

Intervention Analysis in Seasonal Adjustment

In some Consumer Price Index (CPI) series, a process known as seasonal adjustment is used to identify and factor out seasonal movements. The resulting seasonally adjusted data reflect an estimate of nonseasonal price movements. The CPI uses the Bureau of the Census X-12-ARIMA software to calculate factors for seasonal adjustment of both historical and current series. Some CPI series are adjusted using the intervention analysis feature of the Census X-12 seasonal adjustment process.

Intervention analysis seasonal adjustment allows nonseasonal economic phenomena, such as outliers and level shifts, to be factored out of indexes before calculation of seasonal adjustment 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. Intervention analysis seasonal adjustment also makes it possible to account for seasonal shifts, resulting in a better seasonal adjustment in the periods before and after the shift occurred. For those CPI series adjusted using intervention analysis seasonal adjustment techniques the resulting seasonal factors better represent the true seasonal pattern than factors calculated without these techniques. The seasonal factors are applied to the original unadjusted series. Level shifts and outliers, removed for the calculation of seasonal factors, are present in the seasonally adjusted series.

When X-12-ARIMA is used to perform intervention analysis seasonal adjustment, unusual events are modeled as part of the seasonal adjustment process. X-12-ARIMA's built-in regression variables are used for directly estimating the effects of sudden level changes and other disruptions and removing those effects before calculation of the seasonal factors. For a comprehensive discussion of X-12-ARIMA and intervention analysis seasonal adjustment, see "Improvements to CPI Procedures for Intervention Analysis Seasonal Adjustment" in the December 1996 issue of the *CPI Detailed Report*.

A CPI series may receive intervention analysis seasonal adjustment (IASA) if the series is directly adjusted and has a relative importance greater than 0.5% to the U.S. city average All items CPI 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. In January 2008, BLS adjusted the series listed below using intervention analysis seasonal adjustment techniques. BLS examined these series using the 8-year span from January 2000 through December 2007.

Beverage materials including coffee and tea	Gasoline, unleaded premium	New vehicles
Carbonated drinks	Gasoline, unleaded regular	Nonalcoholic beverages and beverage materials
Coffee	Ice cream and related products	Nondurables less food and apparel
Dairy and related products	Juices and nonalcoholic drinks	Nondurables less food, beverages, and apparel
Electricity	Motor fuel	Utility (piped) gas service
Gasoline, all types	New cars	
Gasoline, unleaded midgrade	New cars and trucks	
	New trucks	

For each series that was adjusted using X-12-ARIMA 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 call Jeff Wilson at (202) 691-6968. Mr. Wilson may also be reached at Wilson.Jeff@bls.gov by e-mail.

Consumer Price Index series – intervention analysis seasonal adjustment

Series	Level shift period(s)	Event	Outliers
Beverage materials including coffee and tea	11/04-4/05	Smaller Brazilian coffee crop, rising Brazilian currency	None
Carbonated drinks	4/02-6/02	Promotions associated with significant new brand introductions	10/00, 8/01, 7/03, 3/07
	9/02	Return to normal level of promotions	
Coffee	11/04-4/05	Smaller Brazilian coffee crop, rising Brazilian currency	None
Dairy and related products	3/04-6/04	Rising consumption, inadequate cheese and butter stocks, and very low milk production	None
	6/04-9/04	Low demand in response to tight markets, combined with rising production of milkfat products	
	4/07-8/07	Increased domestic demand and tight global supplies of nonfat dry milk	
Electricity	6/01	Increasing demand due to warmer than expected weather and raising rates to aid the conservation of supplies	11/05
	1/06	Larger than normal increase due to recovery from Hurricane Katrina	
Gasoline, all types	3/03-5/03	Oil strike in Venezuela ends, with faster than expected increases in oil supply	None
	6/05-9/05	Damage to U.S. oil refineries resulting from Hurricane Katrina, along with record global petroleum demand and continued political unrest in Iraq, Venezuela and Nigeria	
	10/05-11/05	Recovery of domestic oil refineries in the Gulf of Mexico, combined with easing crude oil prices	
	8/06-10/06	Collapse in profit margins for oil refineries	
Gasoline, unleaded midgrade	3/03-5/03	Oil strike in Venezuela ends, with faster than expected increases in oil supply	None
	6/05-9/05	Damage to U.S. oil refineries resulting from Hurricane Katrina, along with record global petroleum demand and continued political unrest in Iraq, Venezuela and Nigeria	
	10/05-11/05	Recovery of domestic oil refineries in the Gulf of Mexico, combined with easing crude oil prices	
	8/06-10/06	Collapse in profit margins for oil refineries	
Gasoline, unleaded premium	3/03-5/03	Oil strike in Venezuela ends, with faster than expected increases in oil supply	None
	6/05-9/05	Damage to U.S. oil refineries resulting from Hurricane Katrina, along with record global petroleum demand and continued political unrest in Iraq, Venezuela and Nigeria	
	10/05-11/05	Recovery of domestic oil refineries in the Gulf of Mexico, combined with easing crude oil prices	
	8/06-10/06	Collapse in profit margins for oil refineries	

