COMPARISON OF DIFFERENT METHODS OF COMPUTING YEARLY GROWTH RATES FOR PETROLEUM SUPPLY, 1995-2004

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Highlights

This paper is part of a bigger project to compare the congruence of the monthly petroleum product supply values (in thousands of barrels per day) for finished motor gasoline supplied, distillate fuel oil supplied, and total products supplied as reported in various publications of the Petroleum Division of the Energy Information Administration (EIA) for the years 1995 to 2004. The focus of this paper is to compare 15 methods of using the data from these publications when year-to-year growth rates are computed by dividing the estimated average quantity per day for a month in a particular year by an estimate for that same month in the previous year. The monthly-based estimates used in computing these growth rates come from *Petroleum Supply Monthly* (*PSM)* and *Petroleum Supply Annual* (*PSA*). Weekly-based estimates, from data reported in *Weekly Petroleum Status Report (WPSR)*, are used three different ways to compute monthly estimates. These five different estimates of monthly product supply are then used in various combinations to form the ratios that estimate the year-to-year growth rates. The reason that comparing growth rates based on weekly data, monthly data as reported in *PSM*, and monthly data as reported in *PSA* is important is that weekly-based estimates for a month are available much sooner than the others. The weekly-based estimates are available within 11 days of the end of the month while the *PSM* numbers take up to 60 days to be released and the *PSA* data take about 6 months after the end of the calendar year to be released. Since the weekly-based estimates are based on samples and the *PSM* and *PSA* measurements are based on censuses, the *PSM* and *PSA* data are generally more accurate. The *PSA* numbers contain revisions of the data published in the *PSM* due to late submissions or resubmissions. So, the question of main interest here is whether growth rates using weekly-based estimates or *PSM* numbers can mirror closely the growth rates computed using the PSA numbers.

This paper takes as the "gold standard" the year-to-year growth rate as defined by Formula A:

$$A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$$

, where Month = Jan., Feb., Mar., Apr.… and t = number of years since 1994 and where *PSA* is the monthly amount reported in *Petroleum Supply Annual*. Other methods using *PSM* and/or weekly-based estimates are then compared to this "gold standard".

The 15 methods were first compared using the descriptive statistics of the mean, standard deviation, and correlation. The mean growth rate given by the "gold standard" of Formula A was then compared to the mean growth rates given by the other 14 methods using paired t-tests of statistical significance. Next, the other 14 formulas were compared in terms of the percentage of the time that they are within 1% and within 2% of Formula A. Finally, the other 14 methods were compared to the "gold standard" of Formula

A in terms of the percentage of time that they give growth rates in the same direction (that is, both give positive growth rates or both give negative growth rates).

The method that used *PSM* for the present year in the numerator and *PSM* for the previous year in the denominator is the best formula to use to approximate growth rates as calculated by Formula A. It has descriptive statistics that are the closest of all 14 methods to Formula A for finished motor gasoline supplied, distillate fuel oil supplied, and total products supplied. Its correlations with Formula A are over .900. Further, its year-to-year growth rates are within 2% of Formula A much more often than other methods. Finally, far less of the time, it gives a different direction for year-to-year growth rates than Formula A does as compared to the other methods.

Intuitively, a method that uses *PSM* as the numerator and *PSA* from the previous year as the denominator would seem to be a better estimator than the formula that uses *PSM* as both the numerator and denominator. But, it is not. It underestimates Formula A too often, as is evidenced by its statistically significant (and meaningfully significant) differences in mean growth rates as compared to Formula A for finished motor gasoline supplied, distillate fuel oil supplied, and total products supplied. Finally, when methods are used that involve monthly estimates derived from weekly data in the numerator, the picture is not very clear as to what the best denominator is to get good approximations to Formula A.

Introduction

Statement of Purpose

This paper is part of a bigger project to compare the congruence of the monthly petroleum product supply values (in thousands of barrels per day) for finished motor gasoline supplied, distillate fuel oil supplied, and total products supplied as reported in various publications of the Petroleum Division of the Energy Information Administration (EIA). The focus of this paper is to compare 15 methods of using the data from 1994 to 2004 from these publications when year-to-year growth rates are computed by dividing the estimated average quantity per day for a month in a particular year by an estimate for that same month in the previous year. The monthly-based estimates used in computing these growth rates come from *Petroleum Supply Monthly* (*PSM)* and *Petroleum Supply Annual* (*PSA*). The *PSM* estimates are from data collected using the EIA-810, -811, -812, -813, -814, -815, and -817 surveys. The *PSA* numbers are from the data used for *PSM* plus any submissions/resubmissions that occur after the *PSM* for a particular month is finalized. Weekly-based estimates from data collected on the EIA-800, -801, -802, -803, -804 and -805 surveys, as reported in *Weekly Petroleum Status Report (WPSR)*, are used three different ways to compute monthly estimates. These five different estimates of monthly product supply are then used in various combinations to form the ratios that estimate the year-to-year growth rates.

The reason that comparing growth rates based on weekly data, monthly data as reported in *PSM*, and monthly data as reported in *PSA* is important is that weekly-based estimates for a month are available within 11 days of the end of the month while the PSM and PSA data take longer to be released. The *PSM* data are available within 60 days of the end of month. For example, the *PSM* that included data through June 2006 was released on August 28, 2006. The *PSA* data are usually released approximately six months after the end of the calendar year that they cover.

Since the weekly-based estimates are based on samples and the *PSM* and *PSA* measurements are based on censuses of the same populations, the *PSM* and *PSA* data are generally more accurate, with the *PSA* measurements being more accurate than the *PSM* measurements due to corrections made because of the late submissions or resubmissions. So, the question of main interest here is whether growth rates using weekly-based estimates or *PSM* numbers can mirror closely the growth rates computed using the *PSA* numbers.

This paper will take as the "gold standard" the year-to-year growth rate as defined by $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$ where Month = Jan., Feb., Mar., Apr.,… and t = number of years since 1994 and where *PSA* is the monthly amount reported in *Petroleum Supply Annual*. This formula will be abbreviated throughout the paper as Formula A. Formula A will be compared to 14 other methods of defining year-to-year growth rates. Formula A can be written as a single fraction as $A(Month,t) = \left(\frac{Month_{PSA}(t) - Month_{PSA}(t-1)}{Month_{PSA}(t-1)} \right) * 100\%$.

Product Supplied is defined for Formula A, and for the other formulas to be described in the next section, as equal to (Field Production + Refinery and Blender Net Production + Imports + Adjustments) – (Stock Change + Refinery and Blender Net Inputs + Exports).

Methods for Determining Growth Rates

The 14 methods to be compared to Formula A are defined as formulas as:

1) $\left(\frac{Month_{PSM}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$ where *PSM* = the monthly amount reported in *Petroleum Supply Monthly.* This is the formula used by EIA's *Short-Term Energy Outlook (STEO)* when preparing Figure 8 (U.S. Petroleum Products Consumption Growth). This formula also can be written as a single fraction as $\left(\frac{Month_{PSM}(t) - Month_{PSA}(t-1)}{Month_{PSA}(t-1)} \right) * 100\%$. The remaining methods defined in this section can be written as single fractions in a similar manner.

2) $\left(\frac{Month_{PSM}(t)}{Month_{PSM}(t-1)} - 1 \right) * 100\%$

Before giving the remaining formulas, all of which use weekly-based data in whole or in part, the definition of a week needs to be given. Product supply data are taken from the EIA-800, -801, -802, -803, and -805 establishment surveys. For these surveys a week is defined as starting at 7:01 a.m. on one Friday and ending at 7 a.m. on the next Friday. In deriving monthly estimates from weekly data, a week is then slightly re-defined, for the purpose of this paper, as beginning at 12:01 a.m. on the Friday previous to the reporting date and ending at midnight on the Thursday before the Friday report date. The weekly averages reported in *WPSR* and on the *EIA Petroleum Navigator* website at http://tonto.eia.doe.gov/dnav/pet/pet_pub_publist.asp are used directly. No adjustment is made for the 7 hour difference.

3) $\left(\frac{Month_{MFW}(t)}{Month_{MFW}(t-1)} - 1 \right) * 100\%$ where MFW = the monthly amounts estimated from the weekly data.

The MFW estimates are weighted averages of the weeks that contain the days of a certain month. For example, for July 2006, the weighted average was {6*(data reported for 7/7/06) + 7*(data reported for 7/14/06) + 7*(data reported for 7/21/06) + 7*(data reported for 7/28/06) + 4*(data reported for 8/4/06)}/31. MFW was used in Table S1 (Crude Oil and Petroleum Products Overview) of *PSM* during the period covered by this paper and was used in the past and is used presently in Table H1 (Petroleum Supply Summary) of the *WPSR.*

4) $\left(\frac{Month_{4Wa}(t)}{Month_{4Wa}(t-1)}-1\right)*100\%$ where 4Wa = Four-week averages computed using the 4 weeks before the report date of the last Friday in the month.

5) $\left(\frac{Month_{4Wb}(t)}{Month_{4Wb}(t-1)}-1\right)*100\%$ where 4Wb = Four-week averages using the 4 weeks that cover the most days in the particular month at time t and at time t -1. For example, for August 2006 using the method just defined in Formula 4 would have a cutoff date of Friday, August 25 and thus include 24 days of August and 4 days of July. However, using the four weeks that cover the most days in August would have a cutoff date of September 1 for the data and thus contain 28 days of August.

Four-week averages are used in EIA's *This Week in Petroleum (TWIP)*. *TWIP*, since it is published weekly, uses the nearest four weeks to its publication date when discussing product supply data. Near the end of a month, the values given in *TWIP*, whenever growth rates are discussed, will agree with Formula 4 and/or Formula 5.

