



Marketing Analytics, Inc.  
500 Davis Street, Suite 1010  
Evanston, Illinois 60201  
Tel: (847) 425-9999  
Fax: (847) 425-1332  
[www.marketinganalytics.com](http://www.marketinganalytics.com)

March 15, 2004

Subject: **Weekly Dummies**

This provides a summary of Marketing Analytics' position on the use of weekly dummy variables in sales response models.

**Background:** Some modeling vendors use weekly dummy variables to capture seasonality in sales response models. This white paper looks at this practice to determine the potential benefits and/or risks.

**Summary of Findings and Conclusions:** If run across all SKUs in the category with similar seasonal patterns simultaneously, this may be one of the best methods of estimating seasonality. Unfortunately, no one does it this way: vendors who use this technique run it one SKU at a time. In this case, it is one of the worst methods of modeling seasonality as it can easily pick up the impact of marketing effects. IRI recently switched away from this approach due to its problems. We do not recommend weekly dummies for single-SKU or even single-brand models.

#### **Details**

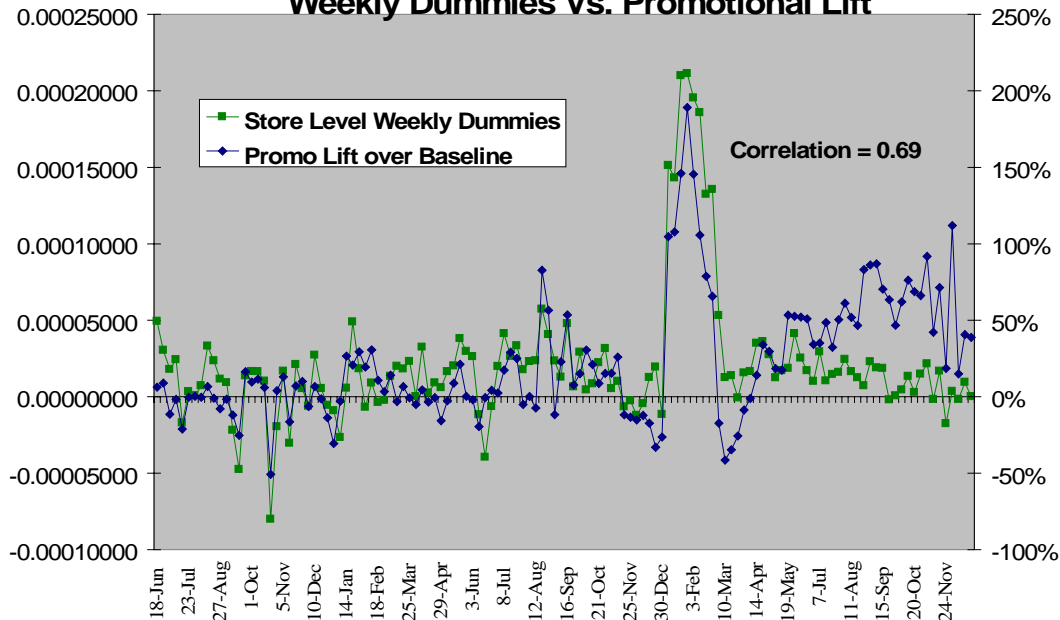
Weekly dummies are typically implemented by adding a dummy variable in a single-SKU model for each week and each market. That adds up to a total of about 5000 weekly dummies in a 2-year model (50 markets x 100 weeks).

The idea of using weekly dummies to estimate seasonality is not in itself a bad one. While at ACNielsen, Dennis Bender discussed the use of weekly dummies in a presentation to the Chicago Marketing Modelers' Group March 6<sup>th</sup>, 1990 ("Seasonality in Regression: From the 17<sup>th</sup> Century Astronomers to the 20<sup>th</sup> Century Marketing Modelers"). Dennis said the way to estimate these dummies is to pool all SKUs in the category (with similar seasonality) together. This makes a huge math problem but Dennis discussed solving it using "coupled regression". In any case, the key point is that 5000 weekly dummies is a lot of dummies, and if you dump them all into the model for one SKU, you will pick up effects particular to that SKU (like its promotions) in addition to true seasonality common across SKUs.

