

## COMPARISON OF NATIONAL AND REGIONAL GASOLINE PRICES FROM TWO SURVEYS

Pedro J. Saavedra and Nancy C. Hassett, Macro International Inc., Paula Weir, U.S. Department of Energy  
Nancy C. Hassett, Macro International Inc., 11785 Beltsville Drive, Calverton, MD 20705

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The U.S. Department of Energy's EIA-782 is a national monthly price and volume survey of refiners, resellers, and retailers of various petroleum products including gasoline. The EIA-878 is a national weekly survey of regular unleaded gasoline prices at the pump. Gasoline prices based on the EIA-782 are published monthly in the Petroleum Marketing Monthly; however, due to the nature of the survey and the required data processing time, the results are not available until over two months later. The Energy Information Administration (EIA) of the Department of Energy would like to produce more timely estimates of national and regional gasoline prices using alternative approaches. One such approach is the use of the EIA-878 survey data to produce the estimates. This paper compares EIA-782 price estimates versus those derived from the EIA-878 for the period October, 1992 through September, 1993.

### Background

The EIA-782 survey collects data at the company level on petroleum product sales to end users and resellers. Reported data do not include taxes. The EIA-782, which is conducted by mail, has two components: the EIA-782A, which is a census of refiners and gas plant operators, and accounts for a large percentage of petroleum products sales volume, and the EIA-782B. The EIA-782B survey is mailed to a sample of resellers/retailers who have been selected according to a complex sampling design involving multiple stratifications. The sample design is based on eight target products and estimates are desired by state/product combination. The sample is redrawn each year and rotated with 50 percent overlap each year.

The EIA-878 survey, which is conducted by telephone, is a national survey of regular unleaded gasoline prices at 600 retail outlets. In contrast to the EIA-782 survey, the reported prices include Federal, state, and local taxes. The EIA-878 frame consists of retail outlets of companies in the EIA-782 frame. The EIA-878 sample is obtained by drawing a subsample of companies from the EIA-782 sample, with probabilities proportional to weighted volume, and then sampling outlets associated with the companies in the subsample.

### Comparison of Gasoline Prices

The comparison of the two price series required the transformation of the EIA-878 prices to a form directly comparable to the EIA-782 prices. The EIA-782 prices do not include taxes; however, the EIA-878 prices include Federal, state, and local taxes. The first step in the comparison of the two price series was the removal of these taxes from the EIA-878 prices. The second step was the conversion of the weekly untaxed prices to an average monthly price. Aggregating the state-level monthly average prices to the national and Petroleum Allocation for Defense District (PADD) levels<sup>1</sup> was the third step, resulting in price estimates which were directly comparable to the EIA-782 prices.

### Step 1: The Problem of Tax Calculation

The identification of taxes levied by the different states and localities presented some difficulties. There are published tables of taxes by state, but they do not include local taxes. Furthermore, sales and use taxes vary from locale to locale within a state. Some states, like Virginia, have a state sales and use tax only for areas where certain conditions are met (in Virginia's case, it is linked to rapid transit systems). For other states, a range is provided, and there is no immediate way of telling what sales and use tax applies in a particular location in the state. Likewise, some states have local option taxes, but in most cases only a range is provided in the tables of taxes. For this study, the midpoint of the values given for sales and use taxes and local option taxes was used as the tax rate for the state. This rate was applied to the value left after Federal and state taxes were subtracted from the EIA-878 price. As an example, consider the state of Michigan, which has a sales and use tax of 4%. For July of 1993, a Federal tax of 14.10cents and a state tax of 15.88cents were subtracted from the reported price for each outlet. The resultant value was divided by 1.04 to account for the 4% sales and use taxes.

### Step 2: Estimate Average Monthly Price

Prices are generally collected on Monday of each week, except when that Monday is a holiday, in which case the prices are collected the next day but represent Monday's price. Each day of the month was assigned the untaxed price that was closest to that day.