6) $\left(\frac{Month_{MFW}(t)}{Month_{PSM}(t-1)}-1\right)*100\%$

7) $\left(\frac{Month_{4Wa}(t)}{Month_{PSM}(t-1)}-1\right)*100\%$

8) $\left(\frac{Month_{4Wb}(t)}{Month_{PSM}(t-1)}-1\right)*100\%$ (This is the closest rate to the method used in the *DOE Weekly Analysis* Newsletter of the PIRA Energy Group at the end of a month to estimate growth rates.)

9) $\left(\frac{Month_{MFW}(t)}{Month_{PSA}(t-1)}-1\right)*100\%$

10) $\left(\frac{Month_{4Wa}(t)}{Month_{PSA}(t-1)}-1\right)*100\%$

11) $\left(\frac{Month_{4Wb}(t)}{Month_{PSA}(t-1)}-1\right)*100\%$

12) Use Formula 6 for the months of January to June and use Formula 9 for the months of July to December (assuming that *PSA* data for year t -1 will be available by July 31 of year t).

13) Use Formula 7 for the months of January to June and use Formula 10 for the months of July to December (assuming that *PSA* data for year t -1 will be available by July 31 of year t).

14) Use Formula 8 for the months of January to June and use Formula 11 for the months of July to December (assuming that *PSA* data for year t -1 will be available by July 31 of year t).

Formulas 12 to 14 are the equivalent for "months" of the formulas used in the *WPSR* for "weeks". Figure 1 shows the relationships between the 15 formulas.

Figure 1. Relationships between the 15 Formulas

			Numerator		
Denominator	**PSA**	**PSM**	**MFW**	**4Wa**	**4Wb**
PSA	Formula A	Formula 1	Formula 9	Formula 10	Formula 11
			Formula 12	Formula 13	Formula 14
PSM		Formula 2	Formula 6	Formula 7	Formula 8
MFW			Formula 3		
4Wa				Formula 4	
4Wb					Formula 5

Note: The reason that Formulas 12, 13, and 14 are listed between the PSA and PSM as denominator rows is that they are hybrid formulas using the PSA denominator for part of the year and the PSM denominator for the remainder of the year.

Data Sources

The data used in this paper are from January 1994 to December 2004. The data for *PSA*, *PSM*, and MFW are from the electronic version of the in-house "Blue Book". The 4wa and 4wb monthly measurements were computed by downloading the WPSR weekly data from *EIA Petroleum Navigator* and taking the means of the appropriate weeks. All the data used in this paper were reported in thousands of barrels per day. Hence no adjustments need to be made to account for the different number of days in different months.

Evaluation Criteria for Comparing the Formulas

The 15 formulas will first be compared using the descriptive statistics of the mean, standard deviation, and correlation. The mean growth rate given by the "gold standard" of Formula A will then be compared to the mean growth rates given by the other 14 formulas using paired (matched) t-tests of statistical significance. Next, the other 14 formulas will be compared in terms of the percentage of the time that they are within 1% and within 2% of Formula A. Finally, the other 14 formulas will be compared to the "gold standard" of Formula A in terms of the percentage of time that they give growth rates in the same direction (that is, both give positive growth rates or both give negative growth rates) as Formula A.

Descriptive Statistics for the 15 Methods

All analyses in this paper will be for the ten-year period of 1995 to 2004. The 1994 data were used only in the denominators for the 1995 growth rate formulas. Tables 1, 2, and 3 give the descriptive statistics of means, standard deviations, and correlations with Formula A (along with the other major evaluation criteria statistics) for finished motor gasoline supplied, distillate fuel oil supplied, and total products supplied, respectively for the 15 methods (that is, the method defined by Formula A and 14 other formulas described above for defining year-to-year growth.) Tables 4, 5, and 6 give more details about the descriptive statistics, including means, standard deviations, medians, minimums, maximums, and ranges.

Finished Motor Gasoline Supplied

As can be seen from Table 1, all of the methods that use *PSM* as a denominator (Formulas 2, 6, 7, and 8) or use the same measure as the numerator and denominator (Formulas 2 to 5) have means close to the mean for Formula A. The formulas that use *PSA* as the denominator for all months or for the last six months of the year (Formulas 1, 9 to 14) all underestimate the mean for Formula A. Further, all 14 formulas have standard deviations and ranges (see Table 4) that are slightly bigger than that of Formula A. Finally, the formulas using *PSM* as the numerator (Formulas 1 and 2) have high correlations with Formula A of .941 and .905 (R^2 = .885 and .819, respectively). The formulas that use the same weekly measure (Formulas 3 to 5) as the numerator and denominator have correlations of only between .385 to .438 (R^2 from .148 to .192) with Formula A. The remaining formulas have correlations between .621 and .721 (R^2 from .386 to .520) with Formula A.

Distillate Fuel Oil Supplied

As can be seen from Table 2, all of the methods that use the same measure as the numerator and denominator (Formulas 2 to 5) or that use *PSA* as the denominator (Formula 1 and Formulas 9 to 11) underestimate the mean growth rate obtained using Formula A while those methods that use *PSM* as the denominator and a weekly measure as the numerator (Formulas 6 to 8) overestimate the mean growth rate. Further, all 14 methods have standard deviations and ranges (see Table 5) that are slightly bigger than that of Formula A. In terms of correlations, the formulas using *PSM* as the numerator (Formulas 1 and 2) have high correlations with Formula A of .983 and .971 (R^2 = .966 and .943, respectively). Finally, all formulas, except those with the same weekly measure as the numerator and denominator (that is, except for Formulas 3 to 5), have a correlation with Formula A between .824 and .857 (R^2 from .679 to .734). Formulas 3 to 5 have lower correlations with Formula A of between .675 and .712 (R^2 from .456 to .507).

Total Products Supplied

As can be seen from Table 3, all of the methods underestimate the mean growth as compared to Formula A. All methods also have standard deviations approximately the same as for Formula A. Further, all 14 methods produce ranges (see Table 6) that are smaller than that for Formula A. This is the opposite as for finished motor gasoline supplied and distillate fuel oil supplied. In terms of correlations, the pattern for total products supplied is the same as for finished motor gasoline and distillate fuel oil supplied. Formulas 1 and 2, that use *PSM* as the numerator, have correlations of .964 and .940 (R^2 =.929 and .884) with Formula A. All other formulas, except those with the same weekly measure as the numerator and denominator (that is, Formulas 6 to 14), have a correlation with Formula A between .696 and .750 (R^2 from .484 to .563). Formulas 3 to 5 have lower correlations with Formula A of between .454 and .508 (R^2 from .206 to .258).

The differences that sometimes occurred between the means and the medians reported in Table 4, Table 5, and Table 6 should not be interpreted as showing skewness for certain growth rate methods. These differences between the means and the medians were investigated carefully. They are caused by some of the growth rate methods having small gaps in the middle when histograms were constructed for finished motor gasoline supplied, distillate fuel oil supplied, and/or total products supplied.

Effects of Outliers on the Results

The effects of outliers were considered carefully since all of the methods being compared use ratio estimators. A growth rate that looks like a potential outlier may be caused by having a numerator or denominator that is larger or smaller than expected for its month. Sometimes the individual numerator and denominator may be outliers, but their ratio may not be an outlier. It was found that there were some

outliers, but that these outliers had no meaningfully significant effects on the results. See Appendix A for details.

Significance Testing of Mean Differences in Growth Rates

The significance tests for deciding whether there were statistically significant differences between the mean growth rate given by Formula A and the other 14 methods are given in Tables 7 to 9. The differences in means and the p-values are also given in Tables 1 to 3. Paired (matched) t-tests were used since the growth rates are indexed by year and month. When reading these tables it is important to remember that if a t-statistic is not statistically significant, then the direction of the difference between two growth rate formulas should not be interpreted. That is, whether the mean difference is negative or positive should not be discussed for non-statistically significant t-statistics. It also needs to be remembered that growth rate differences, and not raw differences, are being tested here.

Finished Motor Gasoline Supplied

As shown in Tables 1 and 7, the statistically significant differences for finished motor gasoline were those that involved one of the weekly measures as the numerator and *PSA* from the preceding year as the denominator of the growth rate formula. Formula A involves the same *PSA* measurement for the preceding year. So, these growth rate formulas and Formula A only differ in their numerators. All of these statistically significant differences were negative and were caused by the monthly values for *PSM* (used in Formula 1), MFW (used in Formula 6), 4Wa (used in Formula 7) and 4Wb (used in Formula 8) being lower on the whole than the corresponding *PSA* reported values (see Table 10.) In particular, *PSM* published data were lower than the *PSA* data 71.2% of the time, MFW data were lower than the *PSA* data 61.3% of the time. The 4-week averages using the last Friday of the month as a cutoff (that is, 4Wa in the context of this paper) were lower than the *PSA* data 61.3% of the time, and the 4-week averages using the 4 weeks that cover the most days possible of the month (that is, 4Wb in the context of this paper) were lower than the *PSA* data 61.3% of the time. Although the percentage of time below *PSA* is the same for all three of the ways of computing monthly averages from weekly data, their frequency distributions are different.

Distillate Fuel Oil Supplied

As shown in Tables 2 and 8, the only statistically significant difference found for distillate fuel oil was between the mean *PSA* growth rate as given by Formula A and the growth rate as given by Formula 1 (*PSM/PSA*). Although the mean difference between the Formula A and Formula 1 is approximately the same as for several other growth rate formulas, the reason this difference is statistically significant is that the range (that is, maximum — minimum) of 3.790% and standard deviation of 1.003% for these differences are much smaller than for the other differences in growth rates. See Table 8 for details. The standard deviations for the differences between Formula A and Formulas 3 to 14 were between 3.072% and 4.882% and the differences between Formula A and Formula 2 had a standard deviation of 1.363%. For comparison with finished motor gasoline supplied and total products supplied, the percentage of the time that the published *PSM* values were lower than the *PSA* values was 57.6% (see Table 10.) The MFW data were lower than the *PSA* data 50.8% of the time. The 4-week averages using the last Friday of the month as a cutoff (that is, 4Wa in the context of this paper) were lower than the *PSA* data only 48.5% of the time, and the 4-week averages using the 4 weeks that cover the most days possible of the month (that is, 4Wb in the context of this paper) were lower than the *PSA* data 53.0% of the time.

