

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 2011 through December 2018 with some exceptions. All of the food related series below were examined with a 7-year span, in order to mitigate the impact on seasonal adjustment of a U.S. – South American drought in 2011 that pushed food prices higher throughout the year. Additionally, *New vehicles*, *New cars and trucks*, *New cars*, *Public transportation*, and *Airline fare* were adjusted using a 5-year span from January 2014 through December 2018.

In January 2019, BLS adjusted the series listed below using IASA techniques.

Beverage materials including coffee and tea	Gasoline, unleaded regular	Nondurables less food and apparel
Carbonated drinks	Juices and nonalcoholic drinks	Nondurables less food and beverages
Cereals and bakery products	Medical care commodities	Nondurables less food, beverages, and apparel
Cigarettes	Medical care services	Other household fuels
Coffee	Medicinal drugs	Physicians' services
Dairy and related products	Milk	Prescription drugs
Fresh milk other than whole	Motor fuel	Professional services
Fresh whole milk	New cars	Propane, kerosene, and firewood
Fuel oil	New cars and trucks	Tobacco and smoking products
Fuel oil and other fuels	New vehicles	Used cars and trucks
Gasoline, all types	Nonalcoholic beverages and beverage materials	Utilities and public transportation
Gasoline, unleaded midgrade	Nondurables	Utility (piped) gas service
Gasoline, unleaded premium	Nondurables less food	

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.

Consumer Price Index series – intervention analysis seasonal adjustment

Series	Level shift period(s)	Event	Outliers
Beverage materials including coffee and tea	None		2/17
Carbonated drinks	None		4/16
Cereals and bakery products	None		10/15
Cigarettes	7/14 4/17	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	None		2/17
Dairy and related products	10/13-5/14	Increase in cheese prices due to higher demand and stronger export sales	12/14
Fresh milk other than whole	11/13-5/14 2/15	Price of corn was low. Strong domestic and foreign demand Strong U.S. dollar and CA port strike affected exports. Wholesale prices also fell because of strong milk production	None
Fresh whole milk	11/13-5/14 2/15	Price of corn was low. Strong domestic and foreign demand Strong U.S. dollar and CA port strike affected exports. Wholesale prices also fell because of strong milk production	None
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 11/14-1/15	High propane prices caused by unseasonably low temperatures and high farm demand, driving residential supply down Low prices due to increased oil production and reduced non-domestic demand	3/15
Gasoline, all types	11/14-1/15 9/15	Weak global demand along with increased supply from continued growth in North American crude production Low prices due to global oil glut	None

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
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	
Juices and nonalcoholic drinks	None		9/12, 2/17, 12/17
Medical care commodities	5/16-8/16	Slowdown in blockbuster drugs and increase in mergers and acquisitions leading to lower competition pushed drug prices higher	None
Medical care services	8/16	Large increase in insurance reimbursements due to contract updates between health insurance companies and providers	None
Medicinal drugs	5/16-8/16	Slowdown in blockbuster drugs and increase in mergers and acquisitions leading to lower competition pushed drug prices higher	None
Milk	11/13-5/14	Price of corn was low. Strong domestic and foreign demand	None
	2/15	Strong U.S. dollar and CA port strike affected exports. Wholesale prices also fell because of strong milk production	
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	
New cars	7/17	Surplus supply and lack of consumer demand after previous years' record sales	1/17, 4/18
New cars and trucks	7/17	Surplus supply and lack of consumer demand after previous years' record sales	1/17, 4/18
New vehicles	7/17	Surplus supply and lack of consumer demand after previous years' record sales	1/17, 4/18
Nonalcoholic beverages and beverage materials	None		2/17, 5/17

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
Nondurables	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
Nondurableslessfood	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
Nondurableslessfood and apparel	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
Nondurableslessfood and beverages	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
Nondurableslessfood, beverages, and apparel	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
Other householdsfuels	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	
Physicians' 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	
Prescription drugs	5/16-8/16	Slowdown in blockbuster drugs and increase in mergers and acquisitions leading to lower competition pushed drug prices higher	None
Professional services	11/15	Cash price increases for office visits	None
	4/16-8/16	Large increase in insurance reimbursements due to contract updates between insurance companies providers	
	4/17	Large cash price decreases for office visits	
Propane, kerosene, and firewood	None		1/14, 2/14, 3/14
Tobacco and smoking products	7/14	Drop in cigarette prices as inventory cleared nationwide and especially in the Midwest	None
	4/17	New California excise tax, along with major manufacturer's price increases	
Used cars and trucks	9/18-11/18	Increase in demand due to depleted used car and truck market after natural disasters	8/18

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
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	3/13-5/13	Cold winter temperatures and large withdrawals of natural gas storage inventories	12/18
	12/13-3/14	Dramatic increase in demand due to extreme winter in Midwest and Northeast	