Econometric Analysis of RSG at the Midwest ISO

Presentation to MISO RSG TF
Carmel, IN
July 8, 2009

Brief Description of Problem

- FERC has determined that RSG should be distributed on a cost causality basis. However, this has not proven to be an easy task over the last four years.
- Various analyses have indicated potential causes of RSG, but not provided a marginal contribution for each. Further, previous analyses have failed to include multiple sources in a single, statistically valid model.
- This analysis presents the results of a statistical analysis including all of hypothesized causes of RSG where data was available in a single framework. From this work we are able to quantify the marginal contribution of these factors to hourly RSG MWP.

Summary of Results

- A statistically significant model can be developed between RSG MWP and many of the factors believed to be contributing to this charge.
- This framework can be used to:
  - Focus efforts on tariff re-design
  - Construct a tariff that is cost-causality based, provides *ex ante* pricing, and is equitable, flexible, and transparent.
  - Serve as the basis of a RSG metric development process.

Summary of Results
(Continued)

- These results indicate that levels of RSG contributed by various factors vary substantially.
  - Load contributes approximately 23% of RSG MWP over the whole period.
  - Generators contribute approximately 39% to RSG MWP over the whole period.
  - Changes in NSI contribute approximately 30% to RSG MWP over the entire period.
  - Virtual supply contributes approximately 1.3%.
  - Factors outside MPs control contribute the remainder.
- Further, these results raise any number of questions concerning the cost causality basis, equity, and effectiveness of the RSG Re-design and similar allocation schemes or proposed solutions.

Data Sources

- All data were extracted from publicly available reports on the MISO website.
- Several variables that might explain RSG MWP were not available. Inclusion of these variables would refine the results.
  - Only the number of binding constraints were available, and not the MWs dispatched to address a constraint.
  - Intra-hour changes in RT load, Econmax, and NSI.
  - Headroom, and therefore a proxy was defined.

Variable Definitions

- RSG MWP: RT RSG Make Whole Payments per MW of Econmax eligible for payment.
- Obligated load covered during FRAC: Difference between load committed for in FRAC and DA-cleared load in GW. (An increase is positive.)
- Change in Econmax during RT: Difference between RT Econmax and FRAC committed Econmax in GW. (Negative means more capacity available; positive indicates more capacity required).
- Change in Load during RT: Difference between RT Load and FRAC Load in GW. (Negative indicates less capacity required in RT; increase indicates more capacity required).

Variable Definitions
(Continued)

- Change in Offer during RT: Difference in RT Econmax due to changes in offer parameters and FRAC in GW. (Negative means less capacity required in RT; positive means more capacity required).
- Binding constraints: Number of binding constraints in RT.
- Headroom proxy: Load covered in FRAC less FRAC committed Econmax less NSI in FRAC in GW (Negative indicates less potential requirement for headroom during RT; positive indicates potential requirement for headroom during RT).

Variable Definitions
(Continued)

- Virtual supply offers: Financial offers for supply cleared in DA- market in GW.
- Load forecast error: Difference between MTLF and SE (RT load) in GW. (Overforecast is negative, i.e., less capacity needed; positive indicates underforecast).
- Change in NSI: Three measures used in GW
  - Change in PJM interchange (market to market) between FRAC and 12:00 a.m. (beginning of RT).
  - Change in other Tier 1 interchanges between FRAC and 12:00 a.m. (beginning of RT market).
  - Change in NSI after 12:00 a.m. in RT.

Methods of Analysis

- Period of analysis: 6/1/2006 through 5/31/2009.
- Hourly data used to estimate a quadratic cost function.
  - Choice of specification is based on the potentially high number of negative values for independent variables.
  - Cross-product terms account correctly for occurrence of multiple RSG-associated events during an hour.
- Binary variables were included to control for peak versus off-peak hours, summer versus winter, years, the FERC order of November 10, 2008, and ASM.
- Since fuel costs are exogenous to the MISO, and the fuel mix for units receiving RSG MWP was not available, RSG MWP was deflated with the BLS PPI for electricity generators. This deflator coupled with binary variables for year and season should account for this factor.

