

Forecast Accuracy by Tax Category: Do Perceptual Forecasts Increase Accuracy?

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Introduction:

- Recently empirical examinations of forecasting strategies have been published.
- There seems to have been a broad perception that various judgmental approaches resulted in better forecasts than statistical models alone.
- The revenue forecasting process in Nebraska has elements of both statistical and judgmental forecasts.
- These are some (very) preliminary results.

Introduction:

- In Nebraska, forecasts are developed using a “Delphi-Lite” approach.
- The Nebraska Economic Forecasting Advisory Board is a nine-member board tasked with making an advisory forecast of tax revenues.

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 - The agencies use the same US macro forecasts for the driver variables.
 - The agencies each produce two forecasts using two forecast services

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 - Each agency presents its forecasts to the Board and answers questions.
 - The Board members discuss the forecasts, and current economic conditions.
 - The Board forecasts net Sales and Use, Individual Income, Corporate Income, Miscellaneous, and total net revenue for each fiscal year of the relevant forecast horizon, and if necessary, revisits forecasts by tax category.

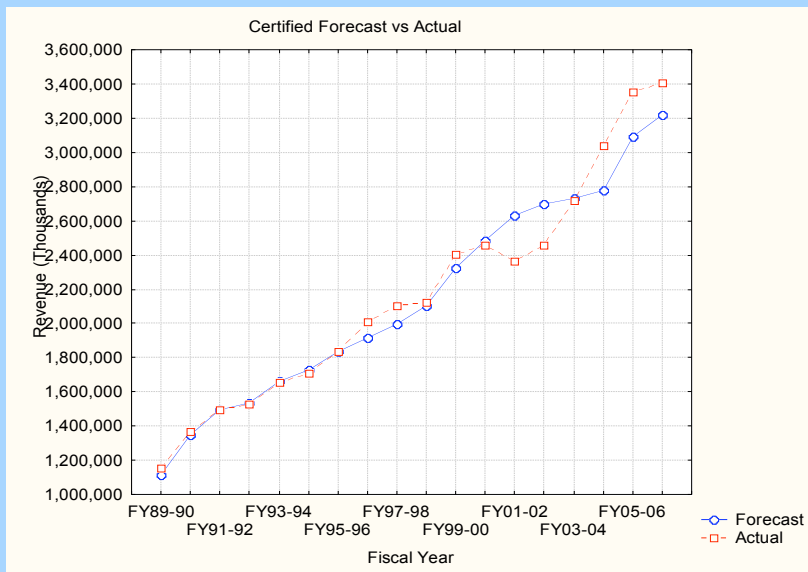
Introduction:

- This general approach has been used since 1985; however, it has been subject to some modifications. Forecasts are fairly consistent from FY1989-90 onward.

Forecast Results

**PERFORMANCE OF NEFAB ORIGINAL CONSENSUS FORECASTS
FY89-90 TO FY06-07 (\$1,000s)**

FISCAL YEAR	NEFAB TOTAL NET REVENUE FORECAST	TOTAL NET REVENUE ACTUAL	DIFFERENCE BETWEEN FORECAST & ACTUAL	PERCENT ERROR BETWEEN FORECAST & ACTUAL
FY89-90	1,110,883	1,152,710	41,827	3.77%
FY90-91	1,345,558	1,367,077	21,519	1.60%
FY91-92	1,495,503	1,492,355	-3,148	-0.21%
FY92-93	1,537,264	1,524,662	-12,602	-0.82%
FY93-94	1,662,548	1,653,752	-8,796	-0.53%
FY94-95	1,729,902	1,705,490	-24,412	-1.41%
FY95-96	1,834,289	1,836,741	2,452	0.13%
FY96-97	1,917,983	2,009,604	91,621	4.78%
FY97-98	1,993,835	2,105,451	111,616	5.60%
FY98-99	2,102,910	2,123,869	20,959	1.00%
FY99-00	2,326,348	2,403,925	77,577	3.33%
FY00-01	2,480,701	2,456,862	-23,839	-0.96%
FY01-02	2,631,848	2,365,509	-266,339	-10.12%
FY02-03	2,694,851	2,456,400	-238,451	-8.85%
FY03-04	2,731,975	2,718,727	-13,248	-0.48%
FY04-05	2,775,479	3,037,194	261,715	9.43%
FY05-06	3,092,258	3,352,188	259,930	8.41%
FY06-07	3,216,895	3,408,332	191,437	5.95%
FY07-08	3,389,186			
Average Error (Absolute Value)				3.74%



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- Research indicates that adding judgment or “domain knowledge” to a statistical forecast, the judgment will improve forecast accuracy.

Question: Do the Board Forecasts Improve Accuracy of the Forecast?

