Seasonal Adjustments to the *Nonmanufacturing Business Outlook Survey*

January 15, 2019

The Federal Reserve Bank of Philadelphia seasonally adjusts the results of its *Nonmanufacturing Business Outlook Survey* (*NBOS*). Revised seasonal adjustment factors (and results) are computed annually, prior to the January *NBOS* release. The full set of historical data — seasonally adjusted (SA) and not seasonally adjusted (NSA) — is available in an Excel spreadsheet on the Philadelphia Fed's website.

Prior to computing the seasonally adjusted data, we ran two standard tests to detect the presence of seasonality in the raw diffusion index series, which indicated seasonality in most of the series. See the appendix of this document for information on and results of the tests.

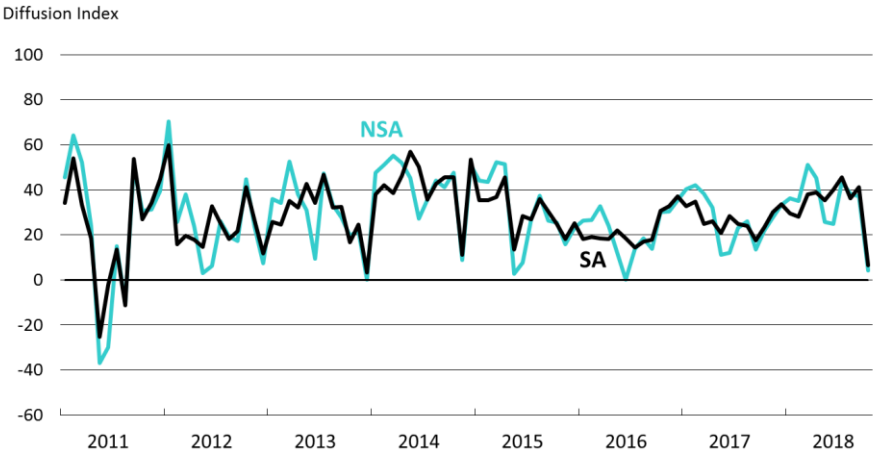
Computing Seasonally Adjusted Data

The Philadelphia Fed uses the U.S. Census Bureau's X-12 methodology with the additive seasonal factors option to adjust the *NBOS* data. Each question's components — increase, decrease, and no change — are seasonally adjusted. In the event a seasonal factor for a component series results in a negative percentage, the percentage is set to zero; if a result exceeds 100, the percentage is set to 100. If the sum of the three adjusted components exceeds 100 percent, the components are proportionally adjusted to equal 100 percent. The sum may fall short of 100 percent — typically representative of nonresponses — and is left as is. The diffusion index for each question is then recalculated using the adjusted component series and is computed as the difference between the percentage of increases and the percentage of decreases.

Results of the Seasonal Adjustment Process

The following chart compares the full history of the current SA series with the NSA series of the current activity diffusion index at the firm level.

***NBOS* Current General Activity at the Firm Level**
March 2011 to December 2018



Note: The diffusion index is computed as the percentage of respondents indicating an increase minus the percentage indicating a decrease; the data are seasonally adjusted.

Appendix: Testing for Seasonality

Prior to computing the SA data, the U.S. Census Bureau's X-12 methodology was used to test for seasonality of the NSA data for each survey question's diffusion index. Table 1 shows results for F-tests and Kruskal-Wallis (KW) chi-square tests for stable seasonality for each diffusion index and the corresponding probabilities for the absence of seasonality.[1] Using a subjective set of criteria to assess acceptance or rejection of the presence of stable seasonality, evidence of seasonality is indicated for 11 series, is uncertain or mixed for three series, and is lacking in two series. In sum, our Bank's researchers find that seasonality is evident for most of the key indexes; therefore, we seasonally adjust all of the *NBOS* series for consistency.

Table 1: Seasonality Tests on the Diffusion Indexes of *NBOS* Series

Code	Series Name	F Test	Prob	KW Test	Prob
GARBN	Current Activity for the Region	7.3	0.00%	51.7	0.00%
GABN	Current Activity for the Company	7.9	0.00%	57.8	0.00%
NOBN	New Orders	7.6	0.00%	53.9	0.00%
SRBN	Sales or Revenues	5.3	0.00%	39.9	0.00%
UOBN	Unfilled Orders	2.1	2.92%	25	0.92%
IVBN	Inventories	2.5	0.82%	25.7	0.72%
PPBN	Prices Paid	1.4	20.80%	12.4	33.74%
PRBN	Prices Received	3.3	0.00%	27.4	0.40%
NFBN	Number of Employees — Full-time Permanent	2.6	0.67%	23.7	1.39%
NPBN	Number of Employees — Part-time, Temporary …	6.8	0.00%	44.2	0.00%
AWBN	Average Hours Worked Per Week	4.4	0.00%	38.6	0.00%
WBBN	Wage and Benefit Costs	2.6	0.75%	26.2	0.60%
CPBN	Capital Expenditures — Physical Plant	1.5	15.03%	16.4	12.85%
CEBN	Capital Expenditures — Equipment and Software	2.2	2.23%	18.5	7.04%
GARFBN	Future Activity for the Region	4.3	0.00%	38.9	0.06%
GAFBN	Future Activity for the Company	2.9	0.28%	27.3	0.42%

The F-test and KW test show whether the null hypothesis ***that no stable seasonality is present*** is:

Rejected (at 1% Level)	**Uncertain** (at 1% to 10% Level)	**Accepted** (at 10% Level)

[1] Additive, stable seasonality was used as the alternative hypothesis in which seasonal adjustment adds or subtracts a fixed amount for each individual month. However, we allowed X-12 to vary the monthly factors when computing the reported values in order to capture more general seasonal patterns, i.e., unstable seasonality.