

**Consensus Revenue Estimating Conference
Forecast Errors - Total Tax Receipts**

Fiscal Year	Initial Forecast	Before Session	After Session	Last Forecast	1% Error = \$mm
1989	-18.2%	-16.1%	-6.3%	-3.1%	\$45.6
1990	-14.2%	-12.8%	-3.5%	-0.7%	\$46.2
1991	-11.2%	-10.1%	-1.5%	0.2%	\$49.2
1992	-4.2%	1.9%	1.0%	-2.0%	\$48.4
1993	-13.9%	-15.1%	-2.5%	-2.3%	\$54.1
1994	-3.3%	-3.3%	-3.1%	-0.6%	\$56.1
1995	-16.7%	-15.6%	-5.3%	-4.1%	\$61.0
1996	-7.5%	-4.8%	-4.8%	-3.2%	\$63.9
1997	-14.9%	-13.1%	-6.6%	-1.1%	\$67.0
1998	-4.7%	-4.0%	-3.9%	-1.8%	\$68.4
1999	-5.9%	0.8%	1.6%	1.6%	\$67.9
2000	-3.9%	-0.3%	-1.8%	-1.1%	\$72.4
2001	-14.2%	-10.8%	-7.7%	-4.2%	\$80.6
2002	-4.9%	-2.7%	-1.4%	-0.5%	\$79.7
2003	-9.0%	-8.4%	-8.4%	-0.4%	\$79.0
2004	-5.4%	-5.1%	-2.9%	-0.5%	\$83.1
2005	-13.1%	-9.6%	-6.3%	-2.6%	\$92.2
2008	-14.3%	-13.1%	-7.0%	-1.9%	\$120.5
2009	-0.9%	3.6%	-0.2%	-0.3%	\$111.6
2010	12.3%	10.4%	7.5%	0.9%	\$89.2
2011	2.2%	-1.0%	0.7%	-0.2%	\$95.4
2012	0.0%	1.2%	-0.1%	-2.1%	\$99.4
2013	0.4%	-2.7%	-3.7%	-2.1%	\$102.3
2014	-2.1%	-0.8%	0.1%	0.1%	\$103.0
2015	0.8%	1.6%	-0.7%	0.2%	\$104.7
2016	3.5%	1.4%	8.3%	2.8%	\$104.0
2017	-6.5%	-2.3%	0.8%	-1.2%	\$119.4
2018	-3.2%	-2.1%	-2.5%	-2.5%	\$123.7
2019	-12.1%	-9.3%	-5.3%	-4.0%	\$126.4
<u>Excluding Fiscal Years 2006 & 2007 (Storm Aftermath Years)</u>					
MAPE	7.7%	6.3%	3.4%	1.7%	\$83.3
<u>Hurricanes Katrina & Rita Aftermath Fiscal Years</u>					
2006	-13.9%	-10.2%	-19.1%	-8.4%	\$100.3
2007	-26.1%	-23.5%	-9.5%	-8.8%	\$116.9
<u>All REC Years Above</u>					
MAPE	8.5%	7.0%	4.1%	2.1%	\$84.9
Under-Forecasts	25 of 31, 81%	24 of 31, 77%	24 of 31, 77%	25 of 31, 81%	{negative errors}
Over-Forecasts	6 of 31, 19%	7 of 31, 23%	7 of 31, 23%	6 of 31, 19%	{positive errors}

MAPE = Mean Absolute Percent Error, the average error of the forecasts without regard to whether errors were over or under forecasts.

Initial Forecast: First forecast that brings that fiscal year into the 2-year budget horizon. As much as a year before that fiscal year starts.

Before Session: Last forecast before any session actions for that fiscal year are included. Commonly referred to as the "May REC", but not always held in May.

After Session: First forecast after the session where session actions for that fiscal year are included. Meeting date can range from summer to late fall.

Last Session: Last forecast for that fiscal year. Commonly referred to as the "May REC" but, not always held in May.

Actual: The collections that actually occurred for that fiscal year.

Consensus Revenue Estimating Conference Forecast Errors - State General Fund Direct