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
Gasoline, unleaded regular	3/03-5/03	Oil strike in Venezuela ends, with faster than expected increases in oil supply	None
	6/05-9/05	Damage to U.S. oil refineries resulting from Hurricane Katrina, along with record global petroleum demand and continued political unrest in Iraq, Venezuela and Nigeria	
	10/05-11/05	Recovery of domestic oil refineries in the Gulf of Mexico, combined with easing crude oil prices	
	8/06-10/06	Collapse in profit margins for oil refineries	
Ice cream and related products	5/01-7/01	Early year drop in milk production was slow to recover. Demand for dairy products remained strong.	11/03, 6/05, 8/06
	3/03-6/03	Sluggish demand for dairy food "treats"	
Juices and non-alcoholic drinks	4/02-6/02	Promotions associated with significant new brand introductions	10/00, 8/01, 7/03, 11/03, 3/07
	9/02	Return to normal level of promotions for carbonated drinks	
	2/05-4/05	Orange juice futures increased due to cuts in projected citrus production of Florida, related to the previous hurricane season	
Motor fuel	3/03-5/03	Oil strike in Venezuela ends, with faster than expected increases in oil supply	None
	6/05-9/05	Damage to U.S. oil refineries resulting from Hurricane Katrina, along with record global petroleum demand and continued political unrest in Iraq, Venezuela and Nigeria	
	10/05-11/05	Recovery of domestic oil refineries in the Gulf of Mexico, combined with easing crude oil prices	
	8/06-10/06	Collapse in profit margins for oil refineries	
New cars	6/04-8/04	Effect of very large cash incentives offered by domestic automakers	11/01, 12/01, 1/02, 1/03, 2/03, 8/03
	11/04	Return to normal promotions, combined with the effect of a model changeover	
	6/05-8/05	Employee pricing discounts offered by domestic automakers and corresponding incentives offered by imported makes	
	8/05-10/05	Short supply of fuel-efficient vehicles in light of record gasoline prices, combined with early 2006 model changeovers and a return to normal promotions following employee pricing offers	

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
New cars and trucks	6/04-8/04	Effect of very large cash incentives offered by domestic automakers	11/01, 12/01, 1/02, 1/03, 2/03, 8/03
	11/04	Return to normal promotions, combined with the effect of a model changeover	
	6/05-8/05	Employee pricing discounts offered by domestic automakers and corresponding incentives offered by imported makes	
	8/05-10/05	Short supply of fuel-efficient vehicles in light of record gasoline prices, combined with early 2006 model changeovers and a return to normal promotions following employee pricing offers	
New trucks	6/04-8/04	Effect of very large cash incentives offered by domestic automakers	10/01, 11/01, 12/01, 1/02, 1/03, 2/03, 10/06
	11/04	Return to normal promotions, combined with the effect of a model changeover	
	6/05-8/05	Employee pricing discounts offered by domestic automakers and corresponding incentives offered by imported makes	
	8/05-10/05	Return to normal pricing following employee pricing offers	
New vehicles	6/04-8/04	Effect of very large cash incentives offered by domestic automakers	11/01 12/01, 1/02, 1/03, 2/03, 8/03
	11/04	Return to normal promotions, combined with the effect of a model changeover	
	6/05-8/05	Employee pricing discounts offered by domestic automakers and corresponding incentives offered by imported makes	
	8/05-10/05	Short supply of fuel-efficient vehicles in light of record gasoline prices, combined with early 2006 model changeovers and a return to normal promotions following employee pricing offers	
Nonalcoholic beverages and beverage materials	4/02-6/02	Promotions associated with significant new brand introductions in carbonated drinks	10/00, 8/01, 7/03, 11/03, 3/07
	9/02	Return to normal level of promotions for carbonated drinks	
	2/05-4/05	Orange juice futures increased due to cuts in projected citrus production of Florida, related to the previous hurricane season, combined with a small Brazilian coffee crop	
Nondurables less food and apparel	3/03-5/03	Oil strike in Venezuela ends, with faster than expected increases in oil supply	None
	6/05-9/05	Damage to U.S. oil refineries resulting from Hurricane Katrina, along with record global petroleum demand and continued political unrest in Iraq, Venezuela and Nigeria	
	10/05-11/05	Recovery of domestic oil refineries in the Gulf of Mexico, combined with easing crude oil prices	
	8/06-10/06	Collapse in profit margins for oil refineries	

CPI series – intervention analysis seasonal adjustment-continued

Series	Level shift period(s)	Event	Outliers
Nondurables less food, beverages, and apparel	3/03-5/03	Oil strike in Venezuela ends, with faster than expected increases in oil supply	None
	6/05-9/05	Damage to U.S. oil refineries resulting from Hurricane Katrina, along with record global petroleum demand and continued political unrest in Iraq, Venezuela and Nigeria	
	10/05-11/05	Recovery of domestic oil refineries in the Gulf of Mexico, combined with easing crude oil prices	
	8/06-10/06	Collapse in profit margins for oil refineries	
Utility (piped) gas service	11/00-1/01	Low inventories for the expected demand of the winter heating season	10/06
	1/03-3/03	Supply problems in Venezuela, onset of colder than expected weather, and historically low storage levels	
	8/05-10/05	Supply disruptions due to Hurricane Katrina	