Concurrent Seasonal Adjustment of State and Metro Payroll Employment Series

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Abstract
Concurrent seasonal adjustment uses the most recent raw data in calculating seasonal adjustment factors, in contrast with methods where factors are estimated periodically and projected forward. The Current Employment Statistics (CES) – State and Area program at the U.S. Bureau of Labor Statistics uses a unique two-step seasonal adjustment approach where the benchmarked universe data are adjusted separately from the survey-based data due to different seasonal patterns exhibited by data from the two sources. A history of survey-based estimates are used each January to provide projected factors for the coming year. Switching to a concurrent adjustment method was examined and is being considered. The concurrent adjustment method yielded factors that were more accurate (evidenced by smaller revisions.) Employment data were less volatile month-to-month under the concurrent method, and also more closely matched universe data, which are considered to be a more accurate gauge of economic reality. Some of the improvement was due to better estimation of a regression effect that is used to adjust for the varying number of weeks between survey reference periods.

Key Words: Concurrent seasonal adjustment, Current Employment Statistics, smoothness, revisions

[1] Any opinions expressed in this paper are those of the author and do not constitute policy of the Bureau of Labor Statistics.

1. Introduction

Current Employment Statistics (CES) is a cooperative program between the U.S. Bureau of Labor Statistics (BLS) and State Workforce Agencies, which produces some of the most timely and closely watched labor market data on payroll employment, hours, and earnings each month at the national, state, and metropolitan[2] level using a survey of about 143,000 businesses and government agencies representing roughly 588,000 establishments. Of principal interest to data users is the over-the-month change in seasonally adjusted total nonfarm (TNF) payroll employment, which is highlighted in the monthly *Employment Situation* and *Regional and State Employment and Unemployment* press releases. Despite being a large survey, CES estimates are inherently subject to sampling error, which tends to be relatively larger for smaller domains, as well as non-sampling error from sources such as nonresponse and the inability to capture business births and deaths on a timely basis. The seasonal adjustment process can also be a source of error. At the national level, seasonal adjustment factors are recalculated each month using the most recent data available, a process referred to as *concurrent seasonal adjustment*. For state and metropolitan data, however, the seasonal adjusted process is performed only annually, with *projected* factors applied to the data in real time[3]. While concurrent adjustment should be able to pick up changes to seasonal patterns and thus produce more accurate seasonal adjustments, concerns over resources (CES currently seasonally adjusts 1,974 state and metro series, which would have to be reviewed in some fashion) as well as a complexity that arises from the benchmarking process have resulted in CES continuing to use projected factors for state and area data. This paper shows the potential gains of adjusting the state and metro data concurrently by simulating 7 years of concurrent adjustments using actual data.

Section 2 offers a broad overview of CES benchmarking and seasonal adjustment methodology. Section 3 covers existing research on concurrent seasonal adjustment and practice at statistical agencies with a focus on BLS. Section 4 describes an empirical project with CES state and metro data and the paper is summarized in Section 5. Tables and figures are in the appendix.

2. Current Employment Statistics Benchmarking and Seasonal Adjustment

CES employment estimators are designed to measure relative monthly employment domain for a given estimating cell (i.e., area and industry.) Due to accumulated error in the monthly estimates, employment levels are re-anchored (benchmarked) each year using data primarily from the Quarterly Census of Employment and Wages (QCEW), an administrative count of jobs covered by the Unemployment Insurance (UI) system representing about 97 percent of the CES universe[4], which are available roughly 6-8 months later than initial CES data.

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[2] Information on metropolitan area concepts is available at: http://www.bls.gov/sae/790over.htm. CES produces seasonally adjusted data for 352 Metropolitan Statistical Areas (MSAs), Metropolitan Divisions, New England County Township Areas (NECTAs), NECTA Divisions, and non-standard areas.

[3] National, state, and metro data are all seasonally adjusted using X11-type adjustments in X-13ARIMA-SEATS software.

[4] Other data sources such as the Railroad Retirement Board, County Business Patterns, and Annual Survey of Public Employment and Payroll are used to derive a count of the 3 percent of the CES universe not covered by UI.