Thus, if the first survey of the month was performed on the seventh, and there had been a survey the last day of the previous month, the last price of the previous month was assigned to the first three days of the following month. For example, consider the two reporting dates of November 30, 1992 and December 7, 1992. The November 30 price would be assigned to December 1, 2, and 3. If a day was exactly the same distance from two reporting dates, the average of the prices for those two dates was assigned to that day. The EIA-878 estimated average monthly price was calculated as the average of the daily prices for each state.

### Step 3: Estimate National and Regional Prices

The monthly prices were aggregated to the national and PADD level. These price estimates were compared to the EIA-782 prices. The ratio of the difference to the standard error of the differences was calculated for each month, both nationally and by PADD. The standard error of the differences was calculated as the square root of the sum of the EIA-878 and EIA-782 variances, both of which had been estimated previously. Ratios greater than two were considered indicative of a potential bias in the EIA-878 estimated average monthly prices.

### Results

Average monthly prices at the national level are shown graphically in Figure 1. Differences at the national level were less than one cent for all months. For some months the national price derived from the EIA-878 was within one hundredth of a cent of the EIA-782 national price estimate. The March, 1993 estimate was off by the largest amount, but it was still within six-tenths of a cent.

Figure 2 presents average monthly price differences at the PADD level. The EIA-878 estimates for every PADD were within 1.5 cents of the EIA-782 survey estimates. In PADD 3, the EIA-878 estimates consistently exceeded the EIA-782 estimates, while in PADD's 2 and 5, the EIA-878 estimates were consistently less than the EIA-782 estimates. Only PADD's 1 and 4 exhibited both positive and negative differences. However, when the ratio of the difference to the standard error of the differences was examined for each month, only PADD 2 exhibited any evidence of a systematic bias in the EIA-878 price estimates.

Figure 3 shows the average monthly price differences at the sub-PADD level. In sub-PADD 1A (New England), the EIA-878 yielded a lower price

estimate than the EIA-782 by up to three cents. However, the EIA-878 estimates for sub-PADD's 1B and 1C were within 1.5 cents of the EIA-782 survey estimates. A comparison of the ratio of the difference to the standard error of the differences by month indicated a systematic bias only in sub-PADD 1A.

### Conclusions and Recommendations

The consistent agreement of the two national estimates is rather promising and suggests that gasoline price estimates derived from the EIA-878 survey may serve as a viable alternative to estimates obtained from the EIA-782 survey. Examination of the ratio of the difference of the estimates divided by the standard errors suggested some systematic biases in some of the regions (PADD 2 and sub-PADD 1A), but not nationwide. The systematic differences in certain regions, particularly New England, where the discrepancy seems to be consistent, may well be due to incorrect assumptions regarding taxes. Taxes may have been overestimated in both PADD 2 and sub-PADD 1A. State tax tables were obtained for three months throughout the year; changes in state taxes during other months may not have been accurately reflected. The use of median local and sales taxes within a state may not have yielded accurate estimates at the PADD level.

There are two modifications which would increase the accuracy of outlet derived estimates. The first would be to obtain the tax component of prices directly from the outlets at least once a quarter. This would facilitate determining the untaxed price of gasoline as reflected by the outlet. The second possible modification is to benchmark the survey on the EIA-782. This would not resolve all discrepancies, but it would considerably reduce the inaccuracies.

#### PADD 1:

Subdistrict 1A: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.

Subdistrict 1B: Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania.

Subdistrict 1C: Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia.

PADD 2: Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, Wisconsin.