Fiscal Year	Initial Forecast	Before Session	After Session	Last Forecast	1% Error = \$mm
1989	-23.3%	-14.2%	-7.0%	-3.7%	\$43.4
1990	-10.3%	-9.1%	1.0%	-1.3%	\$41.6
1991	-13.4%	-11.8%	-2.6%	-0.2%	\$42.3
1992	-1.1%	7.1%	5.6%	2.6%	\$39.0
1993	-10.6%	-10.8%	-1.5%	-2.3%	\$42.8
1994	-1.8%	-1.8%	0.4%	-0.1%	\$43.3
1995	-16.1%	-15.5%	-3.5%	-2.2%	\$47.8
1996	-7.7%	-4.6%	-6.3%	-3.6%	\$51.6
1997	-19.2%	-17.4%	-7.1%	-1.4%	\$56.6
1998	-5.0%	-3.8%	-3.9%	-1.8%	\$57.8
1999	-5.8%	1.7%	1.8%	1.8%	\$57.0
2000	0.4%	2.9%	-1.0%	-1.1%	\$58.5
2001	-14.6%	-10.9%	-7.1%	-3.7%	\$65.3
2002	-2.5%	-1.9%	-0.2%	0.1%	\$64.5
2003	-7.3%	-7.1%	1.7%	0.1%	\$64.0
2004	-4.6%	-4.2%	-3.4%	-0.4%	\$67.7
2005	-11.4%	-7.7%	-5.7%	-3.1%	\$73.9
2008	-14.9%	-14.1%	-7.6%	-1.7%	\$101.7
2009	-1.2%	3.4%	-0.3%	-0.5%	\$93.9
2010	14.2%	12.3%	9.6%	1.5%	\$71.8
2011	3.5%	-0.4%	1.0%	0.2%	\$77.5
2012	1.6%	2.5%	0.0%	-2.5%	\$80.7
2013	1.6%	-2.1%	-3.7%	-2.1%	\$82.8
2014	0.0%	1.9%	1.5%	1.5%	\$81.9
2015	2.5%	3.3%	-0.3%	0.9%	\$84.1
2016	10.4%	8.9%	12.1%	4.0%	\$79.0
2017	-4.7%	0.8%	2.1%	-1.5%	\$94.3
2018	-4.5%	-2.9%	-3.0%	-3.0%	\$98.9
2019	-14.3%	-10.9%	-5.9%	-4.8%	\$100.4
<u>Excluding Fiscal Years 2006 & 2007 (Storm Aftermath Years)</u>					
MAPE	7.9%	6.7%	3.7%	1.9%	\$67.7
<u>Hurricanes Katrina & Rita Aftermath Fiscal Years</u>					
2006	-14.5%	-12.4%	-24.1%	-9.9%	\$83.0
2007	-31.5%	-24.7%	-8.2%	-10.6%	\$96.8
<u>All REC Years Above</u>					
MAPE	8.9%	7.5%	4.5%	2.4%	\$69.2
Under-Forecasts	23 of 31, 74%	21 of 31, 68%	20 of 31, 65%	22 of 31, 71%	{negative errors}
Over-Forecasts	8 of 31, 26%	10 of 31, 32%	11 of 31, 35%	9 of 31, 29%	{positive errors}

MAPE = Mean Absolute Percent Error, the average error of the forecasts without regard to whether errors were over or under forecasts.

Initial Forecast: First forecast that brings that fiscal year into the 2-year budget horizon. As much as a year before that fiscal year starts.

Before Session: Last forecast before any session actions for that fiscal year are included. Commonly referred to as the "May REC", but not always held in May.

After Session: First forecast after the session where session actions for that fiscal year are included. Meeting date can range from summer to late fall.

Last Session: Last forecast for that fiscal year. Commonly referred to as the "May REC" but, not always held in May.

Actual: The collections that actually occurred for that fiscal year.

Consensus Revenue Estimating Conference Forecast Errors

Forecast Error Table

The tables above display forecast errors of the Consensus Revenue Estimating Conference (REC) for total tax receipts and for funds available for direct state general fund appropriation. Since its inception, the REC has considered forecasts for the 31 complete fiscal years of 1989 through 2019¹. The forecast error as a percent of actual collections is displayed for each completed fiscal year for forecasts made at four stages of the budget cycle, and these errors are summarized from inception, as well as exclusive of the two years most heavily affected by hurricanes Katrina and Rita, FY 2006 and FY 2007. Forecast errors for each fiscal year are presented as the simple percentage of error, where under-forecasts have negative signs (forecasts were less than actual collections) and over-forecasts have positive signs (forecasts were greater than actual collections).

These annual errors are summarized over the entire thirtyone-years of the REC and the twenty-nine years excluding FYs 2006 & 2007 with the mean absolute percent error (MAPE), a measure of error where the sign of the error is not considered^{2 & 3}. The dollar equivalent of a 1% forecast error is shown for each year and each of the two groupings of years, and finally, the share of under/over-forecasts are summarized for the entire period. Forecast performance over the REC history is depicted visually at the end of this writeup.

Forecasts Evaluated

The REC may make numerous forecasts for any particular fiscal year, but forecasts made at four stages of the budget process were chosen for evaluation because they are the most meaningful ones the REC makes from the perspective of its role in the budget process⁴.