National CES employment data are anchored to the March universe level each year, with the difference between levels linearly distributed between successive March benchmarks. National CES data thus have a trend tied to administrative data with month-to-month changes largely represented by survey data. State and metro employment data, however, are fully replaced using universe data, adjusted for definitional differences with some adjustments to smooth known administrative breaks. This process was adopted in the 1980s after monthly employment snapshots from the UI system became available. The reasoning implicit in the differing benchmark methods is that, at a national level, the large CES survey is a better measure of month-to-month employment change than the QCEW while, at the state and metro level, sampling error in the CES is of more serious concern than possible administrative error in the QCEW.

The "replacement" benchmarking method used for state and area data has huge implications for seasonal adjustment. Although the sample-based and universe data have similar patterns, there are persistent differences. A great deal of work has gone into determining the cause of the seasonal difference between QCEW and CES, but according to Groen (2012), most of it is due to differences in reporting and imputation. The most notable difference comes between December and January where, at a sum-of-states level, CES survey data initially show jobs losses at least 400,000 fewer than will eventually be shown in the universe data. Berger and Phillips (1993, 1994) noted that state employment data would consistently show a "blip" each January—seasonally adjusted—which would disappear after further revisions, and proposed a method to account for this blip. CES adopted a modified version of this method, detailed by Scott et al. (1994) and commonly referred to as the "two step seasonal adjustment," to seasonally adjust state and metro employment data. Each year, ten years of sample-based employment change ratios are used to reconstruct a sample-based history on the current benchmark level. This is used to adjust the most recent three months, which have not yet been replaced by administrative data, and to project seasonal adjustment factors for use in the coming year. The universe data, which form the majority of the published time series, are seasonally adjusted separately. Since the replacement benchmark is not used for national data, the two-step method is not used at that level.

The reference period for the CES survey and QCEW is the pay period that includes the 12th of the month. The time between reference weeks in two consecutive months varies between four and five weeks, which can noticeably affect job growth, and is also accounted for during the seasonal adjustment process. For example, construction jobs tend to increase in spring as the weather warms up, and it is reasonable to expect construction companies will report more hiring between April and May in years where there is more time between reporting periods. CES adjusts for this effect using a user-defined calendar effect introduced in Cano et al. (1996). Eleven dummy variables are included in the RegARIMA model, one for each month except March, with values of 1.0 for times where there are five weeks between reference periods for that month, -0.6 when there four weeks, and 0.0 otherwise. There is no dummy variable for March, since there are almost always four weeks between February and March reference weeks. The variable is smaller in magnitude when there are four weeks because that occurs more often, and so the sum of the effect is approximately zero.

3. Concurrent Seasonal Adjustment

Concurrent seasonal adjustment is the process of running seasonal adjustment on a time series each month using the most-recent data. This contrasts with methods such as that used by CES in adjusting state and metro data where seasonal adjustment is run less frequently, most often annually, with factors projected for the future. By the late 1970s, there was a general understanding that concurrent seasonal adjustment was one of the clearest ways in which seasonal adjustment practices could be improved. Statistics Canada had already issued guidelines for using concurrent seasonal adjustment and BLS had been producing an experimental unemployment rate based off concurrently adjusted component labor force series (which was included in the monthly Commissioner's Statement to the Joint Economic Committee) when the National Commission on Employment and Unemployment Statistics[5] examined the issue of concurrent seasonal adjustment in 1979. While the Commission noted that concurrent adjustment of thousands of series would be a "nightmarish task" requiring a considerable amount of computer and staff time, delaying publication, the Commission stated that concurrent adjustment was "clearly superior" from a technical standpoint and thus recommended that important labor statistics be seasonally adjusted on a concurrent basis. The Commission noted that frequently revising historical data would likely result in confusion and mistrust, and therefore recommended that it only be revised annually, but stated that the full concurrently-revised series be made available to data users.