While IRI has abandoned this approach, Nielsen is known to still use weekly dummies in single-SKU models. Nielsen's argument is these dummies only pick up true seasonality and (for price-promotion models) omitted marketing mix effects like FSI coupons and advertising. However, our analysis shows that in practice, the dummies pick up other effects, like price and promotions. Further, these dummies over-parameterize the model and contribute to poor holdout sample performance.

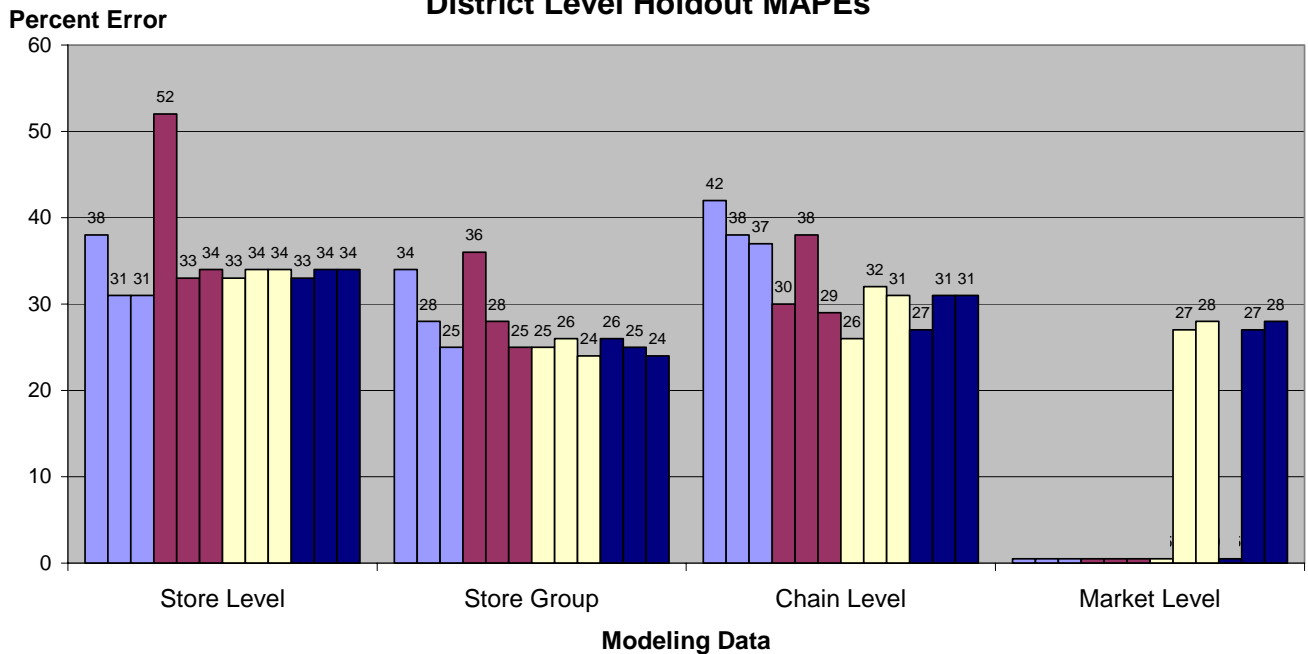
For example, we ran a test in 1999 using store level scanner data for a fast moving CPG category. We studied 430 items in three major category segments. Store level data for 129 stores in 45 chains and 2 markets was used. Models were run for 430 UPC level items over a period of 130 weeks. Each model was then used to predict sales in the following 26 week holdout period. The store level specification was Nielsen's model specification with weekly dummies. We found that the weekly dummies were highly correlated with promotion effects.

**Store Level Model - Sample Item**  
**Weekly Dummies Vs. Promotional Lift**



This contributed to overfitting and degraded holdout performance of the store level model:

**District Level Holdout MAPEs**



Note that model fit is excellent for single-SKU models with weekly dummies. In fact, the fit is guaranteed to be perfect in log-space at the market level or higher. The only reason the fit is not perfect in these models in normal space (the graphs the client will be shown) is because of the reverse transformation from log space. So take fit graphs from models with weekly dummies with a huge grain of salt: they mean absolutely nothing at the market level or higher.

*Bottom line: Weekly dummies in single-SKU models (the norm for weekly dummy models) is not a good way to model seasonality. The dummies pick up effects they are not supposed to, like price and promotions, negatively impacting the accuracy of price and promotion coefficients. We do not recommend this approach.*

Ross-boy Link  
Marketing Analytics Inc.