- a) The initial forecast establishes the first forecast of a particular fiscal year (once that year becomes one of the two immediate fiscal years that is the typical focus of the budget construction process). This could be as much as eighteen months in advance of the start of a fiscal year, but in recent years has typically been done in the fall preceding the start of the fiscal year. This has also typically been the first forecast used in the construction of the executive budget proposal.
- b) The before-session forecast establishes the latest forecast before enactment of each year's budget. Legislative adjustments to the executive proposal are made on the basis of this forecast, and in recent years this forecast has typically been made during the legislative session, in mid-May after preliminary income tax collections from April are known.
- c) The after-session forecast incorporates session actions that are expected to affect revenue collections. The REC statutory provisions call for this forecast to occur no later than August 15 of each year, and in the early years of the REC a meeting was typically held by that date. In later years the REC has tended to incorporate session actions into overall base revisions made at a meeting typically held in the fall of the year, unless large session actions need to be adopted prior to enactment of an appropriations bill.
- d) The last forecast is the last base revision of a particular fiscal year. The dates of this meeting can range throughout the second half of the fiscal year, but have typically been in conjunction with the before-session forecast for the ensuing

Consensus Revenue Estimating Conference Forecast Errors

fiscal year (mid-May). This forecast may be used to adopt supplemental appropriations near the end of the current fiscal year.

Errors Decline Over The Forecast Cycle

As can be seen in the tables above and in the visual charts below, annual forecasting errors can vary widely, both on a year-to-year basis and throughout the budget cycle for a particular year. With respect to forecasts of total tax receipts, in all but two years (FYs 2012 and 2013), errors declined from the initial forecast to the last forecast. With respect to estimates of general fund revenue, in all years, errors declined from the initial forecast to the last forecast. The occurrence of smaller errors near the end of a forecast cycle is to be expected as more information about events affecting collections as well as the collections themselves is accumulated during a forecast cycle. The table indicates that, on average, nearly half of the error in the before-session forecasts is eliminated in the after-session forecasts⁵. Bills changing taxes and dedicating tax revenue enacted almost every legislative session tend to be the most significant events affecting revenue collections, and forecast error typically becomes significantly smaller once these actions are accounted for. On average, nearly half of the after-session error is eliminated by the last-forecast as additional actual collections performance is incorporated. This error pattern is depicted visually at the end of this write-up.

Under-Forecast Bias

A tendency that is reflected in the table above and charts below is the preponderance of under-forecasts made since inception of the REC. For the thirtyone complete years of REC forecasts, 81% (25 of 31) of the initial forecasts and 77% (24 of 31) of the before-session forecasts were under-forecasts, when considering forecasts of total tax receipts. By the time the after-session and last forecast were made each year this under-forecast bias had not changed much with under-forecasts occurring 77% (24 of 31) and 81% (25 of 31), respectively. A similar but somewhat lower tendency to under-forecast is also exhibited when considering estimates of net general fund receipts. Considering estimates of net general fund revenue, 65% - 74% of all forecasts have been under-forecasts.

Asymmetric Cost of Forecast Errors

In the early years of the REC process this tendency to under-forecast was likely due to the recent memories of the oil-bust years of 1982 – 1986. In fact, the REC process was implemented, in part, as a response to the large deficits and budget disruptions of those years. Persistence of an under-forecast bias in later years of the REC process is probably better understood in terms of the different costs imposed by under-forecasts versus over-forecasts. An under-forecast does not preclude actual receipt and expenditure of state revenues, and is thus a less costly forecast error. A delay may occur in the ability to utilize excess collections or an ultimate surplus, but actual revenue collections occur regardless of the forecast and are ultimately available for expenditure. However, an over-forecast cannot make revenue available that is not collected. Once budgets are established on the basis of the forecast in place, a shortfall in forecasted collections must be addressed, typically by substituting other means-of-finance to support planned expenditures as well as absolutely reducing planned expenditures. In addition, the later in the fiscal year a shortfall is acknowledged, the more difficult it is to deal with, especially

Consensus Revenue Estimating Conference Forecast Errors

by absolute expenditure reductions alone. Thus, over-forecasts can be more disruptive to governmental budgeting and service provision, and are thus a more costly forecast error. The forecasters and REC members are aware of these consequences, and tend to make forecasts that are reasonably anticipated to be attained during the fiscal year. While the strict technical goal of forecasting may be to achieve forecasts that are as accurate as possible each and every year, this is a compelling goal only in the abstract, where the purposes for which the forecasts are being made, annual budgeting of ongoing governmental service provision, are ignored. It is preferable for forecast errors to be as small as possible, but a 0% average error would occur only with comparable over-forecast and under-forecast years⁶. Given that over-forecasts are more costly in terms of disruption of the ultimate purpose of the forecasts (the budgeting and provision of governmental services), it is understandable that under-forecasts tend to dominate the REC performance.