Along with rapid advances in computing, the 1980s saw a good deal of empirical and theoretical work examining concurrent adjustment culminating in the method's widespread adoption by some statistical agencies. Examples of this work include that of Dagum (1982a, 1982b, 1986), who examined concurrent filters in the context of the X-11-ARIMA program which she developed at Statistics Canada; Wallis (1982), who found the concurrent filters clearly superior to the projected filters; and McKenzie (1984) and Kenny and Durbin (1982), who provided empirical work to demonstrate the benefits of concurrent adjustment. Pierce and McKenzie (1987) provided an excellent capstone to this research program, and by the late 1980s nearly all seasonally adjusted series published by Statistics Canada and the U.S. Census Bureau were adjusted on a concurrent basis.

Concurrent seasonal adjustment has a long history at BLS, and most programs that publish seasonally adjusted data have at least explored adjusting on a concurrent basis. Methee and McIntire (1987) examined the experimental labor force series that had been produced for over a decade at that time, but had not been adopted as official series due to a desire for continued prior publication of seasonal adjustment factors. Methee and McIntire compared the revisions from the initial to final values obtained from to the final symmetric seasonal filters for both concurrent and projected-factor methods. They found considerable reductions in the revisions to both levels and month-to-month changes in all of the series that they examined, although concurrent adjustment was not adopted for the official series until 2004 (Tiller and Evans 2004). Kropf et al. (2002) examined replacing projected factors with a concurrent adjustment for CES National industry employment data and found that concurrent adjustment resulted in smoother series, less error compared to final seasonal values, and somewhat smaller revisions from first print to second and third print estimates. Following several years of parallel simulations, CES adopted concurrent adjustment for series at the National level in 2003. The Business Employment Dynamics, Job Openings and Labor Turnover Survey, and Local Area Unemployment Statistics programs all adopted concurrent adjustment in the 2000s. Currently, no prices programs use concurrent seasonal adjustment, although the topic has been explored by Buszuwski (1987) and Chow et al. (2005) for the PPI and CPI, respectively. Evans (2012) has also explored running a concurrent adjustment for the weekly unemployment claims, which BLS adjusts for the Employment and Training Administration.

[5] Sometimes referred to as the Levitan Commission, in reference to its chair, Prof. Sar A. Levitan.

4. Empirical Study

In order to investigate the effects of switching to a concurrent seasonal adjustment method for state and metro CES series, concurrent and forecast adjustments were simulated for 2008-14. First, sample-based histories were created on the same benchmark level as far back as histories of estimate links[6] were available as inputs into the seasonal adjustment process. For most series, histories could be constructed back to 2002, when the oldest estimates under the North American Industry Classification System (NAICS) were produced. Sample-based estimates are revised after one month, due to the receipt of more data, and this feature was incorporated in the simulation. When concurrent adjustment was run, the end point of each not seasonally adjusted series represented the initial sample-based data, while the rest of the series was based on the second-print sample-based data.

Model and seasonal adjustment settings from the actual annual review process were used for all series and were locked for the following year during the concurrent adjustments. Using production settings has the benefit of incorporating information provided by state and BLS analysts regarding unusual features in the not seasonally adjusted data due to strikes, severe weather, methodological changes, etc. Both projected-factor and concurrent seasonal adjustments were calculated for each series for the sake of comparison on six measures of gain.

4.1 Five Measures of Gain

X-11-type seasonal adjustment relies on centered moving averages to decompose time series. Near end-points, a combination of forecasts and asymmetric surrogate filters are used. Once a data point is far away from the end point, the decomposition becomes more reliable. Many of the studies of concurrent seasonal adjustment focused on revisions of data from initial to final values, since the final value is considered to be the most accurate (and the "true" value is never observed.) In this study, the seasonally adjusted value from the 2015 annual processing was taken as the most accurate "final" sample-based value and revisions to the levels (**Measure 1**) and over-the-month changes (**Measure 2**) in the concurrent and projected-factor adjustments were compared.

The universe data based on administrative records from the UI system form a benchmark for the sample-based estimates since they are not subject to sampling error and many sources of non-sampling error. In the two-step adjustment process, both sample-based and universe seasonally adjusted data are subject to some degree of seasonal adjustment error. As the concurrent process reduces seasonal adjustment error for the sample-based estimates, it should be expected to produce data more similar to the seasonally adjusted universe data. Revisions in the over-the-month changes of the concurrent and projected factor series to the over-the-month changes in the universe series are compared (**Measure 3**), although revisions to the universe levels were not since there are too many other sources of error that compound over time and therefore it would not be particularly meaningful.