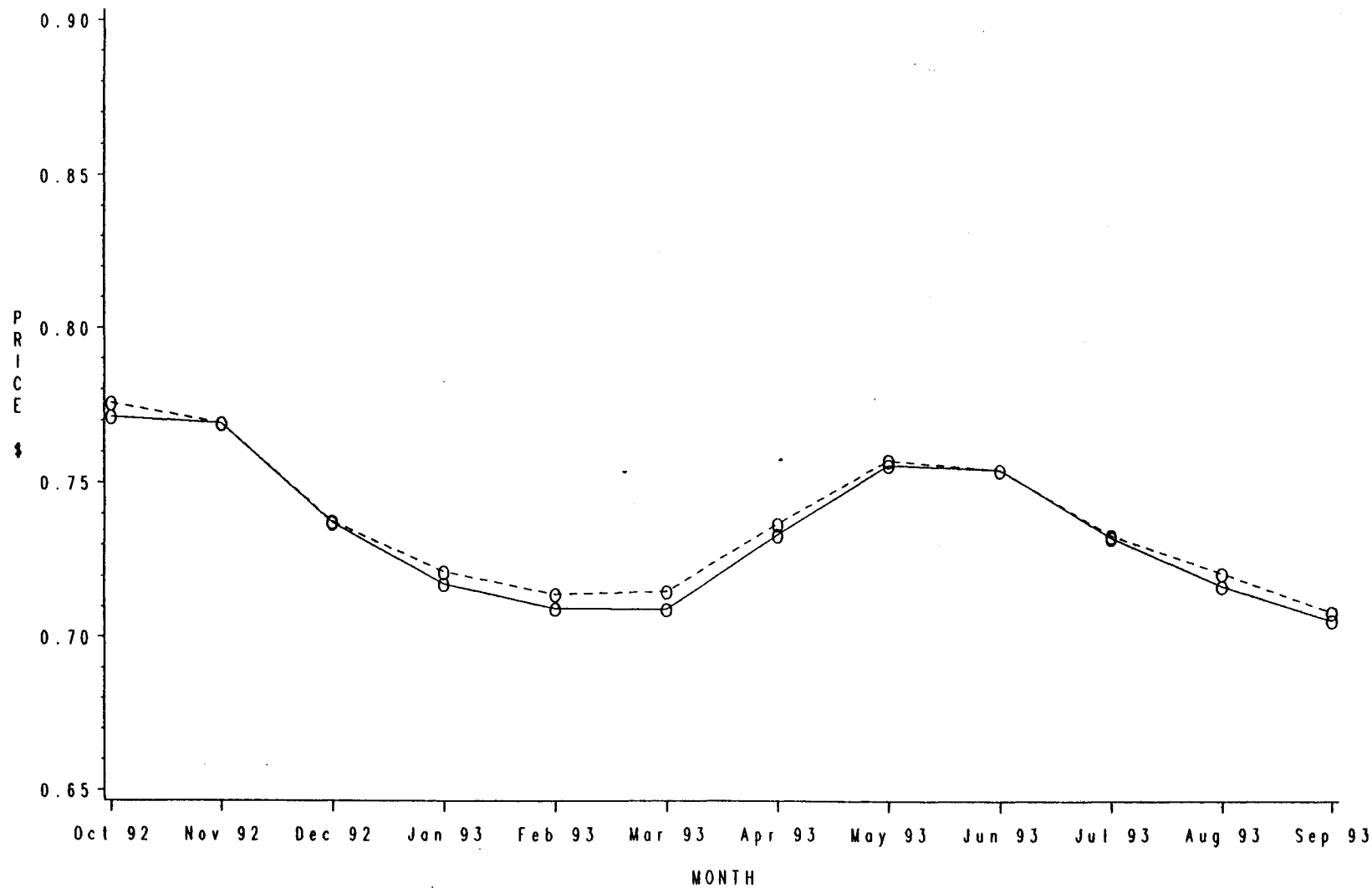
PADD 3: Alabama, Arkansas, Louisiana, Mississippi, New Mexico, Texas.

PADD 4: Colorado, Idaho, Montana, Utah, Wyoming.

PADD 5: Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington.

Figure 1: Average Monthly Prices (\$/gallon) for Motor Gasoline for Total U.S.