Total Products Supplied

As shown in Tables 3 and 9, the statistically significant differences for total products supplied were those that involved *PSA* from the preceding year as the denominator of the growth rate formula (that is, Formula 1 and Formulas 9 to 14.) All of these statistically significant differences were negative and were caused by the monthly estimates being lower on the whole than *PSA* reported values (see Table 10.)

The *PSM* published data were lower than the *PSA* data 81.1% of the time. The MFW data were lower than the *PSA* data 68.2% of the time. The 4-week averages using the last Friday of the month as cutoff (that is, 4Wa in the context of this paper) were lower than the *PSA* data 69.7% of the time, and the 4-week averages using the 4 weeks that cover the most days possible of the month (that is, 4Wb in the context of this paper) were lower than the *PSA* data 68.2% of the time. The statistically significant differences for the "hybrid" measures of Formulas 12 to 14 are caused by the "overwhelming" differences in the last six months of the year compared to the "non-statistically significant" differences for the first six months of the year.

Percentage of the Time Within 1% and 2% of PSA Growth Rate

Finished Motor Gasoline Supplied

From Table 1 and Table 11 it can be seen that 83.33% of the time the growth rate defined by Formula 1 (*PSM/PSA*) was within 1% of Formula A and that 80.83% of the time the growth rate defined by Formula 2 (*PSM/PSM*) was within 1% of Formula A. Further, 96.67% of the time the growth rate defined by Formula 1 was within 2% of Formula A and 97.50% of the time the growth rate defined by Formula 2 was within 2% of Formula A. For the remaining formulas, there was more diversity in the closeness of the growth rates. The other formulas that use *PSA* or *PSM* or both as denominators (Formulas 6 to 14) were within 1% of Formula A between 37.50% and 48.33% of the time and were within 2% of Formula A between 74.17% and 78.33% of the time. The formulas (Formulas 3 to 5) that use the same weekly measurement (either MFW, 4Wa, or 4Wb) did not perform as well. They were within 1% of Formula A between 29.17% and 34.67% of the time and were within 2% of Formula A between 59.17% and 69.17% of the time.

Distillate Fuel Oil Supplied

From Table 2 and Table 12 it can be seen that 76.67% of the time the growth rate defined by Formula 1 (*PSM/PSA*) was within 1% of Formula A and that 60.00% of the time the growth rate defined by Formula 2 (*PSM/PSM*) was within 1% of Formula A. Further, 93.33% of the time the growth rate defined by Formula 1 was within 2% of Formula A and 86.67% of the time the growth rate defined by Formula 2 was within 2% of Formula A. The remaining formulas (Formulas 3 to 14) were within 1% of Formula A between 15.83% and 23.33% of the time and were within 2% of Formula A between 33.33% and 45.00% of the time.

Total Products Supplied

From Table 3 and Table 13 it can be seen that 77.50% of the time the growth rate defined by Formula 1 (*PSM/PSA*) was within 1% of Formula A and that 75.00% of the time the growth rate defined by Formula 2 (*PSM/PSM*) was within 1% of Formula A. Further, 95.83% of the time the growth rate defined by Formula 1 was within 2% of Formula A and 96.67% of the time the growth rate defined by Formula 2 was within 2% of Formula A. For the remaining formulas, there was more diversity in the closeness of the growth rates. The other formulas that use *PSA* or *PSM* or both as denominators (Formulas 6 to 14) were within 1% of Formula A between 34.17% and 40.83% of the time and were within 2% of Formula A between 67.50% and 72.50% of the time. The formulas (Formulas 3 to 5) that use the same weekly measurement (either MFW, 4Wa, or 4Wb) did not perform as well. They were within 1% of Formula A between 30.83% and 32.50% of the time and were within 2% of Formula A between 50.83% and 55.83% of the time.

Occurrence of Reported Wrong Directions of Growth Rates

It is very possible for the year-to-year growth rates for some of 15 methods to yield a positive growth rate and some of the 15 methods to yield a negative growth rate for the same time period. This will especially

occur when the growth rates are small (near 0%). While the growth rates calculated by two different formulas may be close to each other in their values, the fact that one is positive and one is negative is bothersome psychologically. This discrepancy in terms of sign is described in Tables 14 to 19. For all tables, the "gold standard" of Formula A was used and all other formulas were compared to it.

Finished Motor Gasoline Supplied

As seen in Table 14, Formulas 1 and 2, that use only PSA and PSM data in their calculations, give the same direction as Formula A 95.00% and 92.50% of the time, respectively. The other formulas give the same direction as Formula A between 73.34% and 85.83% of the time.

Distillate Fuel Oil Supplied

As seen in Table 15, Formulas 1 and 2, that use only PSA and PSM data in their calculations, give the same direction as Formula A 95.00% and 93.34% of the time, respectively. The other formulas give the same direction as Formula A between 75.83% and 80.00% of the time.

Total Products Supplied

As seen in Table 16, Formulas 1 and 2, that use only *PSA* and *PSM* data in their calculations, give the same direction as Formula A 88.34% and 90.83% of the time, respectively. The other formulas give the same direction as Formula A between 67.50% and 80.00% of the time.

It should be noted that when two formulas gave similar results in terms of percentage of the time, the actual data points (in terms of month and year) that were flagged as being in a different direction than Formula A overlapped quite a lot. There were, however, some data points that were in a different direction than Formula A for some formulas but in the same direction for other formulas. To investigate this phenomenon a bit further, the direction (up or down) given by Formula A was compared to the three formulas that used the same monthly estimate from weekly data as their numerator and denominator (that is, Formulas 3 to 5). The details are given in Tables 17 to 19. The results were similar for finished motor gasoline, distillate fuel oil, and total products and showed that between 15.83% and 25.00% of the time, Formulas 3 to 5 gave the same wrong direction as compared to Formula A. Further, between 12.50% and 13.33% of the time, Formulas 3 to 5 disagreed among themselves. This is surprising when the weekly data used in computing Formulas 3 to 5 only differed by a few days for each monthly calculation.

Discussion/Summary

Which Formula is the Best Estimator of PSA Growth Rates?

From the discussion above it is clear that Formula 2 that uses *PSM* for the present year in the numerator and *PSM* for the previous year in the denominator is the best formula to use to approximate growth rates as calculated by $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$. Formula 2 has descriptive statistics that are the closest of all 14 methods to Formula A's for finished motor gasoline, distillate fuel oil, and total products supplied. Its correlations and Formula 1's correlations with Formula A are the only ones that are over .900, with Formula 1's correlations being non-meaningfully higher than Formula 2's correlations. Further, Formula 1's and Formula 2's growth rates are within 2% of Formula A much more often than Formulas 3 to 14. Finally, far less of the time, Formula 2 gives a different direction for year-to-year growth rates than Formula A does as compared to the other 13 methods.

Intuitively, Formula 1 would seem to be a better estimator than Formula 2. But, it is not. As just discussed, it does an excellent job of getting closer to Formula A than Formulas 3 to 14 as can be seen by its high correlations with Formula A (see Tables 1 to 3) and the higher percent of the time it is within

2% of Formula A (see Tables 1 to 3 or Tables 11 to 13). But, it underestimates Formula A too often as is evidenced by its statistically significant (and meaningfully significant) difference in mean growth rates for finished motor gasoline, distillate fuel oil, and total products supplied (see Tables 1 to 3 or Tables 8 to 10). In fact, it is the only method that gives statistically significant differences in mean growth rates for distillate fuel oil. Other evidence of this underestimation is given in Tables 11 to 13 where it can be seen to underestimate Formula A far more often than it overestimates Formula A.

Which of the Averages Computed from Weekly Data is the Best to Use as a Numerator?

While this paper shows that using *PSM* data for the numerator and denominator of a year-to-year growth rate is best when *PSA* data are not available, sometimes the user cannot wait until the *PSM* estimate for a certain month is available. In these cases, a numerator computed using weekly data must be used. In these situations, sometimes MFW does a little better, sometimes 4wa does a little better, and sometimes 4wb does a little better in estimating year-by-year growth rates. But, none of the differences are either statistically or meaningfully significant. So, no conclusions can be made as to which method of estimating monthly product supply from weekly data is the best to use as a numerator.

Which Denominator is Best when Using Weekly Data to Compute Monthly Averages?

Since the three methods of computing monthly averages (MFW, Four-week using cutoff of last Friday of the month (4Wa), and Four-week using the four weeks that cover the month the best (4Wb)) differ very little in their results with respect to growth rates, for this subsection they will be referred to collectively as the "Weekly Data" growth rates.

The question of the best denominator is actually a hard question to answer. The answer is that it depends on what is important to the consumer of the growth rates and whether finished motor gasoline, distillate fuel oil, or total products supplied is being considered.

For finished motor gasoline, in terms of mean growth rates, dividing a "Weekly Data" measurement by its counterpart from the year before is excellent. Dividing by *PSM* or *PSA* underestimates the mean growth rate, with division by *PSA* giving statistically significant differences (see Table 1 or Table 7.) However, as can be seen in Table 1, in terms of closeness of coming within ±2% of the rate given by the "gold standard" of Formula A, dividing by *PSM* or *PSA* is better (within ±2% about 3/4 of the time) than dividing a "Weekly Data" measurement by its counterpart from the year before (within ±2% about 2/3 of the time). In addition, dividing a "Weekly Data" measurement by its counterpart from the year before yields far worse correlations with Formula A than division by either *PSA* or *PSM*. Further, in terms of getting the same direction as Formula A for the growth rate as compared to Formula A, all denominators do about the same. This situation of one estimator being less biased while a different estimator has less variability is not that unusual in statistics. For example, in estimating the population variance (σ^2) for a normally distributed variable, the denominator of n-1 in the sample variance gives unbiased estimates. Using the denominator of n, however, gives estimates that are slightly biased but that have less variability than when a denominator of n -1 is used.

