998 to November 2008

Country/Region	2% to 5%	5% to 10%	10% to 20%	>20%
U.S.	65%	67%	70%	74%
Canada	60%	65%	69%	74%
Developed Europe	63%	67%	71%	71%
Developed Asia ex-Japan	62%	66%	69%	75%
Japan	60%	65%	71%	78%
Emerging Markets	63%	69%	72%	75%
Global	62%	67%	71%	75%

December 2008 to November 2017

Country/Region	2% to 5%	5% to 10%	10% to 20%	>20%
U.S.	61%	64%	65%	68%
Canada	58%	63%	62%	67%
Developed Europe	63%	65%	69%	70%
Developed Asia ex-Japan	63%	68%	72%	72%
Japan	63%	66%	70%	76%
Emerging Markets	66%	72%	78%	81%
Global	63%	67%	71%	73%

Table 3: The percent of cases in which the Predicted Surprise correctly anticipated the direction of FY1 earnings surprises, as a function of the magnitude of the signal, across regions.

These statistics show that the Predicted Surprise accurately anticipates earnings surprises across regions, and that larger signals are in general more accurate. Globally, the Predicted Surprise has a success rate of 62% to 75% for the period of

January 1998 to November 2008 and of 63% to 73% for the period of December 2008 to November 2017, depending on the magnitude of the signal.

The ability of the Predicted Surprise to correctly predict the direction of the actual earnings surprises is also remarkably consistent across sectors and capitalizations in each region, as shown in Table 4. Significant Predicted Surprises ($\geq 2\%$ in

magnitude) accurately predict the direction of earnings surprises over 60% of the time (with a few exceptions) across all sectors, market caps and regions.

January 1998 to November 2008

	U.S.	Canada	Developed Europe	Developed Asia ex-Japan	Japan	Emerging Markets	Global
All Capitalizations and Sectors	67%	64%	66%	65%	66%	67%	66%
By Capitalization							
Large	67%	64%	67%	66%	66%	69%	67%
Mid	67%		66%				66%
Small	66%		65%	65%	67%	66%	66%
By Sector							
Energy	68%	64%	64%	62%	60%	65%	65%
Basic Materials	67%	64%	66%	65%	68%	68%	67%
Industrials	69%	64%	66%	66%	66%	67%	66%
Consumer Cyclical	67%	65%	66%	67%	66%	67%	66%
Consumer Non-Cyclical	66%	64%	66%	65%	63%	69%	66%
Financials	68%	62%	67%	64%	68%	68%	67%
Healthcare	66%	68%	67%	64%	64%	63%	65%
Technology	63%	64%	66%	67%	68%	70%	67%
Telecommunication Services	61%	61%	66%	63%	56%	67%	65%
Utilities	65%	57%	64%	66%	59%	63%	63%

December 2008 to November 2017

	U.S.	Canada	Developed Europe	Developed Asia ex-Japan	Japan	Emerging Markets	Global
All Capitalizations and Sectors	63%	61%	65%	66%	66%	71%	66%
By Capitalization							
Large	64%	61%	68%	67%	66%	70%	67%
Mid	65%		64%				64%
Small	62%		64%	65%	64%	71%	66%
By Sector							
Energy	64%	59%	67%	69%	62%	70%	66%
Basic Materials	66%	63%	67%	69%	65%	71%	67%
Industrials	63%	58%	65%	66%	67%	71%	67%
Consumer Cyclical	64%	62%	67%	72%	65%	73%	68%
Consumer Non-Cyclical	63%	67%	66%	70%	62%	72%	68%
Financials	61%	64%	62%	59%	63%	69%	63%
Healthcare	59%	62%	66%	64%	66%	73%	66%
Technology	64%	59%	66%	67%	69%	71%	67%
Telecommunication Services	62%	40% ^d	65%	67%	63%	69%	66%
Utilities	62%	61%	64%	66%	63%	65%	64%

Table 4: The earnings surprise prediction success rate by region, market cap and sector for Predicted Surprises with a magnitude $\geq 2\%$. Capitalization breakouts for each region are as follows: U.S.: Large (Top 500), Mid (Next 500), Small (Next 2,000); Developed Europe: Large (Top 500), Mid (Next 500), Small (Next 1,000); Canada: Large (Top 500); Developed Asia ex-Japan, Japan and Emerging Markets each use: Large (Top 500), Small (all else). Global values for capitalization breakouts include data from regions with applicable values.

