

(Box 3) Frequency Spectrum Analysis of Private Consumption

Private consumption has been resilient on the whole, although relatively weak developments have been seen for a prolonged time since the consumption tax hike in April 2014 (Box Chart 3 [1]). Various factors have been pointed out as attributable to such weakness, including (a) stock adjustments in durable goods, (b) a decline in real disposable income due to the consumption tax hike and the rise that happened mainly in food prices, (c) a negative wealth effect due in part to a decline in stock prices, (d) bad weather, and (e) anxiety over the social security system, including pensions.

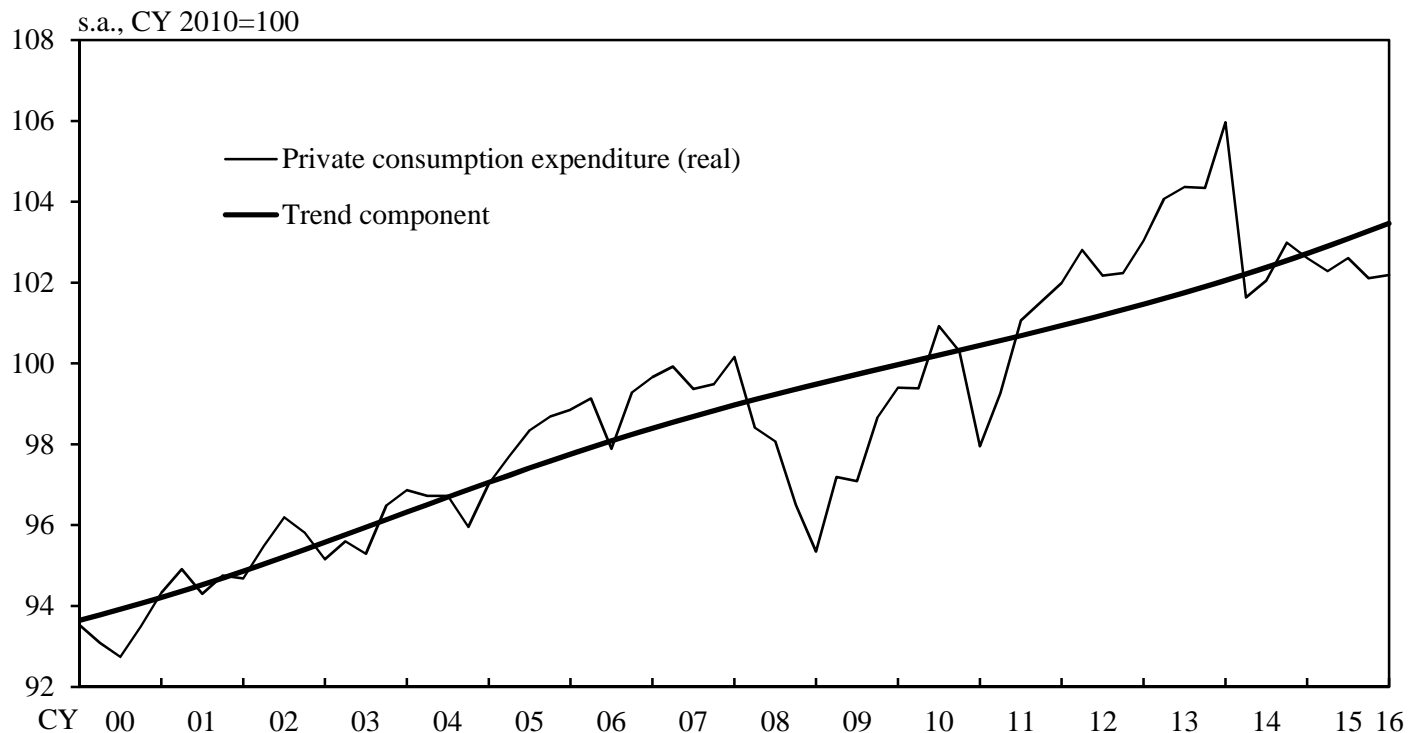
In order to quantitatively gauge what factor is contributing to exerting downward pressure on private consumption, and to what degree, private consumption is decomposed into some cyclical components through a frequency spectrum analysis. Roughly speaking, a frequency spectrum analysis involves replacing time series data with cyclical components that have various frequencies (Box Chart 3 [2]). When it comes to (a) stock adjustments in durable goods, in light of the average year of use of durable goods, the effects of stock adjustments in digital appliances, etc. can be categorized as a medium-term cycle of 2-7 years, while those in automobiles and white goods can be captured through a long-term cycle of 7-12 years (Box Chart 4 [1] and [2]). Meanwhile, as the effects of (d) bad weather are temporary, these can be categorized as a short-term cycle of less than 2 years. A front-loaded increase and subsequent decline in demand prior to and after the consumption tax hikes also can be captured as a short-term cycle in the framework of this analysis. It is not so clear which cycle can capture (b) the decline in real disposable income and (c) the negative wealth effect; however, as employee compensation broadly follows the business cycle and asset prices, such as stock prices, fluctuate in a volatile manner, (b) developments in real disposable income can be captured through a medium-term cycle and (c) the wealth effect due to stock prices through a short-term cycle (Box Chart 4 [3]). (e) Anxiety over the social security system does not seem to be cyclical, and instead can be represented as a trend component, calculated as a residual in this analysis.