For distillate fuel oil, dividing a "Weekly Data" measurement by its counterpart from the year before or division by *PSA* gives a mean underestimate as compared to Formula A and division by *PSM* gives mean overestimates as compared to Formula A (see Table 2 or Table 5.) However, as can be seen by Table 2, none of these underestimates or overestimates is statistically significant. Further, there are negligible differences for the different denominators in the percentage of times that they yield growth rates within ±2% of the rate given by the "gold standard" of Formula A, with all of them falling between 33.33% and 45.00% of the time. In addition, in terms of getting the same direction as Formula A for the growth rate as compared to Formula A, all denominators do about the same. In terms of correlations, dividing a "Weekly Data" measurement by its "Weekly Data" counterpart from the year before yields lower correlations with Formula A than division by either *PSA* or *PSM*. So, for distillate fuel oil, division of

a “Weekly Data” measurement by its “Weekly Data” counterpart is slightly less preferable than division by its *PSA* or *PSM* counterpart.

For total products, in terms of mean growth rates, dividing a “Weekly Data” measurement by its counterpart from the year before or by *PSM* somewhat underestimates the growth rate calculated using Formula A. Division by *PSA* badly underestimates the mean growth rate and gives statistically significant differences (see Table 3 or Table 9.) However, as can be seen from Table 3, in terms of closeness of coming within ±2% of the rate given by the “gold standard” of Formula A, dividing by *PSM* or *PSA* is better (within ±2% about 70% of the time) than dividing a “Weekly Data” measurement by its counterpart from the year before (within ±2% about 55% of the time). In addition, dividing a “Weekly Data” measurement by its counterpart from the year before yields far worse correlations with Formula A than division by either *PSA* or *PSM*. Further, in terms of getting the same direction as Formula A for the growth rate as compared to Formula A, all denominators do about the same.

Overall Recommendations

•Estimating a year-to-year growth rate by dividing the *PSM* value for a certain month for year t by the *PSA* value for the same month of the previous year (Formula 1) should be avoided.

•Dividing the *PSM* value for a certain month for year t by the *PSM* value for the same month of the previous year (Formula 2) is preferable to using any of the monthly averages (that is, MFW, 4wa, or 4wb) derived from weekly data divided by any available denominator (Formulas 3 to 14).

•No recommendation can be made for those situations where it is necessary to use a monthly average in the numerator that is derived from weekly data, since it is a “mixed bag”. See the *Which Denominator is Best when Using Weekly Data to Compute Monthly Averages?* subsection of the Discussion/Summary for details.

Limitations

These analyses are only for finished motor gasoline supplied, distillate fuel oil supplied and total products supplied. Other product supply measures (such as kerosene-type jet fuel and residual fuel oil) were not analyzed.

These analyses only cover the period of 1995 to 2004. They do not reflect how world events since January 2005 have affected growth rates and their measurement.

Directions for Future Research

Similar analyses should be carried out for the equivalent data from the Petroleum Marketing surveys and for other Petroleum Supply measures.

An analysis of the different methods of estimating month-to-month growth rates between two consecutive months should be carried out using similar analyses to those used here.

Seasonal effects on year-to-year growth rates need to be investigated. Part of this is being done in some further research being carried out presently that looks at growth rates when three-month periods in one year are compared to three-month periods in the previous year.

Cumulative growth rates over different time periods need to be investigated. This is being looked at presently.

The rate of change of the growth rates (that is, the counterpart of the second derivative (concavity) when looking at continuous functions) may be worth investigating.

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Appendix A

Effects of Outliers on the Results

Finished Motor Gasoline Supplied

The first outlier for finished motor gasoline year-to-year growth rates occurred for all 15 methods during the month of December 1995. This outlier was caused by higher finished motor gasoline supplied in December 1994 than would be expected for a December for *PSA*, *PSM*, and the weekly data making up the MFW, 4Wa, and 4Wb measurements. The next outliers were for the September 1999 and the September 2000 year-to-year growth rates and were caused by higher values for the weekly data making up the MFW, 4Wa, and 4Wb measurements than would be expected for September 1999. The other outliers involved values for January 2000 and July 2000 that were lower than expected for *PSA*, *PSM*, and the weekly data making up the MFW, 4Wa, and 4Wb measurements. After careful inspection of histograms and scatter plots of the data it was decided to leave these ratios in all analyses since they seemed to have low leverage (that is, their presence did not change any results significantly). See Table 7 for the largest underestimates and overestimates.

Distillate Fuel Oil Supplied

All outliers for distillate fuel oil occurred during the winter months. The first outlier for distillate fuel oil year-to-year growth rates occurred for all 15 methods during the month of January 1995. This outlier was caused by higher than normal supply of distillate fuel oil in January 1994 (the denominator for the growth rates). January 1994 was unusual in that it had a much higher value of 1031 for Heating Degree-Days while all other Januarys between 1994 and 2004 had values between 765 and 968 (see http://www.eia.doe.gov/emeu/aer/txt/ptb0107.html for details). There was a further problem with the data for January 1994 in that the MFW and 4-week published data were almost 600,000 barrels per day higher than the published *PSA* and *PSM* data. This is the only outlier in the entire data set that had medium leverage (that is, its presence changed the results a little). Because cold snaps do occur, it was decided to keep the January 1995 growth rates for distillate fuel oil in the analyses. The next group of outliers occurred for growth rates for the winter of 2000-2001 and the winter of 2001-2002. All of these outliers were caused by higher distillate fuel oil supplied during the months of December 2000, January 2001, February 2001, and March 2001 than would be expected for those months. This extra supply seems to be caused by the winter of 2000-2001 having mean temperatures below normal except in a few areas. Alaska, Arizona, Colorado, Florida New Mexico, and Utah were the only states not below normal according to the NOAA (http://www.ncdc.noaa.gov/img/climate/research/2001/win/fsodtwin2001_pg.gif.) All of these outliers had low leverage (that is, their presence did not change any results significantly.) See Table 8 for the largest underestimates and overestimates.

Total Products Supplied

The first outlier here occurred for ratios using January 1995 data and was caused by the January 1995 data being lower than expected for a January. The second outlier occurred for ratios involving the weekly data (in terms of MFW, 4Wa, and 4Wb values) for April 1996. Here the weekly published data was much lower than the data for the month of April 1996 in *PSA* and *PSM.* The third outlier occurred for ratios using December 2000 data and was caused by the December 2000 data being higher than expected for a December. The final set of outliers involved ratios using data from September to December 2001. All of the outliers here seemed to have low leverage (that is, minimal influence). See Table 9 for the largest underestimates and overestimates.

Table 1. Major Statistics Used to Evaluate the Year-to-Year Growth Rate Formulas for Finished Motor Gasoline Supplied, 1995-2004

Formula Number	Formula in Symbols	Mean	Standard Deviation	Correlation with Formula A	Difference in Mean from A	p-value for the Difference	Percent of Time Within 1% of A	Percent of Time Within 2% of A	Percent of Time in Same Direction
A	**PSA/PSA**	**1.846%**	**1.892%**	**--**	**--**	**--**	**--**	**--**	**--**
1	PSM/PSA	1.442	1.974	0.941	-0.404%	<.0001	83.33	96.67	95.00
2	PSM/PSM	1.819	1.907	0.905	-0.028	0.716	80.83	97.50	92.50
3	MFW/MFW	1.852	2.155	0.438	+0.005	0.978	34.67	69.17	76.67
4	4Wa/4Wa	1.865	2.381	0.385	+0.019	0.932	29.17	59.17	73.33
5	4Wb/4Wb	1.821	2.300	0.433	-0.025	0.903	33.33	64.17	78.33
6	MFW/PSM	1.840	2.137	0.665	-0.006	0.971	44.17	75.00	85.00
7	4Wa/PSM	1.823	2.147	0.621	-0.024	0.885	39.17	75.00	82.50
8	4Wb/PSM	1.844	2.218	0.657	-0.003	0.987	45.00	75.00	82.50
9	MFW/PSA	1.463	2.154	0.721	-0.383	0.007	44.17	78.33	83.33
10	4Wa/PSA	1.446	2.197	0.668	-0.400	0.011	37.50	74.17	78.33
11	4Wb/PSA	1.466	2.217	0.717	-0.380	0.009	42.50	78.33	79.17
12	See Note 4	1.687	2.186	0.692	-0.160	0.284	48.33	76.67	85.83
13	See Note 4	1.669	2.197	0.648	-0.177	0.266	38.33	76.67	80.83
14	See Note 4	1.690	2.263	0.684	-0.157	0.311	45.00	75.83	81.67

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are year-to-year growth rates. For example, for *PSA* monthly estimates the mean year-to-year growth rate using Formula A for the 120 months from January 1995 to December 2004 was 1.846% and the standard deviation was 1.892%.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) The symbol -- in the Formula A row represents "Not Applicable".

(6) The correlations reported here are Pearson Product-Moment Correlations of the year-to-year growth rates determined by the 14 formulas with the growth rates computed using the year-to-year growth rates for *PSA (Petroleum Supply Annual)* defined by Formula A:

$A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$. All correlations have a probability value (p-value) of <.0001.

(7) The percentages reported in the 6th column are mean differences in year-to-year growth rates. For example, the mean difference between Formula A for year-to-year growth rate for the 120 months and the *PSM/PSM* ratio (Formula 2) for year-to-year growth rate for the 120 months is -0.028% (that is, 0.028% less.)

