Variance and Standard Error Estimates
For U.S. Producer Price Index (PPI) Percent Changes

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How do we calculate PPI variance data?

Bootstrapping Method of simulated replication of the PPI survey (i.e. 2-stage sampling)

Step 1 Create subgroups of items using the original sample as a frame

Step 2 Randomly select subgroups from each stratum to form replicates

Step 3 Reweight items to replicate size

Step 4 Calculate replicate percent changes

Step 5 Combine to form aggregate PPI replicates

Step 6 Estimate variances compared to the original sample PPI percent change:

$$v_{PC\,c,t,t-m} = \frac{1}{B}\sum_{b=1}^{B}\left(\hat{\theta}_b - \hat{\theta}_{\text{full}}\right)^2$$

$v_{PC\,c,t,t-m}$ is the variance of the percent change in the index for cell *c* from time $t-m$ to time *t*, in which *m* is equal to 1 month or 12 months previous

B is the number of bootstrap replicates (in the current implementation, B = 150),

$\hat{\theta}_b$ is the percent change estimate for a given replicate, and

$\hat{\theta}_{\text{full}}$ is the percent change estimate of the original sample.

What questions do variance data answer?

With how much precision can we say that the PPI estimate represents the population average?

How similar would the estimates be if the PPI survey could be conducted many times or replicated by another organization?

How might variance data be used?

- To calculate confidence intervals
- As part of an algorithm to decide sample sizes
- To alert analysts where to focus efforts to improve data quality
- As one of many indicators in our "Index Quality Compass" database, that is used internally to analyze index health

What do we publish?

- Data for the previous calendar year — released annually in July
- Methodology, short analysis, and tables

1-Month and 12-Month,

Measure of Variance: **Median Standard Error**

Reference statistic: **Median Absolute Percent Change**

For,

- Aggregate (FD-ID) PPIs
- 6-digit and aggregate industry NAICS code PPIs
- Product-level detail and aggregate commodity code PPIs

Sample Table Format (2016 Estimates)

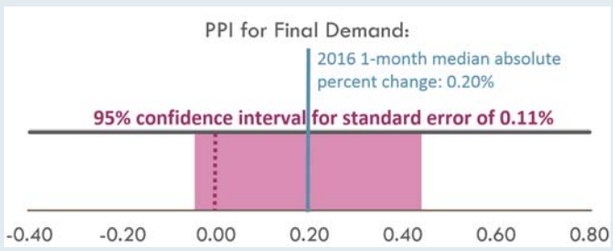
Index	1-mo. median absolute percent change	1-mo. median standard error	12-mo. median absolute percent change	12-mo. median standard error
Final demand	.20	.11	.14	.33
Final demand goods	.46	.10	2.09	.19
Final demand services	.14	.16	1.32	.47
Final demand construction	.05	.06	.92	.21
Engineering services	.28	.13	1.91	.47
Investment banking & securities dealing	1.71	1.87	29.60	4.88

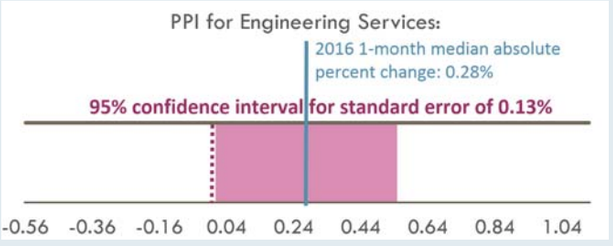
Questions for you!

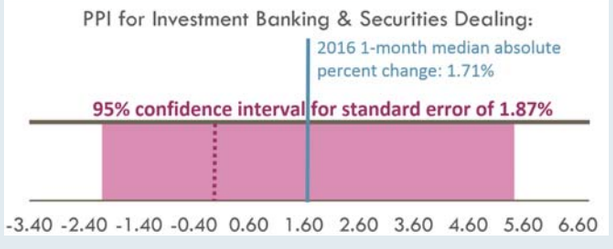
- Does your country calculate variances?
- What are the external and internal uses of your variance estimates?
- What software do you use to calculate variance data?

2016 Results

Standard Errors for 1-Month Percent Change Data







NOTE: Horizontal axes normalized to ±3x the reference statistic percent change to show comparison of Relative Standard Errors (RSE). RSE equals the SE divided by the reference statistic, multiplied by 100. If SE > 50% of the reference statistic, the 95-percent confidence interval contains 0 (indicated by the dotted line in the graphs above).