

## Intervention Analysis in Seasonal Adjustment

Seasonal adjustment is used to identify and factor out seasonal movements in some Consumer Price Index (CPI) series. The resultant seasonally adjusted data reflect an estimate of nonseasonal price movements. The CPI uses the Census Bureau's X-13ARIMA-SEATS software to calculate factors for seasonal adjustment of both historical and current series.

Seasonal adjustment for certain CPI series includes a technique called intervention analysis seasonal adjustment (IASA) that is part of the Census X-13 seasonal adjustment program. The seasonal factors produced for CPI series using IASA more accurately represent the underlying seasonal pattern, because it allows economic phenomena that are not seasonal in nature, such as outliers and level shifts, to be factored out of indexes before the calculation of seasonal factors. An *outlier* is an extreme value for a particular month. A *level shift* is a change or shift in the price level of a CPI series caused by an event, such as a sales tax increase or oil embargo, occurring over one or several months. The result is an adjustment based on a representation of the series with the seasonal pattern emphasized. IASA also makes it possible to account for seasonal shifts, resulting in a better seasonal adjustment in the periods before and after the shift occurred.

X-13ARIMA-SEATS's built-in regression variables are used for directly estimating the effects of sudden level changes and other disruptions and removing those effects before the calculation of seasonal factors. Seasonal factors are applied to the original unadjusted series without interventions removed. As a result, level shifts and outliers, removed for the calculation of seasonal factors, are present in the seasonally adjusted series.

A CPI series may receive IASA if the series is directly adjusted and has a relative importance greater than 0.5% to the U.S. city average All items index. If IASA is used for a component of the seasonally adjusted U.S. city average All items index, series which are subsets of the component series are also eligible for IASA. For a comprehensive discussion of IASA, see "Improvements to CPI Procedures for Intervention Analysis Seasonal Adjustment" in the December 1996 issue of the [CPI Detailed Report](#).

This year, BLS examined CPI series using the 8-year span from January 2010 through December 2017 with some exceptions. *New vehicles, New cars and trucks, New Cars, Used cars and trucks, Public transportation, and Airline fare* were adjusted using a 5-year data span from January 2013 through December 2017. *Fuel oil* was seasonally adjusted for the first time in the five year revision span.

In January 2018, BLS adjusted the series listed below using IASA techniques.

Airline Fare	Ice cream and related products	Utilities and public transportation
Beef and veal	Juices and nonalcoholic drinks	Utility (piped) gas service
Beverage materials including coffee and tea	Leased cars and trucks	
Carbonated drinks	Motor fuel	
Cereals and bakery products	Nonalcoholic beverages and beverage materials	
Cigarettes	Nondurables	
Coffee	Nondurables less food	
Dairy and related products	Nondurables less food and apparel	
Domestically produced farm food	Nondurables less food and beverages	
Fresh milk other than whole	Nondurables less food, beverages, and apparel	
Fresh whole milk	Other household fuels	
Fuel oil	Physicians' services	
Fuel oil and other fuels	Prescription drugs	
Gasoline, all types	Public transportation	
Gasoline, unleaded midgrade	Tobacco and smoking products	
Gasoline, unleaded premium		
Gasoline, unleaded regular		

For each series that was adjusted using X-13ARIMA-SEATS intervention analysis seasonal adjustment, a list of level shifts is provided in the table below, along with the identified causes (events). Outliers are also included in the list.

For further information, write to the Bureau of Labor Statistics, Division of Consumer Prices and Price Indexes, 2 Massachusetts Avenue, NE, Room 3615, Washington, DC 20212-0001, or send an e-mail to [cpiseas@bls.gov](mailto:cpiseas@bls.gov).

