

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 non-seasonal 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 2012 through December 2019 with some exceptions. *New vehicles, New cars and trucks, and New trucks* were examined with a 5-year span from January 2015 through December 2019. Additionally, *Airline fare, Public transportation, and Utilities and public transportation* were adjusted using a 6-year span from January 2014 through December 2019. In 2018, the *Used cars and trucks* index changed its estimation methodology from using a 3-month moving average of depreciated prices to a 1-month price change approach. Seasonal factors for this series were determined using five years of estimated 1-month price change.

In January 2020, BLS adjusted the series listed below using IASA techniques.

Beverage materials including coffee and tea	Gasoline, all types	Nondurables less food and apparel
Carbonated drinks	Gasoline, unleaded midgrade	Nondurables less food and beverages
Cereals and bakery products	Gasoline, unleaded premium	Nondurables less food, beverages, and apparel
Cheese and related products	Gasoline, unleaded regular	Other household fuels
Cigarettes	Juices and nonalcoholic drinks	Physicians' services
Coffee	Milk	Professional services
Dairy and related products	Motor fuel	Propane, kerosene, and firewood
Fresh milk other than whole	New cars	Tobacco and smoking products
Fresh whole milk	Nonalcoholic beverages and beverage materials	Utilities and public transportation
Fuel oil	Nondurables	Utility (piped) gas service
Fuel oil and other fuels	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	2/17	High robusta coffee prices due to weather in the two largest robusta producing countries, Vietnam and Brazil. Vietnam experienced heavy rains and floods during their harvesting season in late 2016 which affected supplies. Brazil's robusta production was reduced due to above average temp and prolonged dry spells	12/17
Carbonated drinks	7/18-10/18	Broad based cost increases and new tariffs on aluminum and steel imported from the E.U., Canada, and Mexico	4/16
Cereals and bakery products	None		10/15
Cheese and related products	10/13-5/14	Increase in cheese prices due to higher demand and stronger export sales	None
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	2/17	High robusta coffee prices due to weather in the two largest robusta producing countries, Vietnam and Brazil. Vietnam experienced heavy rains and floods during their harvesting season in late 2016 which affected supplies. Brazil's robusta production was reduced due to above average temp and prolonged dry spells	12/17
Dairy and related products	10/13-5/14	Increase in cheese prices due to higher demand and stronger export sales	None
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
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

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
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	2/16
	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	2/16
	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	2/16
	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	2/16
	9/15	Low prices due to global oil glut	
Juices and nonalcoholic drinks	7/18-10/18	Price increase due to new tariffs on aluminum and steel imports. Also, Hurricane Irma in 2017 reduced Florida orange crops into 2018. Florida is main supplier of oranges used for juice, so declining crop yields forced commodity prices higher in 2018	None
	12/18-2/19	Price increase due to new tariffs on aluminum and steel imports. Also, Hurricane Irma in 2017 reduced Florida orange crops into 2018. Florida is main supplier of oranges used for juice, so declining crop yields forced commodity prices higher in 2018	
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	2/16
	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

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
Nonalcoholic beverages and beverage materials	12/18-2/19	Price increase due to new tariffs on aluminum and steel imports. Also, Hurricane Irma in 2017 reduced Florida orange crops into 2018. Florida is main supplier of oranges used for juice, so declining crop yields forced commodity prices higher in 2018	2/17
Nondurables	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
Nondurables less food	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	None
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
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
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
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	
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	
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	

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
Utilities and public transportation	None		3/14
Utility (piped) gas service	3/13-5/13	Cold winter temperatures and large withdrawals of natural gas storage inventories	2/18
	12/13-3/14	Dramatic increase in demand due to extreme winter in Midwest and Northeast	