- Does adding judgment or “domain knowledge” to a statistical forecast improve forecast accuracy?
- If the Board’s forecasts are more accurate than the agencies’ statistical forecasts, the Board forecasts will have a lower Mean Squared Error (MSE) than the agencies’ forecasts.

Forecast Results:

Comparison of Forecasts: Total Net Revenue

Mean of all Agency Forecasts Presented to Forecasting Board and Certified Board Forecast

(Thousand Dollars)

FISCAL YEAR	AGENCY MEAN	CERTIFIED TOTAL	TOTAL NET	ROOT Mean Squared Error	
	FORECAST TOTAL NET REVENUE	NET REVENUE FORECAST	REVENUE ACTUAL	AGENCY MEAN	CERTIFIED
FY2006-2007	3,213,962	3,216,895	3,408,332	194,370	191,437
FY2005-2006	3,094,414	3,092,258	3,352,188	257,774	259,930
FY2004-2005	2,826,674	2,775,479	3,037,194	210,521	261,715
FY2003-2004	2,732,708	2,731,975	2,718,727	13,980	13,248
FY2002-2003	2,612,298	2,593,526	2,456,400	155,898	137,126
FY2001-2002	2,632,061	2,631,848	2,365,509	266,553	266,339
FY2000-2001	2,489,848	2,480,701	2,456,862	32,986	23,839
FY1999-2000	2,333,999	2,326,348	2,403,925	69,926	77,577
FY1998-1999	2,105,911	2,102,911	2,123,869	17,959	20,958
FY1997-1998	1,991,987	1,993,835	2,105,451	113,465	111,616
FY1996-1997	1,917,983	1,917,983	2,009,604	91,622	91,621
FY1995-1996	1,804,435	1,817,000	1,836,741	32,306	19,741
FY1994-1995	1,713,779	1,729,902	1,705,490	8,289	24,412
FY1993-1994	1,670,077	1,662,549	1,653,752	16,325	8,797
FY1992-1993	1,519,817	1,520,500	1,524,662	4,845	4,162
FY1991-1992	1,509,925	1,495,000	1,492,355	17,570	2,645
FY1990-1991	1,354,527	1,345,558	1,367,077	12,550	21,519
FY1989-1990	1,114,715	1,110,883	1,152,710	37,995	41,827
SUM ROOT MSE				1,554,931	1,578,509

Forecast Results:

- The sum of the MSE is lower for the Agencies' forecasts, which implies that the Board did not add directly to the accuracy of the total net revenue forecast over the FY1989-90 to FY2006-07 period.
- What about the MSE of the forecasts by tax category?

Forecast Results:

- MSE for the other components of the revenue forecast.

- The MSE of the average of the four agency forecasts only beat the Board on in one tax category.
- The Board is better on everything but Sales & Use tax, the tax with the least variable base.
- There appears to be a limit to the benefits of judgment.

Comparison of Sum of Root Mean Squared Error:

Certified Forecasts FY1989-90 - FY2006-07

Forecast Tax Category	Mean Agency Forecasts	Board Forecast
Total Net Revenue	1,554,931	1,578,509
Sales & Use Tax	327,682	345,553
Individual Income	1,109,131	1,105,181
Corporate Income	320,041	306,204
Miscellaneous	268,916	250,061

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- One problem is the impact of legislation on the “certified forecast.”
 - The Board sets a forecast, and the final forecast is modified to account for new legislation through the fiscal note process.
 - Therefore the certified forecast for the current fiscal year, is a collaboration between the Board and the agencies.
- The October forecast does not have the adjustment problem, as all new legislation is accounted for in this forecast.

October Forecast Results:

**Comparison of Sum of Root Mean Squared Error: October Forecasts
FY1989-90 through FY2006-07**

Forecast Tax Category	Mean All Agency	Mean LFO-NDR Primary	Mean LFO-NDR Secondary	Mean NDR	Mean LFO	Board Forecast
Total Net Revenue	1,025,024	1,053,676	1,001,073	950,615	1,107,098	1,030,320
Sales & Use Tax	264,495	280,362	264,818	282,628	247,516	283,404
Individual Income	755,072	766,254	746,281	672,225	839,983	736,986
Corporate Income	241,523	240,031	240,031	236,298	266,873	239,847
Miscellaneous	189,405	184,675	181,230	182,926	197,912	151,452

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Forecast Tax Category	Mean Agency Forecasts	Board Forecast
Total Net Revenue	1,025,024	1,030,320
Sales & Use Tax	264,495	283,404
Individual Income	755,072	736,986
Corporate Income	241,523	239,847
Miscellaneous	189,405	151,452

Final Thoughts:

- Benefit of the Board in forecasting process also has an indirect benefit. The Board *tends* to reduce the effect of politics on the forecast.
- Can a relationship between the predictability of the forecasted series and the benefit of judgment be quantified?

Thank You