Under-Forecast Bias Shift

It should be noted that there has been a distinct reduction in the under-forecast bias in the years after FY 2006 & FY 2007, the forecast years most heavily affected by hurricanes Katrina and Rita, compared to the years before the storms, FY 1989 through FY 2005. For forecasts of total tax receipts, during the period FY 1989 through FY 2005, the prevalence of under-forecasts was 100% for the initial forecasts, then 88% for all three of the subsequent forecasts for each of these years. This contrasts with the latter period of FY 2008 through FY 2019, when the prevalence of under-forecasts was only 50% for the initial forecast, 58% for both the before-session and after-session forecasts, and then 67% for the last forecast. A similar distinct step-down in the prevalence of under-forecasts exists with respect to estimates of net general fund revenue between these two periods, as well. Of particular note here is the fact that, in this latter period, and with respect to estimates of general fund revenue, a minority of the first two forecasts for a year were under-forecasts, while the last two forecasts of the year tended to be an under-forecast (42% of initial and before-session forecasts, 50% of after-session forecasts, and 58% of last forecasts). This shift in under-forecast bias, especially with respect to estimates of net general fund revenue, has certainly been reflected in numerous downward mid-year forecast adjustments that occurred in this latter period. This shift in bias can be seen visually in the REC historical charts at the end of this writeup, where the actual collections line generally lies above the forecast lines in the pre-storms era and lies amid the forecast lines in the post-storm era. It can also be seen in the charts that the last two years of revenue collections over forecast, FYs 2018 and 2019, may be changing the under-forecast bias back toward the prevalence that was exhibited prior to the 2005 hurricanes.

Absolute Forecast Accuracy Improvement

As a consolation to forecasting, it is also interesting to note that between these two periods, pre-storms and post-storms, overall forecast error also fell distinctly. For forecasts of total tax receipts, during the period FY 1989 through FY 2005, forecast MAPE averaged 9.7% for the initial forecasts, 7.9% for before-session forecasts, 3.6% for after-session forecasts, and 1.8% for last forecasts. This contrasts with the latter period of FY 2008 through FY 2019, when forecast MAPE averaged only 4.9% for the

Consensus Revenue Estimating Conference Forecast Errors

initial forecasts, 4.1% for before-session forecasts, 3.1% for after-session forecasts, and 1.5% for last forecasts. Thus, while under-forecast bias declined, the overall absolute accuracy of total tax forecasts has improved.⁷ A step-down in forecast MAPE also exists with respect to estimates of net general fund revenue between these two periods, for the initial forecast and before-session forecast, while the errors for the after-session and last forecasts are actually somewhat higher. For the early period, forecast MAPE averaged 9.1% for the initial forecasts, 7.8% for before-session forecasts, 3.5% for after-session forecasts, and 1.8% for last forecast, contrasting with lower errors in the latter period of forecast MAPEs of 6.1% for initial forecasts and 5.3% for before-session, but higher errors of 3.9% for after-session, and 2.0% for last forecasts. This bifurcated performance with respect to net general fund revenue is unfortunate, and is exacerbated by the large under-forecasts experienced in the last two years, FYs 2018 and 2019, largely attributable to state and federal tax law changes that have been difficult to incorporate accurately into the revenue forecasts. It is hoped that forecast accuracy will improve as the effect of these tax law changes becomes fully realized into a new normal baseline of tax collections.

Dollar Equivalent of 1% Error Increases Over Time

Finally, the far-right columns of the tables display the dollar equivalent of a 1% forecast error each year since inception of the REC, and the average value for the two multi-year groupings. This column points out the increase in that dollar equivalent over time. Growing by 177% since inception of the REC, from \$45.6 million of total tax receipts for FY 1989 to \$126.4 million for FY 2019. The 1% dollar equivalent of general fund has grown by 131% since REC inception, from \$43.4 million to \$100.4 million. Growth in the absolute value of forecast error occurs because the state tax revenue base grows over time, reflecting the overall economic growth of the state. Even if forecast errors were the same each year and were very small (1% for example), the dollar equivalent of that error gets larger and larger as the economy and tax base grows. Thus, the nominal budgetary consequences of forecast error will get larger and larger, even if forecast errors themselves are fairly small.

¹ Since its inception, the REC has met approximately 3 to 4 times per year to consider forecasts for the two immediate fiscal years that are the primary focus of the budget process, the current fiscal year and the ensuing fiscal year. Forecasts for the three following fiscal years are also considered.

² The mean absolute percent error (MAPE) averages the absolute value of the percentage errors for all the years of each of the two periods (all years from REC inception, and all years excluding the Katrina/Rita storm years of FY 2006 & FY 2007). It reflects absolute forecast error without regard to whether errors are under-forecasts or over-forecasts. The MAPE is a better measure of forecast error than a simple average percent error because the positive and negative signs of individual errors work to offset each other in a simple average, resulting in a lower measure of error than is truly the case.