Methods of Analysis
(Continued)

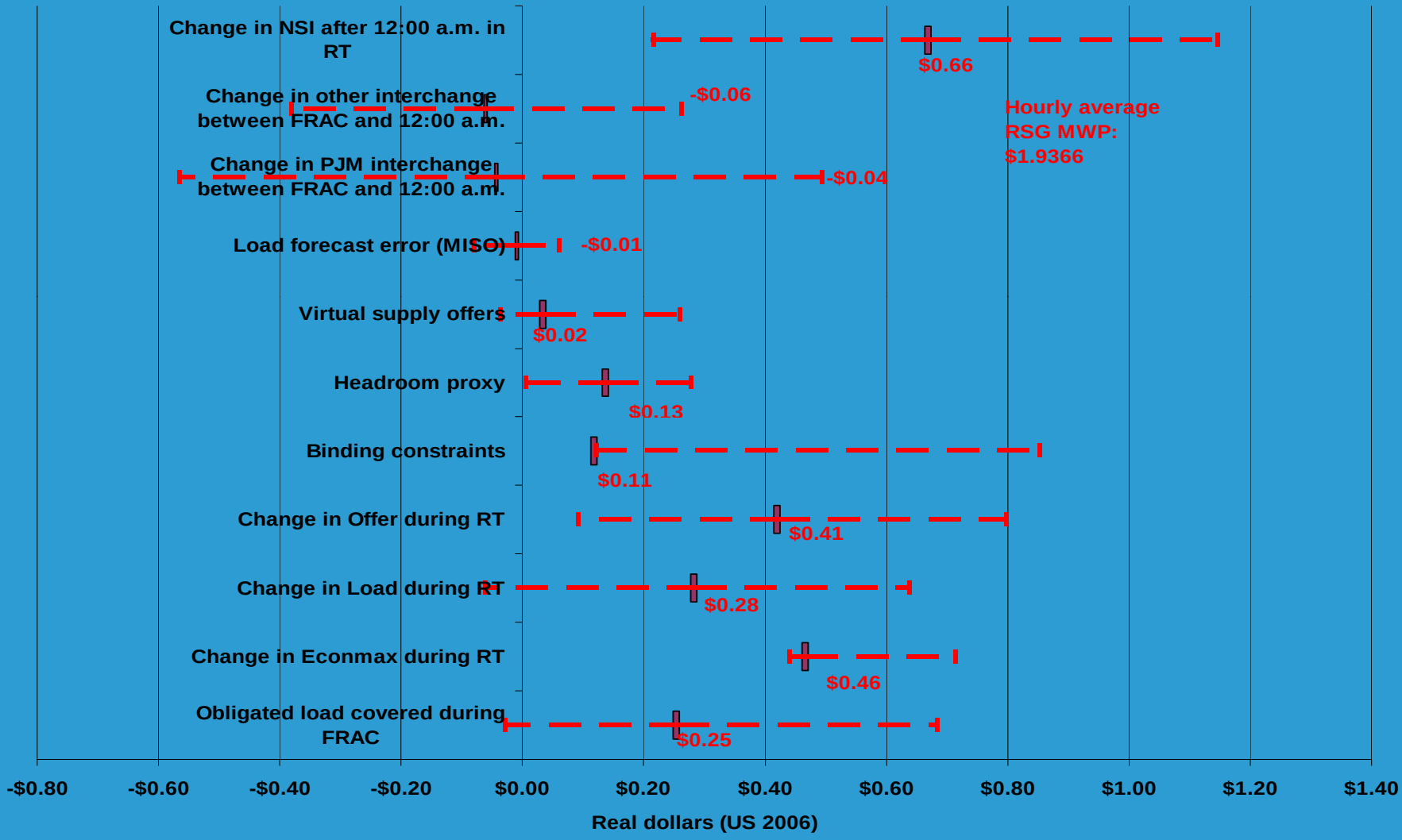
- Model estimated using a Tobit (dependent variable left censored at zero and assuming a gaussian distribution) implemented with maximum likelihood.
  - Test statistics indicate that the overall model is extremely significant.
  - Over 80 percent of the coefficients have significance levels of 90% or greater.
- Robust standard errors were obtained with a White's estimator.