In light of the frequencies of cycles classified by the above factors, recent developments in private consumption expenditure in terms of quarterly change can be decomposed as the

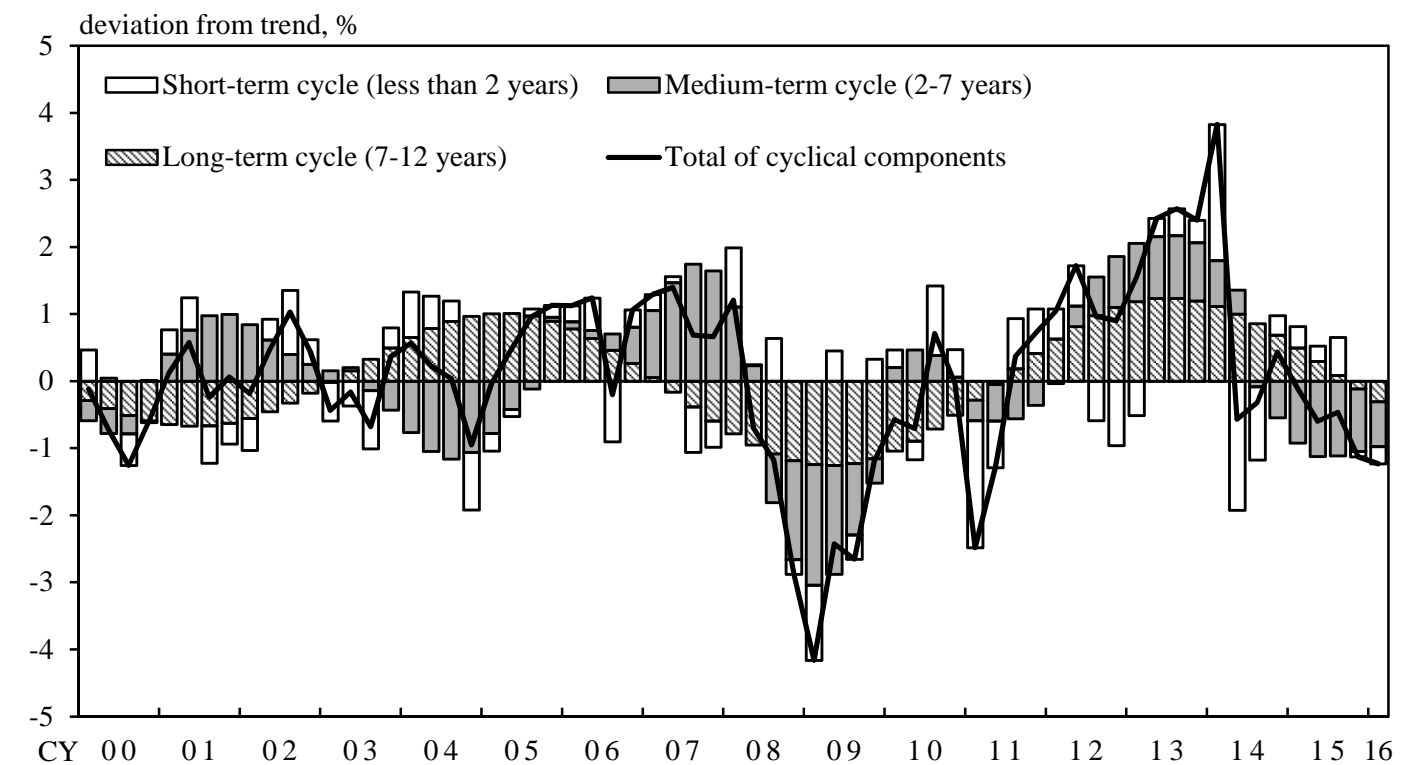
following (Box Chart 4 [4]). (1) The short-term cycle showed substantial fluctuations in 2014 due to the front-loaded increase and subsequent decline in demand prior to and after the consumption tax hike, followed by downward pressure in the October-December quarter of 2015 and the January-March quarter of 2016 -- the bad weather in the October-December quarter of 2015 and negative wealth effect in the January-March quarter of 2016 due to the decline in stock prices since the turn of the year seem to have contributed to exerting this downward pressure; (2) the medium-term cycle exerted adverse effects in 2014, reflecting developments in real disposable income, but is generating positive effects recently; (3) the long-term cycle has consistently been exerting adverse effects due to stock adjustments in durable goods; and (4) the trend component has consistently been trending upward, suggesting that anxiety over the social security system from a long-term perspective may not be a factor that has been exerting significant downward pressure on private consumption.