³ The total tax receipt concept is actually the more appropriate concept for evaluating forecasting performance. Although the budget process tends to focus on the state general fund direct concept, the REC does not actually directly forecast state general fund revenue. The forecasting effort is directed toward the various components of total tax receipts, with the general fund estimate being

Consensus Revenue Estimating Conference Forecast Errors

the residual after formulaic deductions from the total tax forecasts for numerous statutory and constitutional dedications of tax receipts. Actual allocations to these dedications are determined by accounting and budgeting requirements that are not forecastable relationships between the underlying economy and the tax revenue attributable to it.

⁴ The Conference's statutory provisions provide for meetings at least quarterly, by October 15, January 1, the third Monday in March, and August 15. In practice, the typical REC meeting schedule has evolved to a meeting in the late fall (November/December), mid-session (April/May), by September 30 (also in law to adopt the Workforce Commission's unemployment compensation fund balance projection for setting annual unemployment compensation tax rates and benefits), and any other time as necessary. Meetings between the fall and mid-session, as well as even later in the session can also occur.

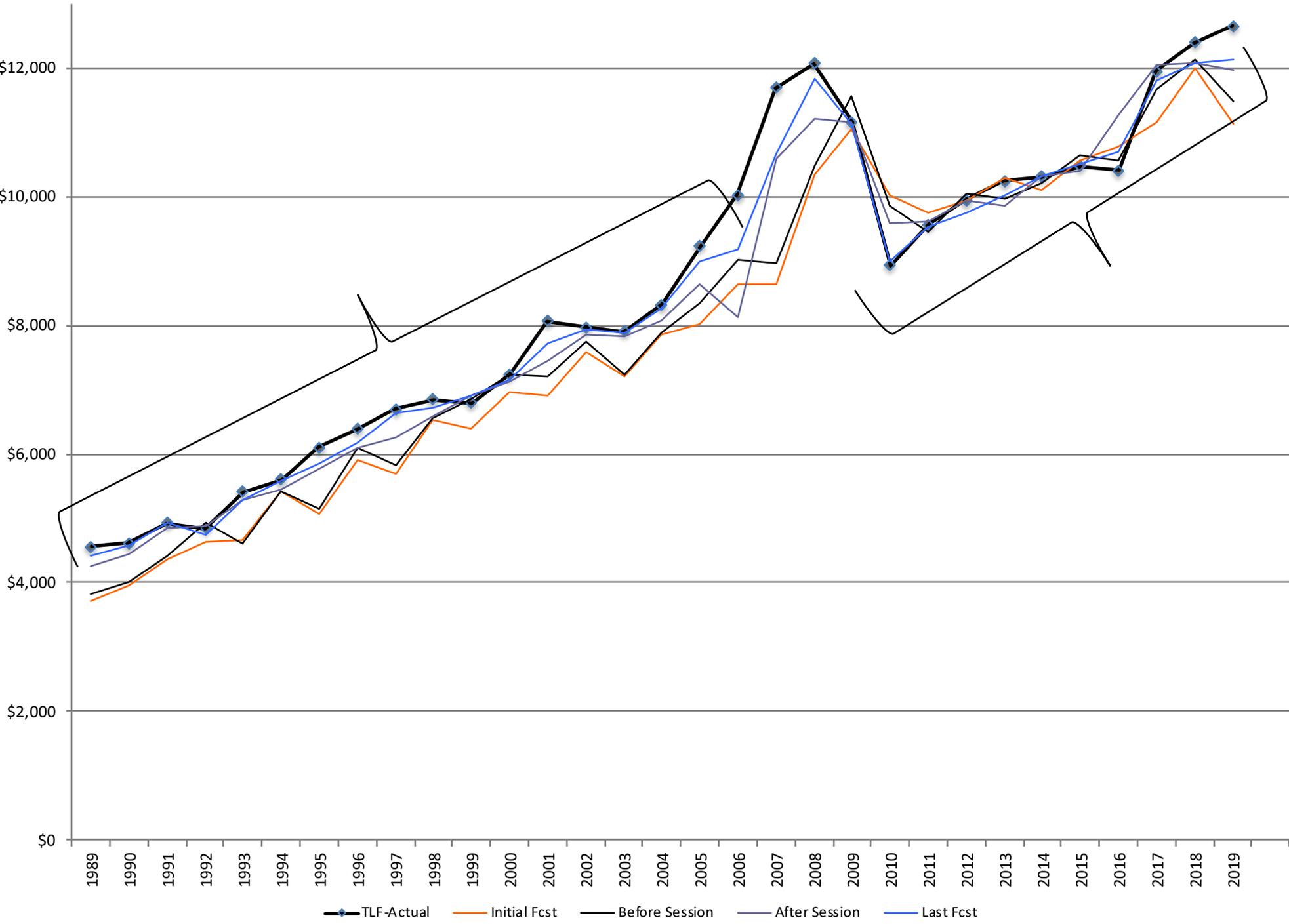
⁵ A number of the forecasts that first incorporate session actions also incorporate some actual collections experience (typically one quarter of collections). Thus, on average, some of this error reduction is attributable to this fact and not strictly to the incorporation of session actions alone. However, apart from the storms heavily affecting 2006 & 2007 and economic business cycles, session actions constitute the most frequent and important events influencing revenue forecasts and collections between the before-session forecast and the after-session forecast.