Marginal Contribution to RSG

- Impacts on RSG MWP were estimated by evaluating the first partial derivative with respect to each continuous variable. This provides the change in RSG MWP with respect to a change in the specified continuous variable, i.e., the marginal contribution to RSG MWP.
- Three cases were evaluated at variable means.
  - The whole period
  - The period before ASM started
  - The period after ASM
- In addition to the expected value, upper and lower bounds were defined using the 90% jointly determined confidence intervals of the model coefficients and the 90% confidence interval of the explanatory variables. These ranges are not symmetric due to the non-linearity of the underlying processes.

Contribution to RSG MWP (2006$/MW):

Whole period



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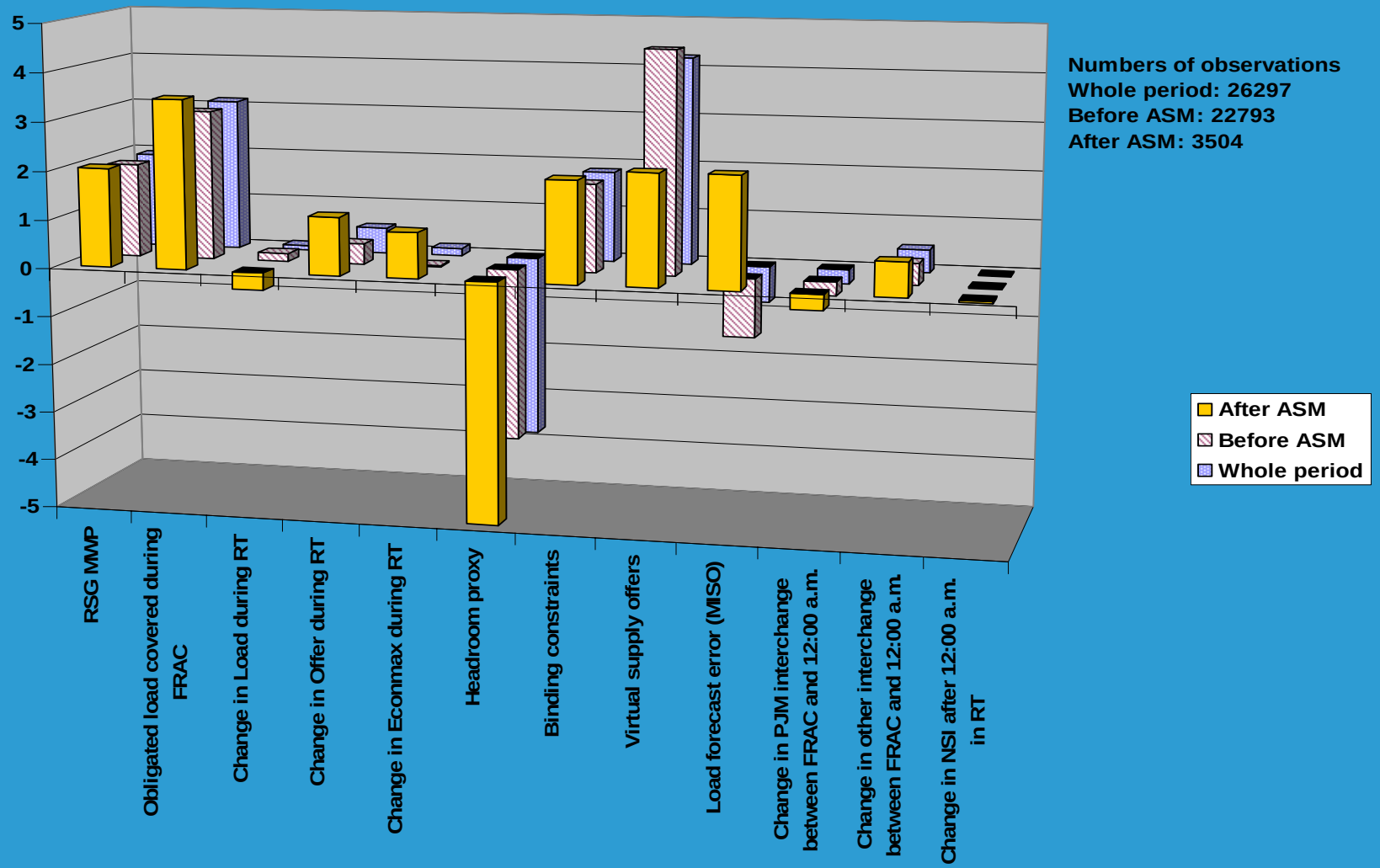
Comments on Whole Period Case