(8) The percentages reported in the 8th and 9th columns are the percentage of times that each formula gives an answer within 1% (8th column) or 2% (9th column) of the *PSA* ratio defined by Formula A. For example, for Formula 2, 80.83% of the time it gives a year-to-year growth rate within 1% of the growth rate given by Formula A and 97.50% of the time it is within 2% of the Formula A growth rate.

(9) The last column gives the percentage of times that each formula gives a growth rate in the same direction as Formula A. That is, it is the percentage of the time that each formula and Formula A both give positive growth rates or both give negative growth rates. For example, 92.50% of the time Formula 2 and Formula A are either both positive or both negative.

Table 2. Major Statistics Used to Evaluate the Year-to-Year Growth Rate Formulas for Distillate Fuel Oil Supplied, 1995-2004

Formula Number	Formula in Symbols	Mean	Standard Deviation	Correlation with Formula A	Difference in Mean from A	p-value for the Difference	Percent of Time Within 1% of A	Percent of Time Within 2% of A	Percent of Time in Same Direction
A	**PSA/PSA**	**2.692%**	**5.470%**	**--**	**--**	**--**	**--**	**--**	**--**
1	PSM/PSA	2.413	5.495	0.983	-0.279%	0.003	76.67	93.33	95.00
2	PSM/PSM	2.685	5.618	0.971	-0.007	0.956	60.00	86.67	93.33
3	MFW/MFW	2.416	5.821	0.712	-0.276	0.483	20.83	41.67	77.50
4	4Wa/4Wa	2.342	6.436	0.675	-0.350	0.435	19.17	35.00	75.83
5	4Wb/4Wb	2.484	5.786	0.678	-0.208	0.616	20.00	33.33	76.67
6	MFW/PSM	2.714	5.932	0.855	+0.022	0.937	15.83	40.00	79.17
7	4Wa/PSM	2.909	6.210	0.824	+0.217	0.502	20.00	35.00	78.33
8	4Wb/PSM	2.786	5.929	0.834	+0.095	0.755	18.33	39.17	78.33
9	MFW/PSA	2.446	5.875	0.856	-0.246	0.382	20.00	45.00	80.00
10	4Wa/PSA	2.640	6.147	0.824	-0.052	0.872	20.83	35.83	78.33
11	4Wb/PSA	2.518	5.879	0.833	-0.174	0.566	20.83	38.33	78.33
12	See Note 4	2.615	5.935	0.857	-0.077	0.785	20.00	42.50	79.17
13	See Note 4	2.809	6.213	0.825	+0.118	0.715	23.33	35.00	80.00
14	See Note 4	2.687	5.934	0.835	-0.005	0.987	22.50	40.00	79.17

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are year-to-year growth rates. For example, for *PSA* monthly estimates the mean year-to-year growth rate using Formula A for the 120 months from January 1995 to December 2004 was 2.692% and the standard deviation was 5.470%.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) The symbol -- in the Formula A row represents "Not Applicable".

(6) The correlations reported here are Pearson Product-Moment Correlations of the year-to-year growth rates determined by the 14 formulas with the growth rates computed using the year-to-year growth rates for *PSA (Petroleum Supply Annual)* defined by Formula A:

$A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$. All correlations have a probability value (p-value) of <.0001.

(7) The percentages reported in the 6th column are mean differences in year-to-year growth rates. For example, the mean difference between Formula A for year-to-year growth rate for the 120 months and the *PSM/PSM* ratio (Formula 2) for year-to-year growth rate for the 120 months is -0.007% (that is, 0.007% less.)

(8) The percentages reported in the 8th and 9th columns are the percentage of times that each formula gives an answer within 1% (8th column) or 2% (9th column) of the *PSA* ratio defined by Formula A. For example, for Formula 2, 60.00% of the time it gives a year-to-year growth rate within 1% of the growth rate given by Formula A and 86.67% of the time it is within 2% of the Formula A growth rate.

(9) The last column gives the percentage of the time that each formula gives a growth rate in the same direction as Formula A. That is, it is the percentage of the time that each formula and Formula A both give positive growth rates or both give negative growth rates. For example, 93.33% of the time Formula 2 and Formula A are either both positive or both negative.

Table 3. Major Statistics Used to Evaluate the Year-to-Year Growth Rate Formulas for Total Products Supplied, 1995-2004

Formula Number	Formula in Symbols	Mean	Standard Deviation	Correlation with Formula A	Difference in Mean from A	p-value for the Difference	Percent of Time within 1% of A	Percent of Time within 2% of A	Percent of Time in Same Direction
A	**PSA/PSA**	**1.616%**	**2.598%**	**--**	**--**	**--**	**--**	**--**	**--**
1	PSM/PSA	1.049%	2.590%	0.964	-0.567%	<.0001	77.50	95.83	88.33
2	PSM/PSM	1.532	2.601	0.940	-0.084	0.309	75.00	96.67	90.83
3	MFW/MFW	1.484	2.487	0.508	-0.132	0.566	30.83	55.83	69.17
4	4Wa/4Wa	1.510	2.609	0.489	-0.106	0.661	32.50	55.83	70.00
5	4Wb/4Wb	1.478	2.432	0.454	-0.138	0.566	31.67	50.83	69.50
6	MFW/PSM	1.304	2.494	0.720	-0.312	0.076	40.83	72.50	79.17
7	4Wa/PSM	1.330	2.523	0.700	-0.286	0.117	37.50	67.50	77.50
8	4Wb/PSM	1.344	2.483	0.696	-0.272	0.136	34.17	67.50	80.00
9	MFW/PSA	0.822	2.464	0.750	-0.794	<.0001	34.17	68.33	77.50
10	4Wa/PSA	0.848	2.495	0.729	-0.768	<.0001	40.83	69.17	78.33
11	4Wb/PSA	0.862	2.472	0.721	-0.754	<.0001	38.33	70.00	77.50
12	See Note 4	1.120	2.538	0.731	-0.496	0.005	38.33	70.83	76.67
13	See Note 4	1.145	2.565	0.712	-0.471	0.010	40.00	67.50	75.83
14	See Note 4	1.160	2.520	0.710	-0.457	0.012	36.67	69.33	78.33

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are year-to-year growth rates. For example, for *PSA* monthly estimates the mean year-to-year growth rate using Formula A for the 120 months from January 1995 to December 2004 was 1.616% and the standard deviation was 2.598%.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) The symbol -- in the Formula A row represents "Not Applicable".

(6) The correlations reported here are Pearson Product-Moment Correlations of the year-to-year growth rates determined by the 14 formulas with the growth rates computed using the year-to-year growth rates for *PSA (Petroleum Supply Annual)* defined by Formula A:

$A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$. All correlations have a probability value (p-value) of <.0001.

(7) The percentages reported in the 6th column are mean differences in year-to-year growth rates. For example, the mean difference between Formula A for year-to-year growth rate for the 120 months and the *PSM/PSM* ratio (Formula 2) for year-to-year growth rate for the 120 months is -0.084% (that is, 0.084% less.)

(8) The percentages reported in the 8th and 9th columns are the percentage of times that each formula gives an answer within 1% (8th column) or 2% (9th column) of the *PSA* ratio defined by Formula A. For example, for Formula 2, 75.00% of the time it gives a year-to-year growth rate within 1% of the growth rate given by Formula A and 96.67% of the time it is within 2% of the Formula A growth rate.

(9) The last column gives the percentage of the time that each formula gives a growth rate in the same direction as Formula A. That is, it is the percentage of the time that each formula and Formula A both give positive growth rates or both give negative growth rates. For example, 90.83% of the time Formula 2 and Formula A are either both positive or both negative.

Table 4. Descriptive Statistics for the Year-to-Year Growth Rates (as Percentages) for Finished Motor Gasoline Supplied, 1995-2004

Formula Number	Formula in Symbols	Mean	Standard Deviation	Median	Minimum	Maximum	Range
A	**PSA/PSA**	**1.846**	**1.892**	**1.871**	**-3.355**	**5.828**	**9.183**
1	PSM/PSA	1.442	1.974	1.348	-3.825	5.593	9.417
2	PSM/PSM	1.819	1.907	1.829	-3.053	7.549	10.602
3	MFW/MFW	1.852	2.155	1.793	-3.678	6.693	10.370
4	4Wa/4Wa	1.865	2.381	2.221	-4.888	6.727	11.615
5	4Wb/4Wb	1.821	2.300	1.659	-4.888	7.079	11.967
6	MFW/PSM	1.840	2.137	1.696	-3.901	6.282	10.183
7	4Wa/PSM	1.823	2.147	1.903	-3.227	6.302	9.529
8	4Wb/PSM	1.844	2.218	1.647	-3.227	6.994	10.221
9	MFW/PSA	1.463	2.154	1.363	-4.075	6.562	10.637
10	4Wa/PSA	1.446	2.197	1.507	-3.992	6.471	10.463
11	4Wb/PSA	1.466	2.217	1.219	-3.992	6.431	10.423
12	See Note 4	1.687	2.186	1.430	-4.075	6.282	10.357
13	See Note 4	1.669	2.197	1.839	-3.992	6.471	10.463
14	See Note 4	1.690	2.263	1.326	-3.992	6.994	10.987

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are year-to-year growth rates. For example, for *PSA* monthly estimates the mean year-to-year growth rate for the 120 months from January 1995 to December 2004 was 1.846% and the minimum growth rate was -3.355%.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) Totals across components, where applicable, may not add due to independent rounding.