### Consumer Price Index series – intervention analysis seasonal adjustment

Series	Level shift period(s)	Event	Outliers
Airline fare	None		3/13, 5/13, 6/13
Beef and veal	12/10-1/11 8/14 6/17	Higher input costs (wheat and corn) due to drought Higher feed prices coupled with increased demand Restrictions were lifted and as a result the U.S. were able to export to China for first time since 2003	
Beverage materials including coffee and tea	8/10-9/10 2/11-6/11	Bad weather conditions in Brazil and Colombia, planned supply hoarding by exporters in Brazil and Vietnam, and a general manufacturer's price increase for coffee Bad weather conditions in Brazil and Colombia and increased supply hoarding for coffee	12/10, 8/17
Carbonated drinks	4/11-7/11	Higher costs of sweeteners, such as corn syrup and other raw materials, were passed to consumers	10/10, 12/10, 2/11, 4/16
Cereals and bakery products	1/11-10/11	Southern U.S. and Mexico drought	10/15
Cigarettes	5/10 7/14 4/17	Prices adjust to local and national excise taxes Drop in cigarette prices as inventory cleared nationwide and especially in the Midwest New California excise tax, along with major manufacturer's price increases	None
Coffee	8/10-9/10 2/11-7/11	Bad weather conditions in Brazil and Colombia, planned supply hoarding by exporters in Brazil and Vietnam, and a general manufacturer's price increase for coffee Bad weather conditions in Brazil and Colombia and increased supply hoarding for coffee	12/10, 8/17
Dairy and related products	2/11-9/11 10/13-5/14	Higher feed prices, rising energy prices, and strong international demand for dairy products Increase in cheese prices due to higher demand and stronger export sales	12/14
Domestically produced farm food	3/11 1/14-5/14	Southern U.S. and Mexico drought; global demand for biofuel increased demand for feedstock crop (i.e. production of corn-based ethanol) Higher beef and veal prices as a result of drought (i.e. Texas and California) and higher feed prices; higher dairy prices	12/14

## CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
Fresh milk other than whole	2/11-5/11	Higher feed prices (corn/soybean), rising energy prices, and strong international demand for dairy products	None
	11/13-5/14	Price of corn was low. Strong domestic and foreign demand	
Fresh whole milk	2/11-5/11	Higher feed prices (corn/soybean), rising energy prices, and strong international demand for dairy products	None
	11/13-5/14	Price of corn was low. Strong domestic and foreign demand	
Fuel oil	11/14-1/15	Low prices due to increased oil production and reduced non-domestic demand	3/15
Fuel oil and other fuels	3/14	High propane prices caused by unseasonably low temperatures and high farm demand, driving residential supply down	3/15
	11/14-1/15	Low prices due to increased oil production and reduced non-domestic demand	
Gasoline, all types	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Gasoline, unleaded midgrade	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Gasoline, unleaded premium	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Gasoline, unleaded regular	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Ice cream and related products	11/10-2/11	Strong foreign demand for whey, butter fat and other ingredients used in ice cream	None
Juices and nonalcoholic drinks	None		12/10, 9/12

## CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
Leased cars and trucks	10/15-12/15	Lower residual values pushed lease prices higher	None
	2/17	Lower residual values and higher rent charges	
	9/17-11/17	Lower residual values and higher rent charges	
Motor fuel	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Nonalcoholic beverages and beverage materials	2/11-7/11	Bad weather conditions in Brazil and Colombia and increased supply hoarding for coffee; higher prices for sweeteners used in soft drinks	12/10
Nondurables	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Nondurables less food	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Nondurables less food and apparel	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Nondurables less food and beverages	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Nondurables less food, beverages, and apparel	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
	9/15	Low prices due to global oil glut	
Other households fuels	12/13-2/14	High propane prices caused by unseasonably low temperatures and high farm demand, driving residential supply down	None
	2/14-4/14	Return to normal pricing and supply recovery after low temperatures	
Physician's services	11/15	Cash price increases for office visits	2/15
	4/16-8/16	Large increase in insurance reimbursements due to contract updates between insurance companies and providers	
	4/17	Large cash price decreases for office visits	

## CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
Prescription drugs	10/12-12/12	Expiration of patents resulted in increased availability of generic alternatives	12/13
	5/16-8/16	Slowdown in blockbuster drugs and increase in mergers and acquisitions led to lower competition, pushing drug prices higher	
Public transportation	None		3/13, 5/13 6/13
Tobacco and smoking products	5/10	Prices adjust to local and national excise taxes	None
	7/14	Drop in cigarette prices as inventory cleared nationwide and especially in the Midwest	
	4/17	New California excise tax, along with major manufacturer's price increases	
Utilities and public transportation	12/13-3/14	Dramatic increase in demand due to extreme winter in Midwest and Northeast	4/14, 2/17
Utility (piped) gas service	12/13-3/14	Dramatic increase in demand due to extreme winter in Midwest and Northeast	None