Although CES uses a user-defined regression effect to control for different lengths of time between survey periods, it occasionally picks up something very different. At the state and area level, estimation of this calendar effect has been affected by events ranging from the hiring of temporary Census workers in 2009 and 2010 to the shuttering of factories as many U.S. auto makers and suppliers went into bankruptcy in 2009. These events clearly had

[6] Ratios of monthly employment change. For example, if the employment estimate in month *t-1* is 1,000 and 900 in month *t*, the estimate link in month *t* is 0.9.

nothing to do with the length of time between CES reference weeks and in these examples either the calendar effect was removed or appropriate outliers were included, resulting in a reasonable model. More often, there is no obvious way of telling whether large, estimated effects are truly due to the calendar or something else. When "something else" is the answer, projected factors can result in unreasonable adjustments. The results of the estimated forecast and concurrent effects were compared with their final values from the 2015 annual run (**Measure 4**). This effect is usually small compared to the overall seasonal component, but extreme values do occur and an avoidance of the rare, large errors was of particular concern.

Finally, the smoothness of the concurrent and projected-factor adjusted series were examined (**Measure 5**). Although the goal of concurrent seasonal adjustment is to produce a more accurate adjustment, state and area estimates tend to be somewhat volatile and many data users would appreciate a smoother series. Pierce and McKenzie (1987) explain why concurrent seasonal adjustment can be expected to result in a smoother times series through the removal of an avoidable revision.

The measures to calculate gain from concurrent adjustment are root mean square (RMS) ratios taking the general form:

$$RMS\ ratio_{y,k}\ (r) = \frac{RMS(r^{c}_{y,k})}{RMS(r^{p}_{y,k})}$$

The numerators in these ratios reflect a statistic (r) calculated from the concurrent adjustments for year y and domain k while the denominator measures the same thing for the projected-factor adjustment. In all cases, the statistics represent something that should be minimized—such as error, revision, or volatility—and therefore a value below one indicates gain. Formulae for all five measure are presented in Table 1.

4.2 Results

Table 2 presents the measures of gain from concurrent adjustment for the concurrent month by year for the statewide total nonfarm (TNF), statewide industry, and metropolitan area TNF domains. The results, at least at the level presented, are almost universally positive. In nearly all years and nearly all domains, the levels and over-the-month changes indicate that the factors are more accurate, the revisions are smaller, and the series are less volatile under concurrent adjustment. The calendar effect used to control for different lengths of time between survey reference weeks was also more accurate. Gains are more significant in change measures than in level measures, a result that has been well-documented elsewhere in the literature.

RMS ratios for revisions to the "final" value imply somewhat more gain than for the revisions to the universe data. Although the sample-based data already undergo one revision, the revision to the universe tends to be somewhat larger. Pierce and McKenzie (1987) explain why revisions to the underlying not seasonally adjusted data diminish but do not eliminate the gain from concurrent adjustment.

An interesting result is that concurrent seasonal adjustment appears to be least-beneficial in 2008 and 2009, when the U.S. economy experienced since steepest and broadest job losses since the 1940s[7]. Wright (2013) argued that the acute job losses, particularly from November 2008 through March 2009, distorted seasonal factors in the national CES data for the surrounding years. A phenomenon was observed in the national CES data where the seasonally adjusted data would be consistently revised down after a month or two (despite no pattern of negative revisions to the not seasonally adjusted data) as the seasonal adjustment process was apparently "adjusting away" some of the steep job losses in the concurrent month[8]. This suggests a possible drawback of concurrent methods during periods when the data are most important; however, the results of this project indicate positive if diminished gain for all measures save one in 2008 and 2009. Although these results indicate that concurrent adjustment is helpful even in extreme circumstances, the performance of seasonal adjustment techniques during recessions deserves continued research.