Table 5. Descriptive Statistics for the Year-to-Year Growth Rates (as Percentages) for Distillate Fuel Oil Supplied, 1995-2004

Formula Number	Formula in Symbols	Mean	Standard Deviation	Median	Minimum	Maximum	Range
A	**PSA/PSA**	**2.692**	**5.470**	**2.856**	**-15.200**	**17.447**	**32.647**
1	PSM/PSA	2.413	5.495	2.501	-14.776	17.367	32.143
2	PSM/PSM	2.685	5.618	2.619	-15.413	17.177	32.591
3	MFW/MFW	2.416	5.821	2.474	-20.812	15.140	35.952
4	4Wa/4Wa	2.342	6.436	2.296	-20.109	18.382	38.941
5	4Wb/4Wb	2.484	5.786	2.235	-20.109	16.579	36.687
6	MFW/PSM	2.714	5.932	2.099	-12.333	18.118	30.452
7	4Wa/PSM	2.909	6.210	2.357	-15.113	18.818	33.931
8	4Wb/PSM	2.786	5.929	1.920	-10.839	18.226	29.064
9	MFW/PSA	2.446	5.875	2.081	-13.225	18.309	31.535
10	4Wa/PSA	2.640	6.147	1.944	-15.977	18.417	34.394
11	4Wb/PSA	2.518	5.879	2.071	-11.746	18.417	30.162
12	See Note 4	2.615	5.935	2.039	-12.333	18.118	30.452
13	See Note 4	2.809	6.213	2.110	-15.113	18.226	33.339
14	See Note 4	2.687	5.934	2.071	-10.839	18.226	29.064

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are year-to-year growth rates. For example, for *PSA* monthly estimates the mean year-to-year growth rate for the 120 months from January 1995 to December 2004 was 2.692% and the minimum growth rate was -15.200%.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) Totals across components, where applicable, may not add due to independent rounding.

Table 6. Descriptive Statistics for the Year-to-Year Growth Rates (as Percentages) for Total Products Supplied, 1995-2004

Formula Number	Formula in Symbols	Mean	Standard Deviation	Median	Minimum	Maximum	Range
A	**PSA/PSA**	**1.616**	**2.598**	**1.800**	**-8.701**	**8.611**	**17.312**
1	PSM/PSA	1.049	2.590	0.931	-8.417	8.226	16.644
2	PSM/PSM	1.532	2.601	1.431	-7.641	8.380	16.021
3	MFW/MFW	1.484	2.487	1.489	-5.636	6.903	12.539
4	4Wa/4Wa	1.510	2.609	1.733	-6.237	6.804	13.041
5	4Wb/4Wb	1.478	2.432	1.618	-5.353	7.747	13.100
6	MFW/PSM	1.304	2.494	1.011	-4.112	9.273	13.385
7	4Wa/PSM	1.330	2.523	1.118	-4.348	9.692	14.041
8	4Wb/PSM	1.344	2.483	1.042	-4.348	8.676	13.024
9	MFW/PSA	0.822	2.464	0.731	-4.678	6.780	11.458
10	4Wa/PSA	0.848	2.495	0.836	-4.828	7.190	12.018
11	4Wb/PSA	0.862	2.472	0.841	-4.565	6.927	11.492
12	See Note 4	1.120	2.538	0.800	-4.463	9.273	13.736
13	See Note 4	1.145	2.565	1.055	-4.483	9.692	14.175
14	See Note 4	1.160	2.520	1.055	-4.483	8.676	13.158

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are year-to-year growth rates. For example, for *PSA* monthly estimates the mean year-to-year growth rate for the 120 months from January 1995 to December 2004 was 1.616% and the minimum growth rate was -8.701%.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) Totals across components, where applicable, may not add due to independent rounding.

Table 7. Differences for Finished Motor Gasoline Supplied Between Formula A and the Other Growth Rates, 1995-2004

Formula Number	Formula in Symbols	Largest Underestimate	Largest Overestimate	Mean Difference	t	p-value	Standard Deviation of the Differences	Mean Square Error
1	PSM/PSA	-2.568%	1.094%	-0.404%	-6.629	<.0001	0.667%	0.608%²
2	PSM/PSM	-2.434	2.200	-0.028	-0.365	0.716	0.828	0.686
3	MFW/MFW	-6.037	6.642	+0.005	+0.028	0.978	2.156	4.648
4	4Wa/4Wa	-7.314	6.105	+0.019	+0.086	0.932	2.403	5.775
5	4Wb/4Wb	-5.925	6.105	-0.025	-0.122	0.903	2.257	5.095
6	MFW/PSM	-3.623	4.181	-0.006	-0.037	0.971	1.663	2.833
7	4Wa/PSM	-3.811	4.673	-0.024	-0.145	0.885	1.774	3.148
8	4Wb/PSM	-3.811	4.673	-0.003	-0.016	0.987	1.727	2.983
9	MFW/PSA	-4.139	4.031	-0.383	-2.741	0.007	1.530	2.486
10	4Wa/PSA	-4.006	4.573	-0.400	-2.593	0.011	1.689	3.013
11	4Wb/PSA	-4.006	3.911	-0.380	-2.646	0.009	1.573	2.619
12	See Note 4	-3.623	4.175	-0.160	-1.076	0.284	1.624	2.663
13	See Note 4	-3.811	4.673	-0.177	-1.119	0.266	1.737	3.048
14	See Note 4	-3.811	4.673	-0.157	-1.018	0.311	1.685	2.867

Notes:
(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The formula that each of Formula 1 to Formula 14 is being compared to is Formula A: $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$. The percentages reported are differences in year-to-year growth rates. For example, the mean difference between Formula A for year-to-year growth rate for the 120 months and the *PSM* ratio (Formula 2) for year-to-year growth rate for the 120 months is -0.028% (that is, 0.028% less.)

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) The last column is a common measure of the usefulness of an estimator. Generally, the bigger the Mean Square Error is, the less useful an estimator is. Mean Square Error = $(\text{Bias})^2$ + $(\text{Standard Deviation})^2$. Here the Bias = Mean Difference (the 5th column).

Table 8. Differences for Distillate Fuel Oil Supplied Between Formula A and the Other Growth Rates, 1995-2004

Formula Number	Formula in Symbols	Largest Underestimate	Largest Overestimate	Mean Difference	t	p-value	Standard Deviation of the Differences	Mean Square Error
1	PSM/PSA	-4.896%	2.279%	-0.279%	-3.042	0.003	1.003%	1.084%²
2	PSM/PSM	-4.234	4.240	-0.007	-0.055	0.956	1.363	1.858
3	MFW/MFW	-12.456	11.630	-0.276	-0.704	0.483	4.297	18.540
4	4Wa/4Wa	-11.753	11.952	-0.350	-0.784	0.435	4.883	23.966
5	4Wb/4Wb	-11.753	11.952	-0.208	-0.503	0.616	4.528	20.546
6	MFW/PSM	-6.549	7.755	+0.022	+0.079	0.937	3.098	9.598
7	4Wa/PSM	-7.550	10.143	+0.217	+0.673	0.502	3.536	12.550
8	4Wb/PSM	-7.091	10.000	+0.095	+0.313	0.755	3.311	10.972
9	MFW/PSA	-6.256	7.899	-0.246	-0.878	0.382	3.072	9.498
10	4Wa/PSA	-7.573	10.147	-0.052	-0.016	0.872	3.504	12.281
11	4Wb/PSA	-7.858	10.147	-0.174	-0.174	0.566	3.301	10.927
12	See Note 4	-6.256	7.899	-0.077	-0.274	0.785	3.084	9.517
13	See Note 4	-7.549	10.147	+0.118	+0.366	0.715	3.526	12.446
14	See Note 4	-6.607	10.147	-0.005	-0.016	0.987	3.303	10.910

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The formula that each of Formula 1 to Formula 14 is being compared to is Formula A: $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$. The percentages reported are differences in year-to-year growth rates. For example, the mean difference between Formula A for year-to-year growth rate for the 120 months and the *PSM* ratio (Formula 2) for year-to-year growth rate for the 120 months is -0.007% (that is, 0.007% less.)

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) The last column is a common measure of the usefulness of an estimator. Generally, the bigger the Mean Square Error is, the less useful an estimator is. Mean Square Error = $(\text{Bias})^2 + (\text{Standard Deviation})^2$. Here the Bias = Mean Difference (the 5th column).

Table 9. Differences for Total Products Supplied Between Formula A and the Other Growth Rates, 1995-2004

Formula Number	Formula in Symbols	Largest Underestimate	Largest Overestimate	Mean Difference	t	p-value	Standard Deviation of the Differences	Mean Square Error
1	PSM/PSA	-3.064%	0.726%	-0.567%	-8.891	<.0001	0.698%	0.809%²
2	PSM/PSM	-2.472	1.819	-0.084	-1.022	0.309	0.899	0.815
3	MFW/MFW	-5.672	5.447	-0.132	-0.575	0.566	2.523	6.383
4	4Wa/4Wa	-6.120	5.621	-0.106	-0.440	0.661	2.633	6.944
5	4Wb/4Wb	-6.159	5.621	-0.138	-0.576	0.566	2.631	6.941
6	MFW/PSM	-3.881	5.048	-0.312	-1.790	0.076	1.908	3.738
7	4Wa/PSM	-4.326	5.610	-0.286	-1.580	0.117	1.985	4.022
8	4Wb/PSM	-4.338	5.610	-0.272	-1.502	0.136	1.983	4.006
9	MFW/PSA	-4.019	4.604	-0.794	-4.853	<.0001	1.792	3.842
10	4Wa/PSA	-4.845	4.795	-0.768	-4.484	<.0001	1.877	4.113
11	4Wb/PSA	-4.845	4.795	-0.754	-4.354	<.0001	1.896	4.163
12	See Note 4	-3.881	4.604	-0.496	-2.885	0.005	1.884	3.795
13	See Note 4	-4.555	4.795	-0.471	-2.630	0.010	1.961	4.067
14	See Note 4	-4.338	4.795	-0.457	-2.564	0.012	1.951	4.015

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The formula that each of Formula 1 to Formula 14 is being compared to is Formula A: $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$. The percentages reported are differences in year-to-year growth rates. For example, the mean difference between Formula A for year-to-year growth rate for the 120 months and the *PSM* ratio (Formula 2) for year-to-year growth rate for the 120 months is -0.084% (that is, 0.084% less.)