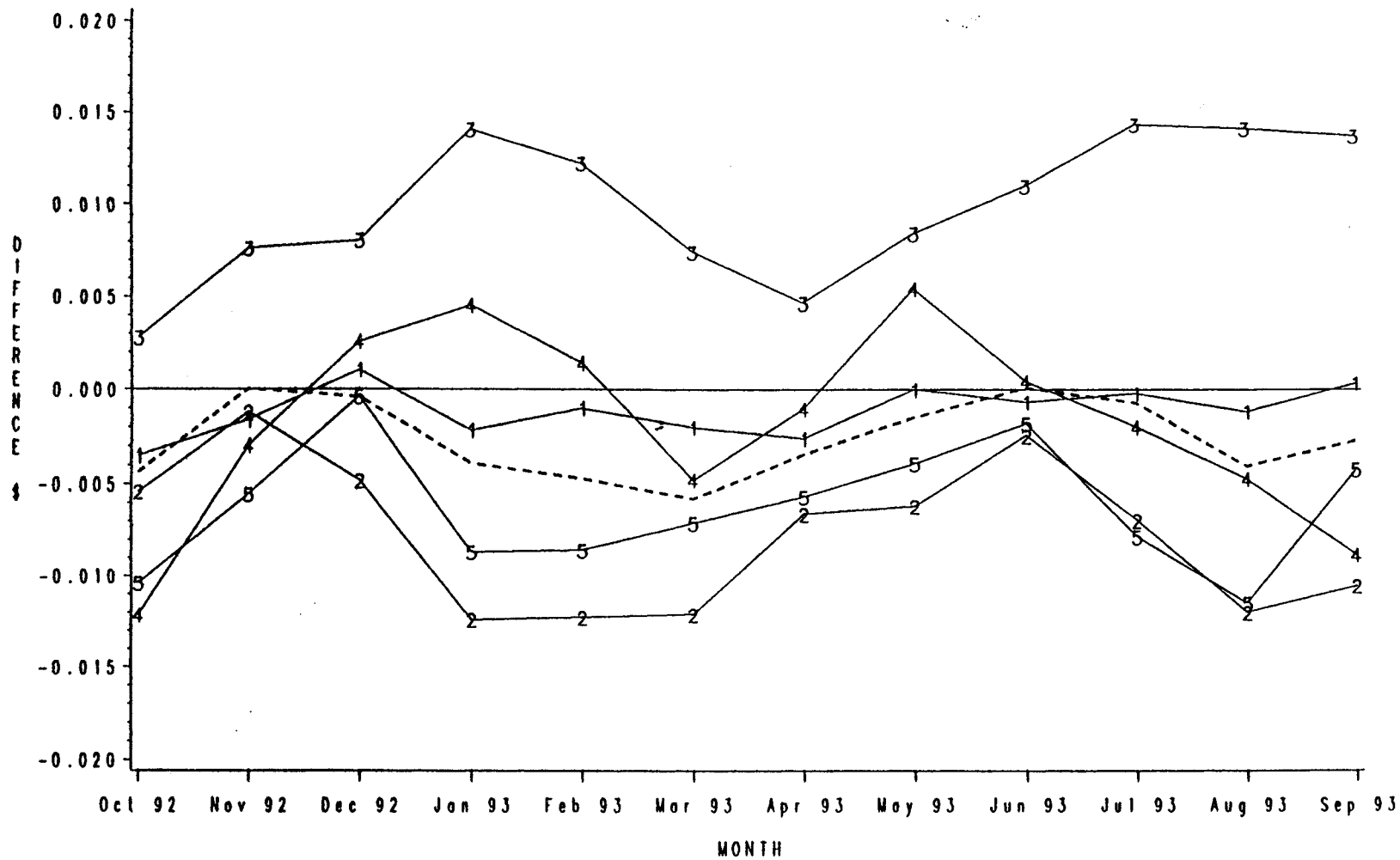
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EIA-878 prices (taxes removed) represented by solid line  
EIA-782 prices represented by dashed line