There is particular concern regarding large errors in the projected calendar adjustment factors that are used to control for the different length of time between survey reference periods. In order to do this, the Relative Gain in the Calendar Effect from Concurrent (RGCEC) was calculated for each month *t* and series *j*:

$$RGCEC_{t,j} = 100 * \frac{|Projected_{t,j} - Final_{t,j}| - |Concurrent_{t,j} - Final_{t,j}|}{Final_{t,j}}$$

The results were binned and are displayed in Figure 1, which shows the proportion of each bin with a positive gain, negative gain (loss), or no change (neutral—for the substantial number of data points where concurrent estimation results in an identical estimate.)

It is important to note that concurrent estimation rarely results in a factor substantially closer or further from its final value than does the projected process. In 92 percent of data points considered, the gain or loss from concurrent is less than 0.1 percent of the series level. In the relatively few extreme values, however, concurrent usually offers a positive gain. This confirms experience in the CES program office with problematic projected factors that are identified mid-year: concurrent estimation generally gives a better factor. To take the most extreme values, there are 24 observations where concurrent moves the estimated effect closer to the final value by at least 1.0 percent of the level, and only 6 observations where it moves the value further away by at least that much.

Finally, the question of how many months of data should be revised each month must be addressed[9]. When concurrent factors are calculated, updated factors are produced for every month of data that was input to the seasonal adjustment process. Statistical agencies using concurrent seasonal adjustment have to set a revisions policy that weighs the benefits of new factors and the potential confusion and hassle for data users of updating more data. Kenny and Durbin (1982), Dagum (1982b), and Dagum (1986) all concluded that nearly all of the benefit of concurrent adjustment comes in the concurrent and preceding month and around the year-ago value, although dissent can be traced back at least as far back as the discussion of Kenny and Durbin (1982).

[7] For information on how CES data behaved during the 2007-09 recession compared to other recessions, see Goodman and Mance (2011) and many other analyses.
[8] Revisions for the national CES data are available at:
http://www.bls.gov/web/empsit/cesnaicsrev.htm
[9] Loya (2014) explored this question in great detail for CES National estimates

The two-step seasonal adjustment procedure greatly simplifies this question. During the annual benchmark processing each winter, survey data are replaced with administrative counts through September of the preceding year. No additional information on the seasonal factors of this universe portion of the time series is obtained for another year; concurrent seasonal adjustment only affect the sample-based portion. January survey data are released with the benchmark, and it seems natural to adjust the four months of survey data with concurrent factors, but in following months the number of months that could be updated is necessarily limited. Importantly, only October, November, and December could ever have updated "year-ago" factors, which other studies have should can have noticeable improvements. In this paper, only the concurrent month and six prior months are considered, and only January-June are examined (since they will occupy each one of those seven positions at some point during the year.) Results for Measures 1, 2, and 3 (based on the revision of the level to "final", change to "final", and change to universe) are presented in Figure 2. The age of the data refers to how many months older they are than the concurrent data. For example, when June data are released, the same-year January output from the latest seasonal adjustment run would have an age of six.

The RMS ratio based on the revisions in the over-the-month changes to their "final" value indicates that there is noticeably increasing gain from the concurrent month to the month prior, with no discernable increase in gain to the preceding months. The other two measures show a somewhat more surprising pattern. Apparently all of the gain in relation to the benchmarked universe values comes in the concurrent month. The measure of revision of the level to its "final" value indicates a trend of increasing gain that continues for a few months beyond the concurrent point, although at the metropolitan area TNF and statewide industry level there is a small, unexpected decrease in gain from the concurrent to the preceding month.

5. Conclusion

Concurrent seasonal adjustment achieved broad acceptance for its technical superiority amongst the statistical community by the 1980s, although its use is not universal. Concerns about resources (computer and human) and a desire to pre-publish seasonal factors have generally slowed its adoption by statistical programs. A great deal of work has convinced many programs that its benefits substantially outweigh its drawbacks.

This paper sought to demonstrate that concurrent seasonal adjustment has clear benefits for the state and metro CES data. The seasonally adjusted data are more accurate, both in comparison to the current best estimate of the sample-based seasonal factors as well as to the seasonally adjusted benchmark universe data, with gain of about 15-20 percent for the over-the-month changes. The calendar adjustment factors are more accurate and, most importantly, large errors tend to be reduced. Finally, volatility is reduced by nearly 30 percent through a theoretically-sound reduction in avoidable variance.