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) The last column is a common measure of the usefulness of an estimator. Generally, the bigger the Mean Square Error is, the less useful an estimator is. Mean Square Error = $(\text{Bias})^2$ + $(\text{Standard Deviation})^2$. Here the Bias = Mean Difference (the 5th column)

Table 10. Percentage of Time Other Monthly Measurements are Lower Than *PSA* Monthly Measurements, 1994-2004

Measurement	Percent of Time Lower Than PSA for Finished Motor Gasoline	Percent of Time Lower Than PSA for Distillate Fuel Oil	Percent of Time Lower Than PSA for Total Products Supplied
PSM Monthly	71.2	57.6	81.1
Monthly From Weekly (MFW)	61.3	50.8	68.2
4wa	61.3	48.5	69.7
4wb	61.3	53.0	68.2

Notes:

(1) All statistics in this table are based on 132 observations (12 months for each of the years 1994 to 2004).

(2) *PSA* = *Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

Table 11. Percentage of Time Each Year-to-Year Growth Rate is Within 1% and 2% of Formula A Growth Rate for Finished Motor Gasoline Supplied, 1995-2004

Formula Number	Formula in Symbols	Percent of Time Within -1%	Percent of Time Within +1%	Percent of Time Within -2%	Percent of Time Within +2%	Percent of Time More Than +/-2%
1	PSM/PSA	55.83	27.50	68.33	28.33	3.33
2	PSM/PSM	38.33	42.50	46.67	50.83	2.50
3	MFW/MFW	15.83	18.83	31.67	37.50	30.83
4	4Wa/4Wa	16.67	12.50	29.17	30.00	40.83
5	4Wb/4Wb	13.33	20.00	31.67	32.50	35.83
6	MFW/PSM	20.00	24.17	35.83	39.17	25.00
7	4Wa/PSM	17.50	21.67	38.33	36.67	25.00
8	4Wb/PSM	20.00	25.00	37.50	37.50	25.00
9	MFW/PSA	23.33	20.83	47.50	30.83	21.67
10	4Wa/PSA	20.00	17.50	43.33	30.83	25.83
11	4Wb/PSA	23.33	19.17	49.17	29.17	21.67
12	See Note 4	23.33	25.00	41.67	35.00	23.33
13	See Note 4	18.33	20.00	41.67	35.00	23.33
14	See Note 4	23.33	21.67	42.50	33.33	24.17

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are percentage of times that each formula gives an answer within 1% or 2% (depending on the column) of Formula A defined by A(month, t) = $\left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)}-1\right)*100\%$. For example, the first two entries for the Formula 2 row mean that 38.33% of the *PSM/PSM* ratios are below the Formula A ratios, but are still within 1% of them and that 42.50% of the *PSM/PSM* ratios are above the Formula A ratios, but are still within 1% of them.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) Totals across components, where applicable, may not add to 100% due to independent rounding.

Table 12. Percentage of Time Each Year-to-Year Growth Rate is Within 1% and 2% of Formula A Growth Rate for Distillate Fuel Oil Supplied, 1995-2004

Formula Number	Formula in Symbols	Percent of Time Within -1%	Percent of Time Within +1%	Percent of Time Within -2%	Percent of Time Within +2%	Percent of Time More Than +/-2%
1	PSM/PSA	40.83	35.83	54.17	39.17	6.67
2	PSM/PSM	28.33	31.67	41.67	45.00	13.33
3	MFW/MFW	10.00	10.83	19.17	22.50	58.33
4	4Wa/4Wa	9.17	10.00	16.67	18.33	65.00
5	4Wb/4Wb	10.83	9.17	18.33	15.00	66.67
6	MFW/PSM	7.50	8.33	19.17	20.83	60.00
7	4Wa/PSM	14.17	5.83	17.50	17.50	65.00
8	4Wb/PSM	11.67	6.67	20.00	19.17	60.83
9	MFW/PSA	8.33	11.67	24.17	20.83	55.00
10	4Wa/PSA	14.17	6.67	20.00	15.83	64.17
11	4Wb/PSA	13.33	7.50	21.67	16.67	61.67
12	See Note 4	9.17	10.83	21.67	20.83	57.50
13	See Note 4	16.67	6.67	20.83	14.17	65.00
14	See Note 4	14.17	8.33	23.33	16.67	60.00

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are percentage of times that each formula gives an answer within 1% or 2% (depending on the column) of Formula A defined by A(month, t) = $\left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)}-1\right)*100\%$. For example, the first two entries for the Formula 2 row mean that 28.33% of the *PSM/PSM* ratios are below the Formula A ratios, but are still within 1% of them and that 31.67% of the *PSM/PSM* ratios are above the Formula A ratios, but are still within 1% of them.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) Totals across components, where applicable, may not add to 100% due to independent rounding.

Table 13. Percentage of Time Each Year-to-Year Growth Rate is Within 1% and 2% of Formula A Growth Rate for Total Products Supplied, 1995-2004

Formula Number	Formula in Symbols	Percent of Time Within -1%	Percent of Time Within +1%	Percent of Time Within -2%	Percent of Time Within +2%	Percent of Time More Than +/-2%
1	PSM/PSA	58.33	19.17	76.67	19.17	4.17
2	PSM/PSM	36.67	38.33	47.50	49.17	3.33
3	MFW/MFW	14.17	16.67	31.67	24.17	44.17
4	4Wa/4Wa	12.50	20.00	29.17	26.67	44.17
5	4Wb/4Wb	13.33	18.33	25.83	25.00	49.17
6	MFW/PSM	20.83	20.00	39.17	33.33	27.50
7	4Wa/PSM	20.83	16.67	38.33	29.17	32.50
8	4Wb/PSM	20.00	14.17	38.33	29.17	32.50
9	MFW/PSA	18.33	15.83	41.67	26.67	31.67
10	4Wa/PSA	25.83	15.00	44.17	25.00	30.83
11	4Wb/PSA	23.33	15.00	43.33	26.67	30.00
12	See Note 4	21.67	16.67	43.33	27.50	29.17
13	See Note 4	26.67	13.33	44.17	23.33	32.50
14	See Note 4	25.83	10.83	44.17	24.17	31.67

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) The percentages reported are percentage of times that each formula gives an answer within 1% or 2% (depending on the column) of Formula A defined by A(month, t) = $\left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$. For example, the first two entries for the Formula 2 row mean that 36.67% of the *PSM/PSM* ratios are below the Formula A ratios, but are still within 1% of them and that 38.33% of the *PSM/PSM* ratios are above the Formula A ratios, but are still within 1% of them.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) Totals across components, where applicable, may not add to 100% due to independent rounding.

Table 14. Percentage of Time that the Other Growth Rate Measures Match in Direction with Formula A Growth Rates for Finished Motor Gasoline Supplied, 1995-2004

		SAME DIRECTION		DIFFERENT DIRECTIONS	
Formula Number	Formula in Symbols	Percent of Time Both Measures Up	Percent of Time Both Measures Down	Percent of Time PSA is Up and the Other is Down	Percent of Time PSA is Down and the Other is Up
1	PSM/PSA	80.83	14.17	3.33	1.67
2	PSM/PSM	80.83	11.67	3.33	4.17
3	MFW/MFW	70.00	6.67	14.17	9.17
4	4Wa/4Wa	66.67	6.67	17.50	9.17
5	4Wb/4Wb	70.00	8.33	14.17	7.50
6	MFW/PSM	75.83	9.17	8.33	6.67
7	4Wa/PSM	73.33	9.17	10.83	6.67
8	4Wb/PSM	73.33	9.17	10.83	6.67
9	MFW/PSA	71.67	11.67	12.50	4.17
10	4Wa/PSA	68.33	10.00	15.83	5.83
11	4Wb/PSA	69.17	10.00	15.00	5.83
12	See Note 4	75.00	10.83	9.17	5.00
13	See Note 4	71.67	9.17	12.50	6.67
14	See Note 4	72.50	9.17	11.67	6.67

Notes:
(1) All statistics are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) Formula A is given by $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) To read the percentages in this table, go across a row. For example, when comparing year-to-year growth rates as calculated by Formula A and Formula 3, 70.00% of the time both formulas show a year-to-year growth rate that is positive (up), 6.67% of the time of the time both formulas show a year-to-year growth rate that is negative (down), 14.17% of the time Formula A shows a year-to-year growth rate that is positive (up) and Formula 3 shows a year-to-year growth rate that is negative (down), and 9.17% of the time Formula A shows a year-to-year growth rate that is negative (down) and Formula 3 shows a year-to-year growth rate that is positive (up).

(6) Totals across rows may not add to 100% due to independent rounding.

Table 15. Percentage of Time that the Other Growth Rate Measures Match in Direction with Formula A Year-to-Year Growth Rates for Distillate Fuel Oil Supplied, 1995-2004

		SAME DIRECTION		DIFFERENT DIRECTIONS	
Formula Number	Formula in Symbols	Percent of Time Both Measures Up	Percent of Time Both Measures Down	Percent of Time PSA is Up and the Other is Down	Percent of Time PSA is Down and the Other is Up
1	PSM/PSA	66.67	28.33	2.50	2.50
2	PSM/PSM	66.67	26.67	2.50	4.17
3	MFW/MFW	56.67	20.83	12.50	10.00
4	4Wa/4Wa	55.00	20.83	14.17	10.00
5	4Wb/4Wb	56.67	20.00	12.50	10.83
6	MFW/PSM	57.50	21.67	11.67	9.17
7	4Wa/PSM	56.67	21.67	12.50	9.17
8	4Wb/PSM	56.67	21.67	12.50	9.17
9	MFW/PSA	56.67	23.33	12.50	7.50
10	4Wa/PSA	55.83	22.50	13.33	8.33
11	4Wb/PSA	55.83	22.50	13.33	8.33
12	See Note 4	56.67	22.50	12.50	8.33
13	See Note 4	57.50	22.50	11.67	8.33
14	See Note 4	56.67	22.50	12.50	8.33

Notes:
(1) All statistics are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) Formula A is given by $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) To read the percentages in this table, go across a row. For example, when comparing year-to-year growth rates as calculated by Formula A and Formula 3, 56.67% of the time both formulas show a year-to-year growth rate that is positive (up), 20.83% of the time of the time both formulas show a year-to-year growth rate that is negative (down), 12.50% of the time Formula A shows a year-to-year growth rate that is positive (up) and Formula 3 shows a year-to-year growth rate that is negative (down), and 10.00% of the time Formula A shows a year-to-year growth rate that is negative (down) and Formula 3 shows a year-to-year growth rate that is positive (up).