Frequency Spectrum Analysis of Private Consumption (1)

(1) Private Consumption Expenditure and Its Trend



(2) Cyclical Components of Private Consumption Expenditure



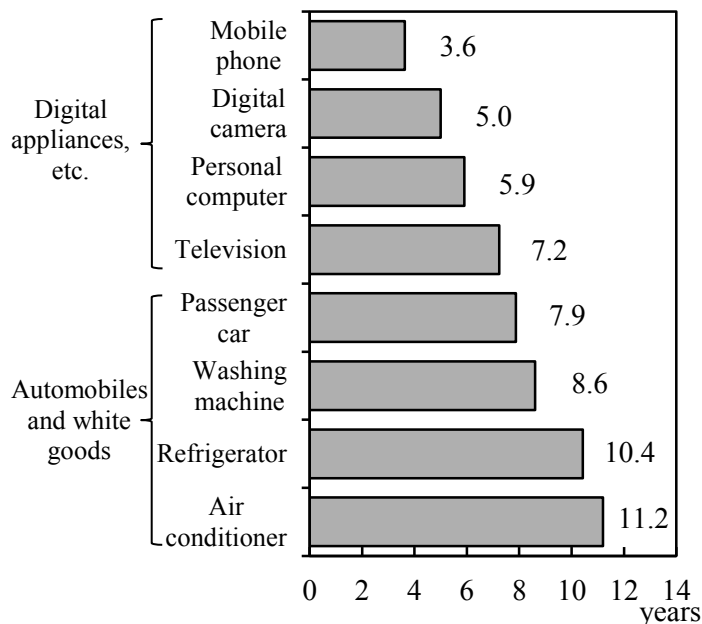
Notes: 1. Cyclical components are extracted using the Christiano-Fitzgerald filter. The trend component is calculated by subtracting cyclical components from the original series. The estimation period for filtering is 1980/Q1-2016/Q1.

2. Up to 2013/Q4, private consumption expenditure is consumption of households (excluding imputed rent) from the SNA (second annual revision). Data from 2014/Q1 are obtained by extending private consumption expenditure using the quarter-on-quarter rate of change in the Consumption Activity Index (adjusting travel balance).

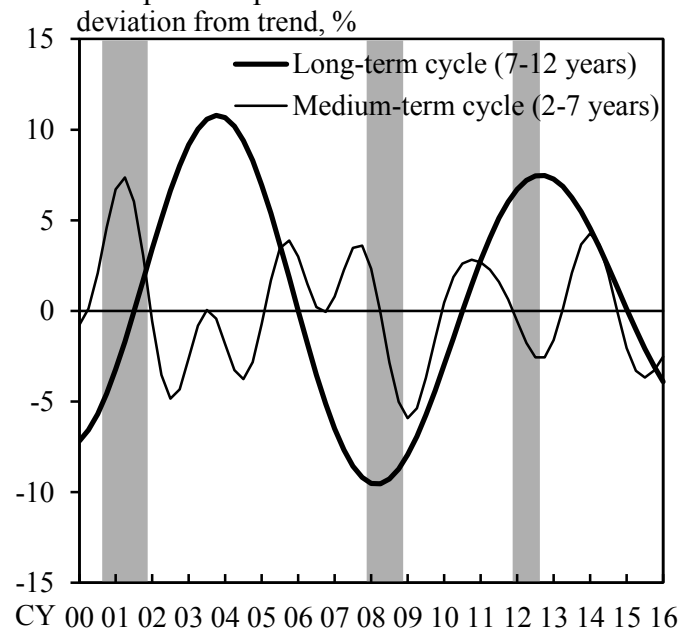
Sources: Cabinet Office; Bank of Japan; Ministry of Economy, Trade and Industry; Ministry of Internal Affairs and Communications, etc.