^d For Telecommunication Services in Canada (Dec 2008 – Nov 2017) there are only 25 cases in which $IPSI \geq 2\%$ and the low hit rate of 40% is a reflection of poor statistics.

Significant Predicted Surprises on other financial measures also predict actual surprises. In Table 5, we display the surprise prediction success rate for Revenue, EPS and EBITDA in the

various global markets. We see that Predicted Surprises of at least 2% in magnitude generally have the highest success rate with Revenue, followed by EPS and EBITDA.

January 1998 to November 2008

Country/Region	Revenue	EPS	EBITDA
U.S.	73%	67%	66%
Canada	66%	64%	65%
Developed Europe	70%	66%	66%
Developed Asia ex-Japan	64%	65%	61%
Japan	79%	66%	67%
Emerging Markets	64%	67%	59%
Global	70%	66%	64%

December 2008 to November 2017

Country/Region	Revenue	EPS	EBITDA
U.S.	66%	63%	63%
Canada	64%	61%	62%
Developed Europe	68%	65%	66%
Developed Asia ex-Japan	69%	66%	63%
Japan	74%	66%	67%
Emerging Markets	71%	71%	65%
Global	69%	66%	65%

Table 5: The FY1 surprise prediction success rate by measure and region. Success rates shown are for significant Predicted Surprises (i.e., with magnitudes $\geq 2\%$).

4. Combining Predicted Surprise and consensus revision

When Predicted Surprises are accompanied by revisions to the consensus of the same sign, i.e. positive (negative) Predicted Surprises accompanied by an upwards (downwards) revision to the consensus estimate, the surprise prediction success rate is considerably higher than the case without revision, or contradictory revisions. For cases in which the direction (positive or negative) of the Predicted Surprise is corroborated by the

direction of the 30-day change in the consensus, the earnings surprise prediction success rate is 74% globally for both periods studied. In the absence of supporting revisions to the consensus, the global success rate is 59% and 56% for the periods of January 1998 to November 2008 and December 2008 to November 2017, respectively.

January 1998 to November 2008

Country/Region	FY1 EPS Surprise Prediction Success Rate (PSI ≥ 2%) with Corroborating Revisions	FY1 EPS Surprise Prediction Success Rate (PSI ≥ 2%) with NO Corroborating Revisions
U.S.	77%	53%
Canada	74%	52%
Developed Europe	74%	55%
Developed Asia ex-Japan	75%	56%
Japan	69%	65%
Emerging Markets	75%	61%
Global	74%	59%

December 2008 to November 2017

Country/Region	FY1 EPS Surprise Prediction Success Rate (PSI ≥ 2%) with Corroborating Revisions	FY1 EPS Surprise Prediction Success Rate (PSI ≥ 2%) with NO Corroborating Revisions
U.S.	73%	49%
Canada	72%	48%
Developed Europe	73%	54%
Developed Asia ex-Japan	75%	54%
Japan	73%	54%
Emerging Markets	77%	64%
Global	74%	56%

Table 6: The earnings surprise prediction success rate for |Predicted Surprise| ≥ 2% conditional on corroborating revisions to the consensus, by region. Across regions, the success rate is higher for the cases with corroborating revisions over the last 30 days, as compared to cases without supporting revisions.

5. Conclusions

We studied the SmartEstimate performance across two periods, January 1998 to November 2008 and December 2008 to November 2017. Since the SmartEstimate algorithm has remained unchanged since 1999 when it was developed based on U.S. EPS estimates, the results for the first period of the study are mostly out-of-sample, and for the second period are completely out-of-sample. Remarkably, almost 20 years later, its value at predicting actual surprises remains strong in all global markets among earnings and other financial measures. SmartEstimates are more accurate than the consensus across regions and various financial measures in terms of their error from the reported actual. When the EPS SmartEstimate differs from the consensus estimate by more than 2%, it correctly predicts the direction of the actual reported earnings surprises 66% of the time for both periods considered. The surprise prediction success rate is also significantly greater than 50% for Revenue and EBITDA, and there was very little variation from one period to the next for these financial measures.

6. References

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