- Not all factors contribute equally to hourly RSG MWP.
- Virtual supply offers appear to contribute on average only 1.3% which is much lower than previous estimates from incomplete models.
- Positive and negative deviations in RT NSI accounts for 30%.
- Generators account for 39% while load accounts for 23%.
- Factors outside MPs' control account for the remainder.

Comparison of Variable Means

- In comparing the results of the cases of before ASM and after ASM with the whole period case, a comparison of the means of variables is helpful.
- Notable points include:
  - RSG MWP increased by 5% after ASM.
  - Virtual supplies decreased by approximately 50%.
  - The load forecast reversed from an overforecast to a substantial underforecast.
- Many of these changes could be attributable to weather.

Means Comparison for Cases



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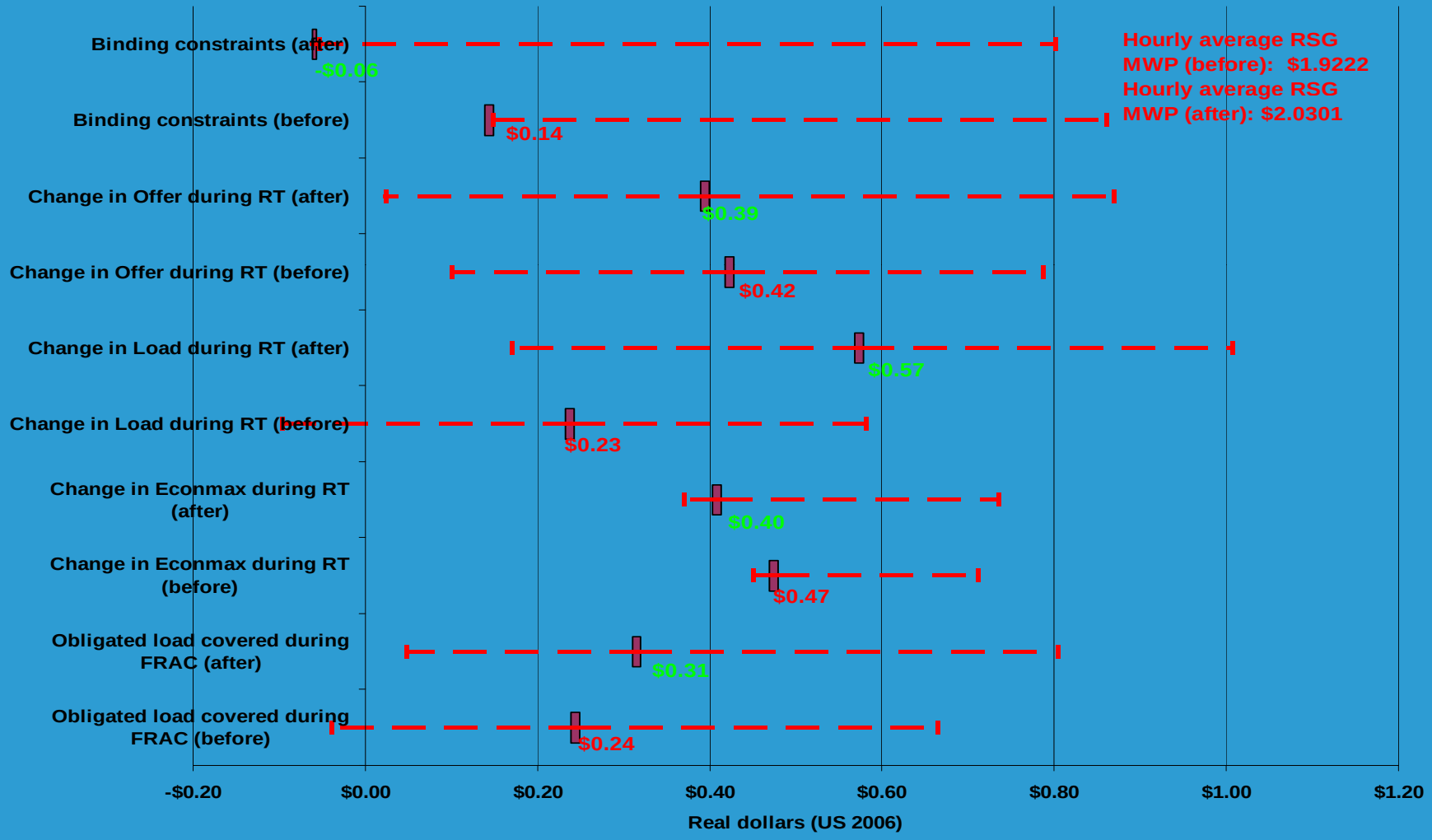
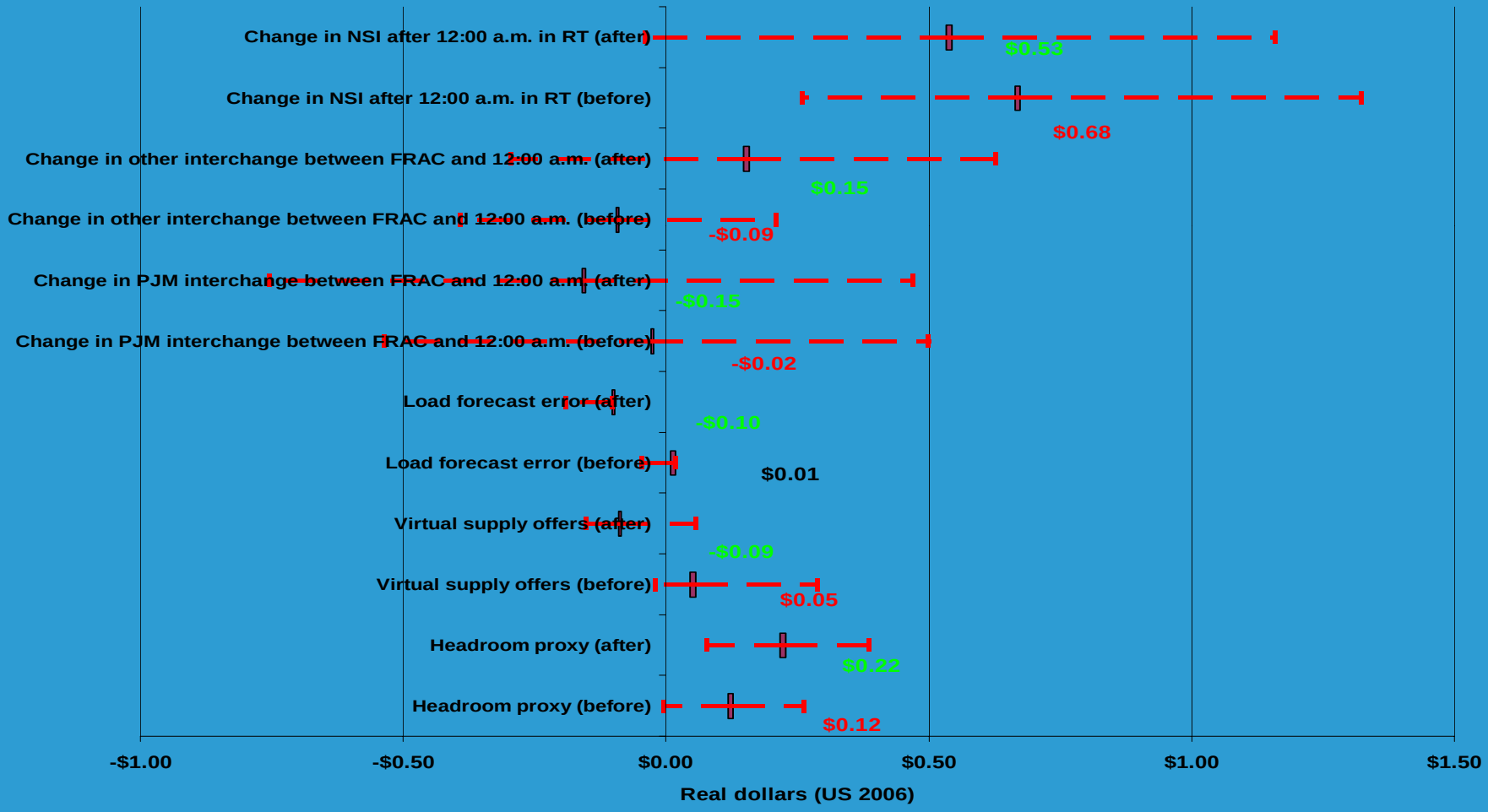
Contribution to RSG MWP (2006$/MW):