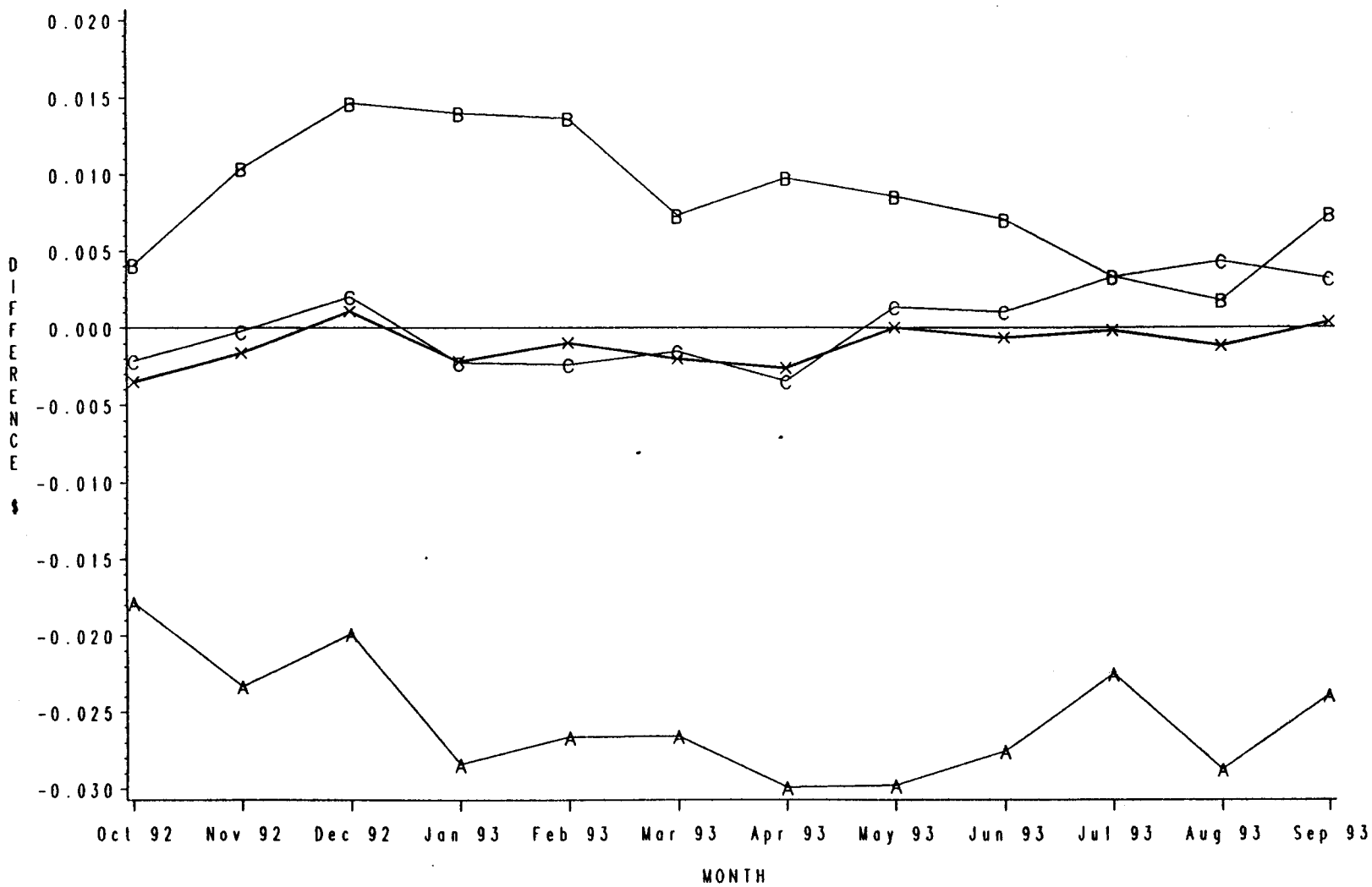
Figure 2: Average Monthly Price Differences for Motor Gasoline by PADD  
 EIA-878 Untaxed Price - EIA-782 Price

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-- = Total U.S.

Figure 3: Average Monthly Price Differences (\$/gallon) for Motor Gasoline by Sub-PADD's 1A, 1B, 1C  
 EIA-878 Untaxed Price - EIA-782 Price



x = PADD 1    A = PADD 1A    B = PADD 1B    C = PADD 1C

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