Frequency Spectrum Analysis of Private Consumption (2)

(1) Average Years of Use of Durable Goods



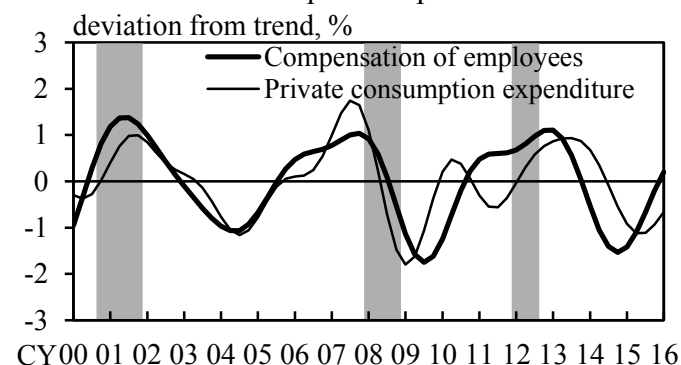
(2) Long-Term and Medium-Term Cycles of Consumption Expenditure on Durable Goods



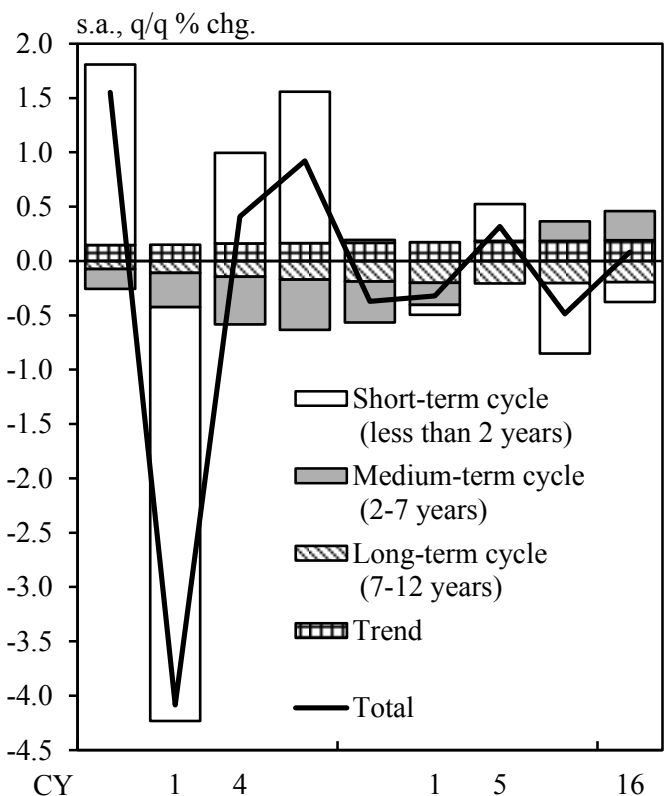
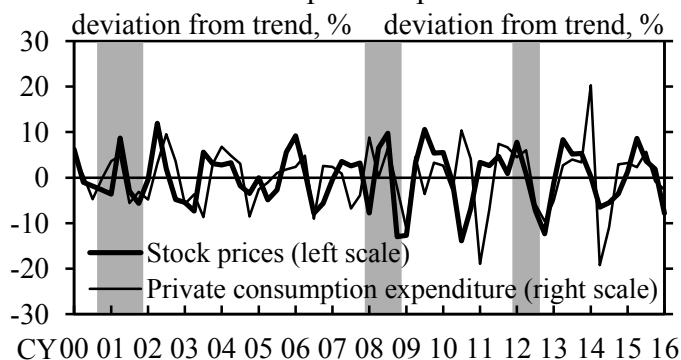
(3) Cyclical Components of Employee Compensation and Stock Prices

(4) Decomposition of Recent Developments in Private Consumption Expenditure

(a) Medium-term Cycles of Employee Compensation and Private Consumption Expenditure



(b) Short-term Cycles of Stock Prices and Private Consumption Expenditure



Notes: 1. Figures for the years of use of durable goods are averages for fiscal 2013-15 and are based on the "Consumer Confidence Survey" conducted by the Cabinet Office.
 2. The cyclical and trend components are calculated using the same approach as in Box Chart 3.
 3. Shaded areas indicate recession periods.

Sources: Cabinet Office; Bank of Japan; Ministry of Economy, Trade and Industry; Ministry of Internal Affairs and Communications, etc.