⁶ Under-forecasts may still be consequential for a number of reasons. Were forecasts more accurate, these funds could have been allocated to some purpose at an earlier date. In addition, the initial allocation of excess collections is generally at the initiative of the governor, where later changes to these initial proposed uses by the legislature implies "taking" the promised funds from a use or project that anticipates them. Finally, end-of-year surplus balances become officially designated as nonrecurring by the REC and can only be allocated to Constitutionally prescribed uses, generally capital outlay or debt reduction. Flexibility or discretion in their use is not eliminated but is limited.

⁷ There is no formal or official standard for forecasting accuracy. Through many discussions with state revenue forecasters over the years, a 2% error seems to be the typical standard that most apply to their own work. Individual revenue sources can have significantly higher typical errors depending on their own characteristics but a 2% error goal for overall revenue forecasts is typical.

REC Total Tax Forecasts Relative To Actuals, Over REC History

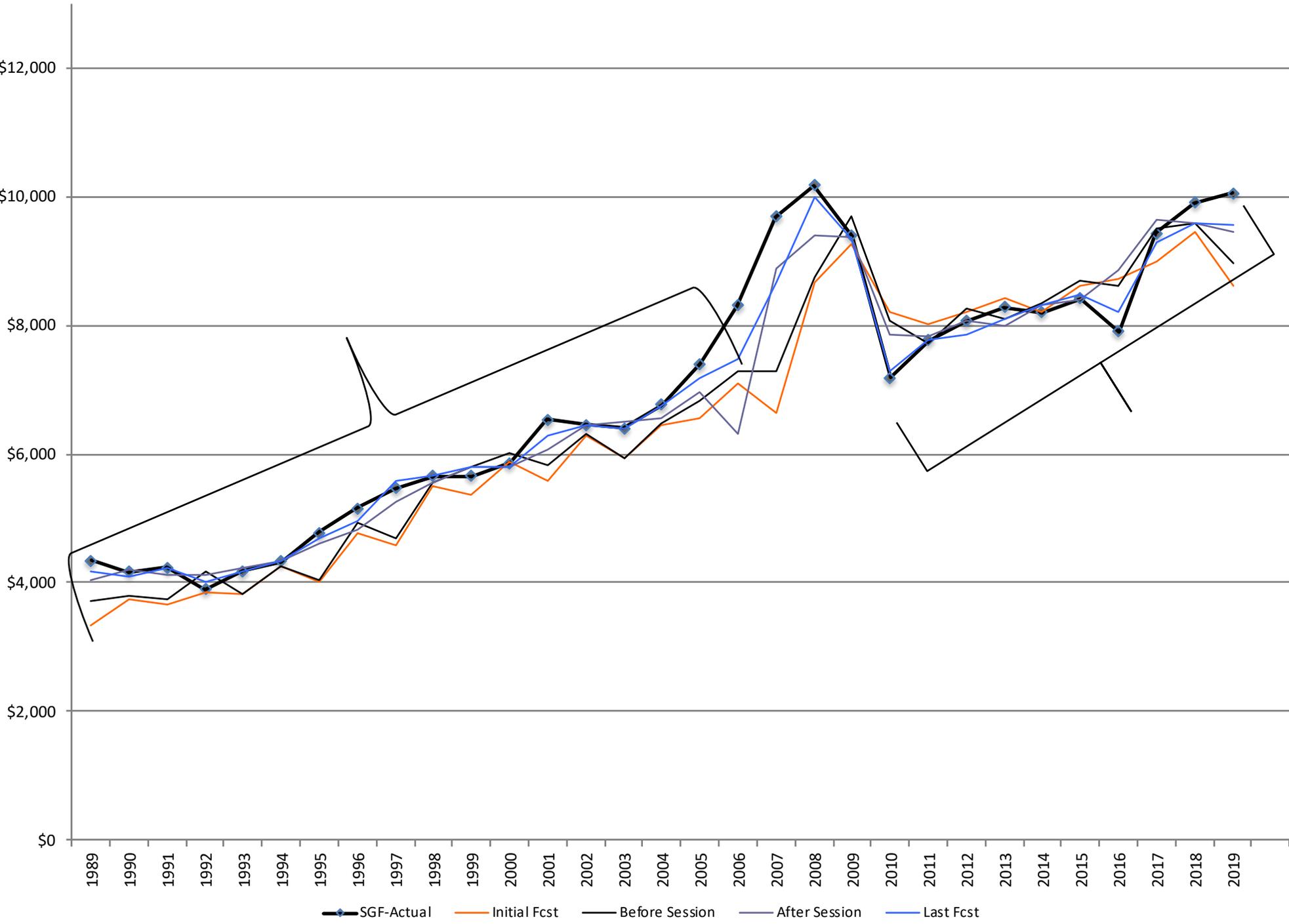
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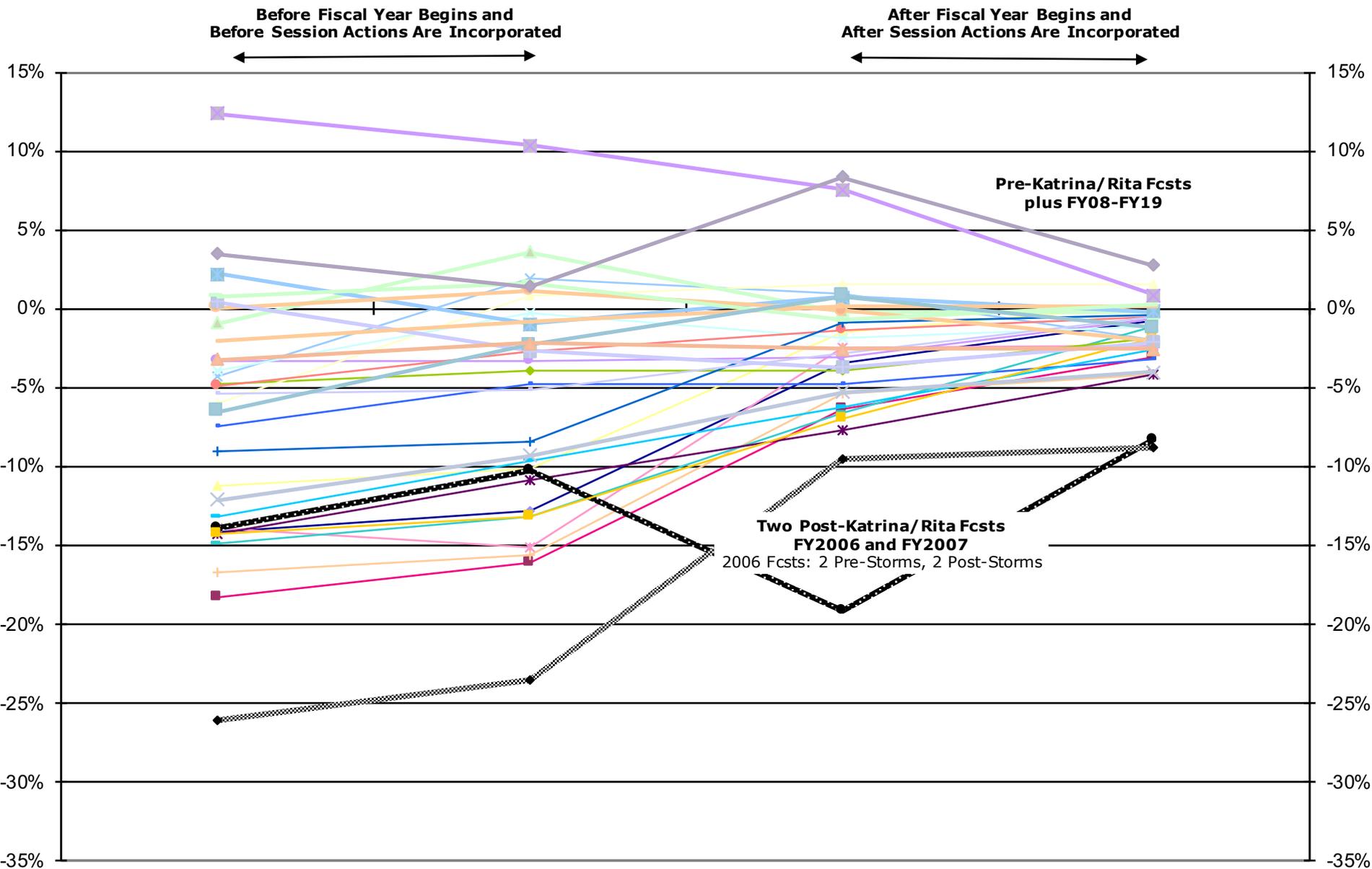
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REC General Fund Estimates Relative To Actuals, Over REC History