The main hurdles in the way of implementation involve systems changes and coordination within the Fed-State framework. Computing resources are no longer a serious concern (running a monthly concurrent adjustment on all 1,974 series using the program office's server takes only a few minutes.) Increases in computing power have also made it relatively easy and quick to screen for possible anomalies through thousands of seasonal adjustment runs. There were no manual interventions in the simulation presented in this paper, and the results showed that concurrent seasonal adjustment with zero human review still clearly outperforms projected factors. Finally, the CES State and Area program currently does not publish seasonal factors in advance, so there is no concern about their potential withdrawal.

As of 2015, concurrent seasonal adjustment is being run each month and analyzed by a small team of CES State and Area program office analysts. The resulting factors are currently for internal use only and the published data continue to be adjusted using projected factors for the time being. The results continue to be promising. Unusual changes in employment tend to be far more moderate using the concurrent factors and problems that have required mid-year corrections would have been far less serious using concurrent factors. Only a handful of interventions have been considered (due to strikes), although the concurrent factors would not have been especially problematic without intervention. The results of the study presented in this paper along with the real-time experience of program office analysts continues to be assessed with an eye towards possible implementation.

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Appendix

Table 1. Root Mean Square Ratio Formulae

Measure 1: RMS Revision of Level to "Final" Ratios

$$Measure\ 1_{y,k} = \frac{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(Concurrent_{m,j} - Final_{m,j})^2}}{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(Projected_{m,j} - Final_{m,j})^2}}$$

Measure 2: RMS Revision of Change to "Final" Ratio

$$Measure\ 2_{y,k} = \frac{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(\Delta Concurrent_{m,j} - \Delta Final_{m,j})^2}}{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(\Delta Projected_{m,j} - \Delta Final_{m,j})^2}}$$

Measure 3: RMS Revision of Change to Universe Ratio

$$Measure\ 3_{y,k} = \frac{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(\Delta Concurrent_{m,j} - \Delta Universe_{m,j})^2}}{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(\Delta Projected_{m,j} - \Delta Universe_{m,j})^2}}$$

Measure 4: RMS Revision of Calendar Effect-Adjusted Level to "Final" Ratio

$$Measure\ 4_{y,k} = \frac{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(\widetilde{Concurrent}_{m,j} - \widetilde{Final}_{m,j})^2}}{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(\widetilde{Projected}_{m,j} - \widetilde{Final}_{m,j})^2}}$$

Measure 5: Smoothness Ratio

$$Measure\ 5_{y,k} = \frac{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(\Delta Concurrent_{m,j})^2}}{\sqrt{\frac{1}{n*m}\sum_{j=1}^{n}\sum_{m=1}^{12}(\Delta Projected_{m,j})^2}}$$

For year y and set of series k, where series $j \in k$, month $m \in y$. *Concurrent*, *Projected*, and *Final* are log transformations of the seasonally adjusted data using concurrent factors, projected factors, and the factors from the 2015 annual review. *Universe* is the same for the benchmarked universe data. $\widetilde{Concurrent}$, $\widetilde{Projected}$, and $\widetilde{Final}$ are log transformations of the data using concurrent calendar factors, projected calendar factors, and the calendar factors from the 2015 annual review. The first-difference operator is denoted by Δ.

Table 2. Measures of Gain from Concurrent

RMS Revision of Level to "Final" (Measure 1)

Domain	2008	2009	2010	2011	2012	2013	2014	All Years
Statewide TNF	0.969	1.008	0.924	0.925	0.903	0.902	0.906	0.938
Stwd. Industry	0.951	0.956	0.945	0.929	0.914	0.839	0.915	0.931
Area TNF	0.978	0.951	0.960	0.946	0.953	0.816	0.897	0.943

RMS Revision of Change to "Final" (Measure 2)

Domain	2008	2009	2010	2011	2012	2013	2014	All Years
Statewide TNF	0.879	0.875	0.784	0.715	0.675	0.745	0.707	0.772
Stwd. Industry	0.818	0.833	0.837	0.747	0.738	0.697	0.665	0.777
Area TNF	0.789	0.796	0.786	0.766	0.735	0.609	0.631	0.735

