**Possible Approach to Estimate Economic Impact of Price Verification Inspections**

Submitted by Henry Oppermann, Weights and Measures Consulting

The purposes of price verification include the evaluation of the practices that stores use to maintain accurate price postings. To have an appropriate estimate of pricing errors found during price verification inspections, it is critical that the inspections are performed using the randomized sampling methods described in NIST Handbook 130. Additionally, if the distribution of pricing errors resembles a normal distribution, this simplifies the process to make a reasonable estimate of the total pricing errors per inspection for a given sample size.

There are several things that weights and measures officials do not know about the sales in each category of retail stores (e.g., supermarkets, convenience stores, department stores, sporting goods stores, etc.) that makes it difficult to estimate the economic impact of price verification inspections. Each category of stores sells items that have different price distributions and different numbers of products and product sizes in their annual sales. The pricing errors for different types (categories) of retail stores depend to some extent upon the price distribution of the products sold. Consequently, it is necessary to treat each category of store separately from other categories of stores to make estimates for the number of pricing errors in each store.

1. We do not know the percentages of each product and product size that comprise the annual sales figures for each store or category of store.
2. We do not know how well the pricing errors found in price verification inspections reflect the distribution and volume of products sold that comprise the annual sales figures for the stores. We assume that the inspection sample is representative of the entire store.
3. Consequently, we do not know the percentage of annual sales that are affected by pricing errors, which represents the economic impact of the pricing errors on annual sales.
4. We don’t know the sales total for the products sampled as part of each price verification inspection. Frequently, only the numbers and the dollar amounts of items over priced and under priced are documented.

Since we don’t know specifically how the items with pricing errors impact the overall sales figures, we should look at alternative measures to provide an indication of economic impact. If someone can provide a better way to estimate economic impact, then the better method should be used.

1. Using the **average errors** in prices (both over and under pricing errors are treated as positive values) found during price verification inspections, the total dollar amount of pricing errors in the store on a single day can be estimated based upon the total number of product items in the store. This can be extended to compute an estimate of the total amount of pricing errors in the store over a one-year period.
2. For comparison purposes, the estimates above can be compared to the daily and annual sales of individual stores in this category.

A spreadsheet is provided to calculate the dollar amount of pricing errors for all the product items in a store based upon the average results for all price verification inspections for the same category of stores.

* The total sales and number of establishments (stores) within a jurisdiction are needed. The Economic Census has this information available or it can be obtained from other sources.
* The “daily pricing errors/store” is computed by multiplying the average dollar errors for all inspections of the stores in each category by the ratio of the total number of product items in the store divided by the average sample size taken in the price verification inspections.
* The “Annual pricing errors/store” is calculated by multiplying the “daily pricing errors/store” by 360 sales days per year.
* The total annual amount of pricing errors for the store category (“For all stores in category, annual pricing errors”) is computed by multiplying the “Annual pricing errors/store” by the total number of stores in the jurisdiction that are in the store category.

An example of the spreadsheet calculation for the data that follows is shown below.



To assess the effect of enforcement and improved store practices to maintain accurate price postings, a “what if” calculation can be performed to estimate the effect of improved accuracy in pricing. The example below is based on, “What if the error rate and the overall pricing errors were reduced by half?”



This comparison shows that the pricing errors for one store over one year would be reduced by about $67,000. For all of the stores in this category, the pricing errors over one year would be reduced by over $79 million.

**Data from Inspections in One Jurisdiction**

The charts and tables that follow are summaries of price verification inspections for four retail chains in the same store category over a six-year period in one jurisdiction. I won’t identify the category of retail store or the jurisdiction, but the stores are not supermarkets or convenience stores. The average (mean values) for the total amount of pricing errors per inspection (which generally had a sample size of 50 items) is suggested as the basis for estimating the economic impact. Please note the large differences between the mean values and the median values in the tables and how they vary from chain to chain. Also note the different values for the variances in the total pricing errors, which indicates that there are large variations in results from store to store within a retail chain and from retail chain to retail chain. While these characteristics of pricing errors create a challenge to obtain precise estimates of economic impact, the average values of total pricing errors per inspection can be used to estimate the economic impact for each category of retail stores (based on proportional and randomized samples in the inspections versus the total number of product items in each category of store) for which price verification inspections are done in a jurisdiction. The estimate should be made separately for each category of store based upon the price verification inspections for each category of store.





The next chart and table show the total pricing errors per inspection for all four retail chains for this category of retail store.





The charts below show the total pricing errors per inspection separated for Chain A and the combined total pricing errors for Chains B, C and D. This was done because there are enough inspections in each group to provide a reasonable analysis.









The table below provides summary statistics for the total pricing errors per inspection separated for Chain A and the combined total pricing errors for Chains B, C and D.



I would welcome other suggestions that could be used to estimate the economic impact of price verification inspections. What I like about this approach is that each jurisdiction can use the results of its own inspections to make estimates of economic impacts for the different types of retail stores.