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REC Total Tax Forecast Errors Decline Over Forecast Cycle

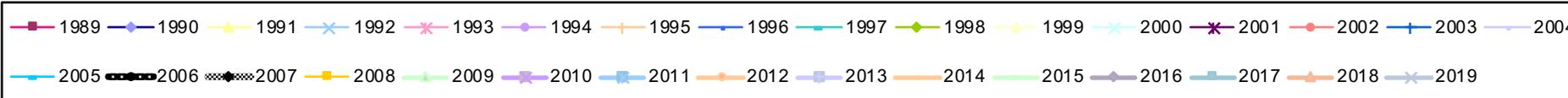


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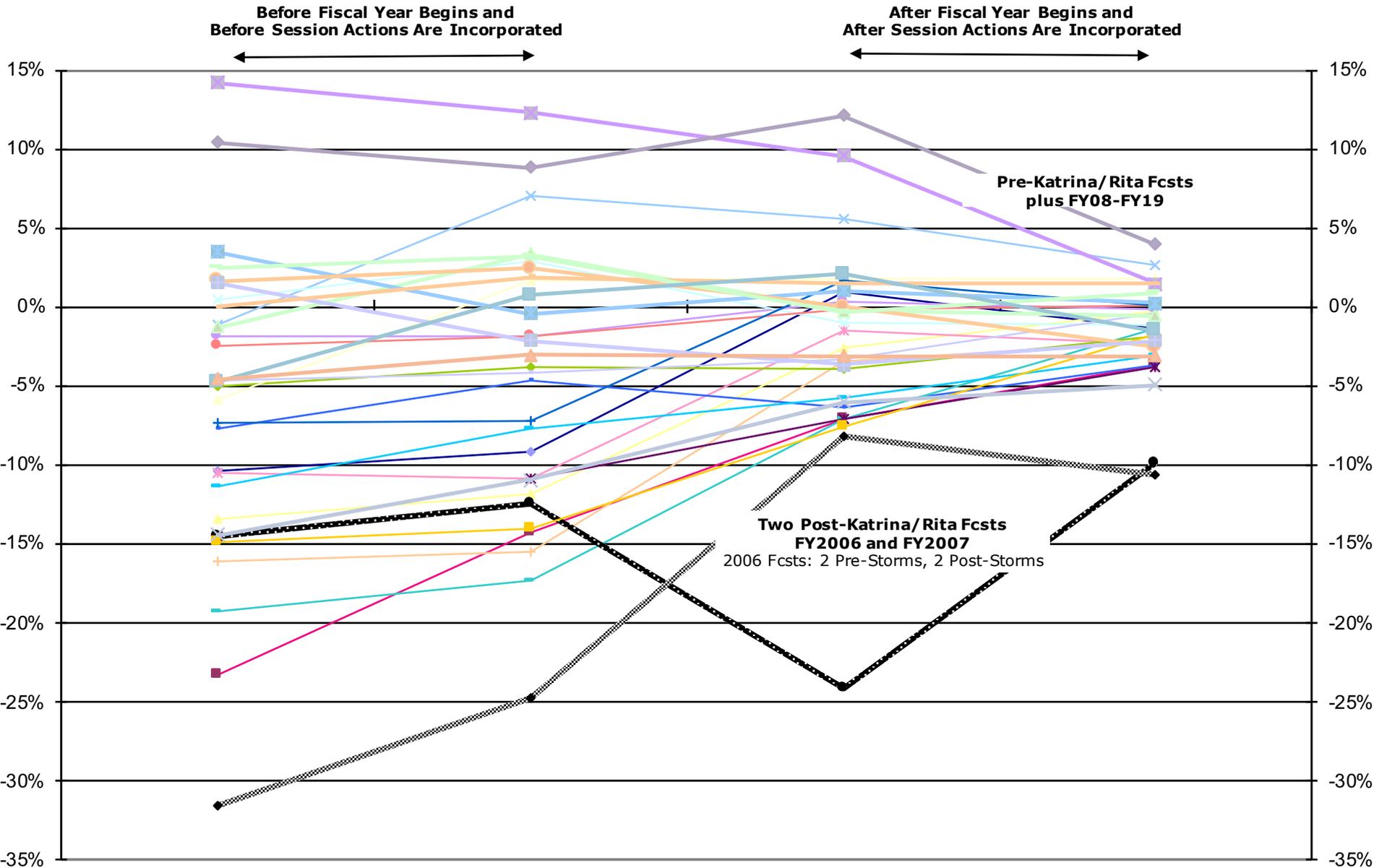
Before Session

After Session

Last Fcst



REC General Fund Estimate Errors Decline Over Forecast Cycle



Initial Fcst

Before Session

After Session

Last Fcst