RMS Revision of Change to Universe (Measure 3)

Domain	2008	2009	2010	2011	2012	2013	2014	All Years
Statewide TNF	0.889	0.917	0.820	0.752	0.754	0.766	0.810	0.819
Stwd. Industry	0.841	0.846	0.822	0.744	0.743	0.765	0.785	0.792
Area TNF	0.887	0.921	0.886	0.834	0.782	0.832	0.895	0.850

RMS Revision of Level to "Final", Calendar Effect (Measure 4)

Domain	2011	2012	2013	2014	All Years
Statewide TNF	0.882	0.951	0.940	0.930	0.921
Stwd. Industry	0.943	0.958	0.934	0.920	0.940
Area TNF	0.928	0.904	0.850	0.914	0.902

Smoothness Ratio (Measure 5)

Domain	2008	2009	2010	2011	2012	2013	2014	All Years
Statewide TNF	0.783	0.824	0.771	0.713	0.641	0.702	0.743	0.747
Stwd. Industry	0.742	0.765	0.722	0.705	0.627	0.606	0.641	0.676
Area TNF	0.757	0.782	0.810	0.703	0.649	0.666	0.680	0.731

Figure 1. Relative Gain from Concurrent in the Calendar Effect

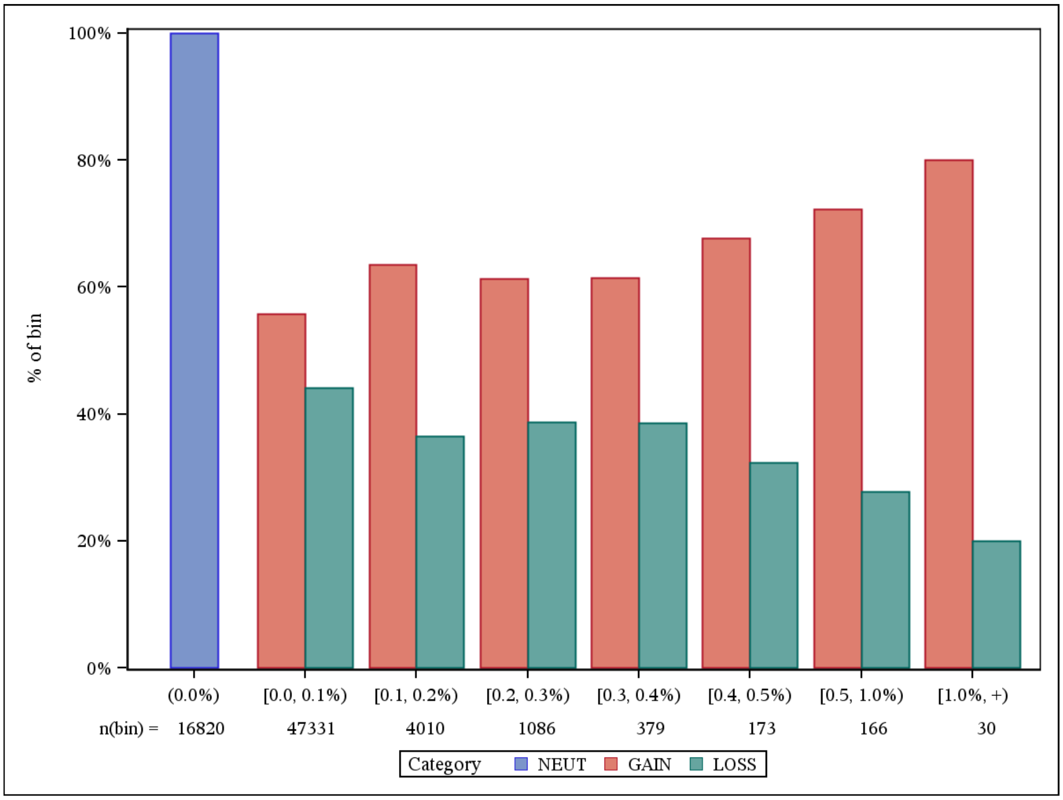

Figure 2. RMS Ratios by Age