(6) Totals across rows may not add to 100% due to independent rounding.

Table 16. Percentage of Time that the Other Growth Rate Measures Match in Direction with Formula A Year-to-Year Growth Rates for Total Products Supplied, 1995-2004

		SAME DIRECTION		DIFFERENT DIRECTIONS	
Formula Number	Formula in Symbols	Percent of Time Both Measures Up	Percent of Time Both Measures Down	Percent of Time PSA is Up and the Other is Down	Percent of Time PSA is Down and the Other is Up
1	PSM/PSA	61.67	26.67	10.83	0.83
2	PSM/PSM	68.33	22.50	4.17	5.00
3	MFW/MFW	57.50	11.67	15.00	15.83
4	4Wa/4Wa	60.83	9.17	11.67	18.33
5	4Wb/4Wb	58.33	9.17	14.17	18.33
6	MFW/PSM	60.83	18.33	11.67	9.17
7	4Wa/PSM	61.67	15.83	10.83	11.67
8	4Wb/PSM	63.33	16.67	9.17	10.83
9	MFW/PSA	57.50	20.00	15.00	7.50
10	4Wa/PSA	59.17	19.17	13.33	8.33
11	4Wb/PSA	58.33	19.17	14.17	8.33
12	See Note 4	57.50	19.17	15.00	8.33
13	See Note 4	59.17	16.67	13.33	10.83
14	See Note 4	60.83	17.50	11.67	10.00

Notes:
(1) All statistics are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the "Formula in symbols" column, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA = Petroleum Supply Annual*; *PSM =Petroleum Supply Monthly;* MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) Formula A is given by $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$.

(4) Formula 12 uses Formula 6 for the months of January to June and uses Formula 9 for the months of July to December. Formula 13 uses Formula 7 for the months of January to June and uses Formula 10 for the months of July to December. Formula 14 uses Formula 8 for the months of January to June and uses Formula 11 for the months of July to December.

(5) To read the percentages in this table, go across a row. For example, when comparing year-to-year growth rates as calculated by Formula A and Formula 3, 57.50% of the time both formulas show a year-to-year growth rate that is positive (up), 11.67% of the time of the time both formulas show a year-to-year growth rate that is negative (down), 15.00% of the time Formula A shows a year-to-year growth rate that is positive (up) and Formula 3 shows a year-to-year growth rate that is negative (down), and 15.83% of the time Formula A shows a year-to-year growth rate that is negative (down) and Formula 3 shows a year-to-year growth rate that is positive (up).

(6) Totals across rows may not add to 100% due to independent rounding

Table 17. Distribution of Percent Agreement in Direction for the Growth Rates Based on Weekly Data for Finished Motor Gasoline Supplied, 1995-2004

PSA/PSA (Formula A)	MFW/MFW (Formula 3)	4Wa/4Wa (Formula 4)	4Wb/4Wb (Formula 5)	Count	Percentage
All 3 Weekly Formulas Agree with PSA Growth Rate					
UP	UP	UP	UP	76	63.33
DOWN	DOWN	DOWN	DOWN	8	6.67
Subtotal				**84**	**70.00**
All 3 Weekly Formulas Disagree with PSA Growth Rate					
UP	DOWN	DOWN	DOWN	12	10.00
DOWN	UP	UP	UP	8	6.67
Subtotal				**20**	**16.67**
Disagreement Among the 3 Weekly Formulas					
UP	UP	UP	DOWN	2	1.67
UP	UP	DOWN	UP	4	3.33
UP	UP	DOWN	DOWN	2	1.67
UP	DOWN	UP	UP	1	0.83
UP	DOWN	UP	DOWN	1	0.83
UP	DOWN	DOWN	UP	3	2.50
DOWN	UP	UP	DOWN	1	0.83
DOWN	UP	DOWN	UP	0	0.00
DOWN	UP	DOWN	DOWN	1	0.83
DOWN	DOWN	UP	UP	0	0.00
DOWN	DOWN	UP	DOWN	1	0.83
DOWN	DOWN	DOWN	UP	0	0.00
Subtotal				**16**	**13.33**

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the formula in symbol form, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) Formula A is given by $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$.

(4) The UPs and DOWNs in this table refer to whether a particular formula gives a positive (UP) or a negative (DOWN) estimate of year-to-year growth rate. For example, the third row under "Disagreement Among the 3 Weekly Formulas" says that 1.67% of the time Formula A and Formula 3 predict upward growth while Formula 4 and Formula 5 predict downward growth.

(5) Totals down the last column may not add due to independent rounding.

Table 18. Distribution of Percent Agreement in Direction for the Growth Rates Based on Weekly Data for Distillate Fuel Oil Supplied, 1995-2004

PSA/PSA (Formula A)	MFW/MFW (Formula 3)	4Wa/4Wa (Formula 4)	4Wb/4Wb (Formula 5)	Count	Percentage
All 3 Weekly Formulas Agree with PSA Growth Rate					
UP	UP	UP	UP	65	54.17
DOWN	DOWN	DOWN	DOWN	21	17.50
Subtotal				**86**	**71.67**
All 3 Weekly Formulas Disagree with PSA Growth Rate					
UP	DOWN	DOWN	DOWN	10	8.33
DOWN	UP	UP	UP	9	7.50
Subtotal				**19**	**15.83**
Disagreement Among the 3 Weekly Formulas					
UP	UP	UP	DOWN	1	0.83
UP	UP	DOWN	UP	2	1.67
UP	UP	DOWN	DOWN	2	1.67
UP	DOWN	UP	UP	1	0.83
UP	DOWN	UP	DOWN	1	0.83
UP	DOWN	DOWN	UP	2	1.67
DOWN	UP	UP	DOWN	1	0.83
DOWN	UP	DOWN	UP	2	1.67
DOWN	UP	DOWN	DOWN	0	0.00
DOWN	DOWN	UP	UP	0	0.00
DOWN	DOWN	UP	DOWN	1	0.83
DOWN	DOWN	DOWN	UP	2	1.67
Subtotal				**15**	**12.50**

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the formula in symbol form, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) Formula A is given by $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$.

(4) The UPs and DOWNs in this table refer to whether a particular formula gives a positive (UP) or a negative (DOWN) estimate of year-to-year growth rate. For example, the third row under "Disagreement Among the 3 Weekly Formulas" says that 1.67% of the time Formula A and Formula 3 predict upward growth while Formula 4 and Formula 5 predict downward growth.

Table 19. Distribution of Percent Agreement in Direction for the Growth Rates Based on Weekly Data for Total Products Supplied, 1995-2004

PSA/PSA (Formula A)	MFW/MFW (Formula 3)	4Wa/4Wa (Formula 4)	4Wb/4Wb (Formula 5)	Count	Percentage
All 3 Weekly Formulas Agree with PSA Growth Rate					
UP	UP	UP	UP	65	54.17
DOWN	DOWN	DOWN	DOWN	10	8.33
Subtotal				**75**	**62.50**
All 3 Weekly Formulas Disagree with PSA Growth Rate					
UP	DOWN	DOWN	DOWN	11	9.17
DOWN	UP	UP	UP	19	15.83
Subtotal				**30**	**25.00**
Disagreement Among the 3 Weekly Formulas					
UP	UP	UP	DOWN	2	1.67
UP	UP	DOWN	UP	1	0.83
UP	UP	DOWN	DOWN	1	0.83
UP	DOWN	UP	UP	3	2.50
UP	DOWN	UP	DOWN	3	2.50
UP	DOWN	DOWN	UP	1	0.83
DOWN	UP	UP	DOWN	0	0.00
DOWN	UP	DOWN	UP	0	0.00
DOWN	UP	DOWN	DOWN	0	0.00
DOWN	DOWN	UP	UP	2	1.67
DOWN	DOWN	UP	DOWN	1	0.83
DOWN	DOWN	DOWN	UP	1	0.83
Subtotal				**15**	**12.50**

Notes:

(1) All statistics in this table are based on 120 observations (12 months for each of the years 1995 to 2004).

(2) To interpret the formula in symbol form, the symbols in the numerator represent the data from a particular month in a particular year for the measure listed and the symbols in the denominator represent the data from the same month in the previous year. *PSA* = *Petroleum Supply Annual*; MFW = Monthly estimates based on weekly data; 4Wa = Monthly estimates based on the four weeks preceding the last Friday of the month; 4Wb = Monthly estimates based on the four weeks that best cover the month. See main text for more detailed formulas.

(3) Formula A is given by $A(Month,t) = \left(\frac{Month_{PSA}(t)}{Month_{PSA}(t-1)} - 1 \right) * 100\%$.

(4) The UPs and DOWNs in this table refer to whether a particular formula gives a positive (UP) or a negative (DOWN) estimate of year-to-year growth rate. For example, the third row under "Disagreement Among the 3 Weekly Formulas" says that 0.83% of the time Formula A and Formula 3 predict upward growth while Formula 4 and Formula 5 predict downward growth.

(5) Totals down the last column may not add due to independent rounding.