Before and after ASM



Contribution to RSG MWP (2006$/MW):

Before and after ASM (Continued)



Comments on ASM Cases

- After ASM (and the November FERC order), our analysis indicates a number of changes.
  - Virtual supply offers declined roughly by half and the marginal contribution to RSG MWP dropped to -$0.10.
  - The contribution by changes in Load during RT doubled.
  - Comparison of other variables indicates a shift of RSG contribution from generators to load.
- Caveat: After ASM, this analysis only includes 3504 hours in comparison to 22793 hours before. As a result, care should be taken in interpreting the results. A longer time span after ASM is really needed prior to making definitive statements concerning the impacts of the new tariff.

Conclusions

- This work demonstrates that the marginal contribution of various assumed causal factors to the incurrence of RSG in the MISO can be estimated.
- Direct contributions between assumed causes of RSG can be quantified. This is superior evidence to the use of correlation coefficients.
- Not all factors contribute equally to RSG MWP.
  - Load contributes approximately 23% of RSG MWP over the whole period.
  - Generators contribute approximately 39% to RSG MWP over the whole period.
  - Changes in NSI contribute approximately 30% to RSG MWP over the entire period.
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Conclusions
(Continued)

- This approach provides for the identification of distortionary tariffs and regulatory responses.
- Use of this type of method in tariff design incorporates cost causality, *ex ante* pricing, flexibility, equity, and transparency.
- The approach could also provide a means of developing metrics that gauge the effects of changes in market behaviors.
- Caveat: Inclusion of more factors, and better definition of others at the nodal level would provide more conclusive results.

“And just because the rooster crows. . .”

Questions on this analysis should be directed to:

Lorna Greening

(505-695-9224 or LGDoone@aol.com)