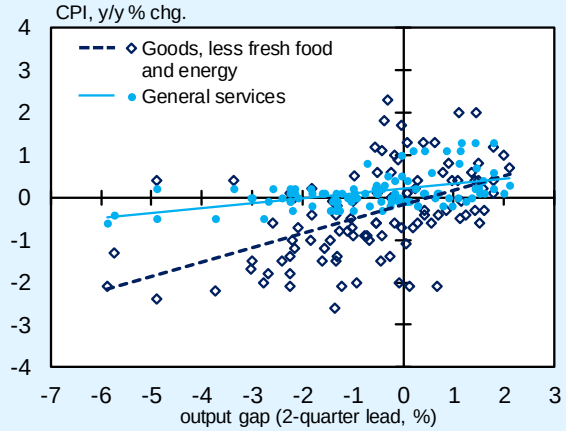
(Box 4) Relationship between Price Changes and the Output Gap in the Goods and Services Sectors

Looking at developments after the outbreak of COVID-19, even though the output gap deteriorated significantly to an extent not seen since the GFC, the year-on-year rate of change in the CPI has remained slightly positive to date when excluding the effects of temporary factors such as a decline in energy prices (Chart 47). The relationship between the CPI and the output gap has been weakening since the outbreak, and this is attributable to the following factors, as pointed out in past Outlook Reports: (1) there have been cost increases on the supply side as a result of taking preventive measures against COVID-19 and avoiding creating crowds -- for example, conducting temperature checks and disinfection steps or reducing the number of seats -- and (2) many firms in the face-to-face services industry have been cautious in cutting prices, which could lead to further deterioration in their profitability because the price elasticity of demand has decreased in the industry due to consumers' vigilance against COVID-19. Besides these factors, this box points out that the recent firmness in the CPI may also be attributable to (3) a difference in price sensitivity to economic activity (or price stickiness) between goods and services, taking into account that the supply-demand conditions for goods and services have been significantly different during the pandemic.

Chart B4-1: Output Gap and Prices of Goods and Services



Sources: Ministry of Internal Affairs and Communications; Bank of Japan.
Notes: 1. The observation period is 1996/Q1-2021/Q1.
2. The CPI figures exclude the effects of the consumption tax hikes, policies concerning the provision of free education, and the "Go To Travel" campaign, which covers a portion of domestic travel expenses. The figures from 2020/Q2 onward are based on staff estimations, and exclude the effects of measures such as free higher education introduced in April 2020. Goods exclude water charges.
3. The output gap is based on staff estimations.

Since before the outbreak of COVID-19, the general tendency has been that prices of the

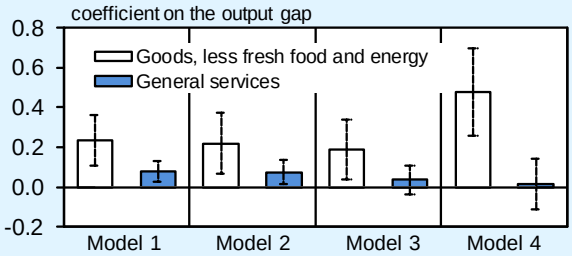
majority of services for households do not immediately respond to the supply-demand conditions at the time or to changes in marginal costs, partly because such prices are revised with less frequency compared with goods prices. In fact, looking at the scatter diagram showing the relationship between the rates of change in prices of goods or services and the output gap, the slope of regression line for services price inflation on the output gap is flatter than that for goods price inflation (Chart B4-1). The aforementioned tendency is also evident from the quantitatively estimated Phillips curves that take into account not only the output gap but also such factors as inflation expectations, using different models and various estimation periods. The results indicate that, while goods prices are sensitive to such factors as the output gap, services prices do not immediately respond to changes in the supply-demand conditions, as seen in the fact that the coefficients of the output gap for regressions of services prices are smaller than those for regressions of goods prices and are statistically insignificant in some models (Chart B4-2).

While the negative demand shock due to COVID-19 has been seen mainly in the services sector, many items in the goods sector -- such as digital devices and household electrical appliances -- have improved in terms of the supply-demand conditions due, for example, to a demand shift from the services sector. Thus, the fact that the overall CPI has remained firm seems to be partly because, in the services industry -- where prices are sticky -- deterioration in the supply-demand conditions has not immediately led to exerting downward pressure on prices,

Chart B4-2: Phillips Curves for Goods and Services

Dependent variables:
CPI (goods, less fresh food and energy, s.a., ann., q/q % chg.)
CPI (general services, s.a., ann., q/q % chg.)

Explanatory variables	Model 1	Model 2	Model 3	Model 4
Output gap	○	○	○	
DI for domestic supply & demand conditions for goods and for services				○
Lagged dependent variables	○	○	○	○
Medium- to long-term inflation expectations			○	○
Estimation period	1990/Q4-2020/Q4	1996/Q1-2020/Q4	1996/Q1-2020/Q4	2004/Q1-2020/Q4



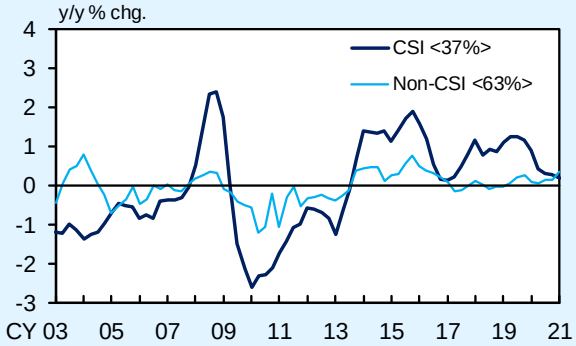
Sources: Ministry of Internal Affairs and Communications; Bank of Japan; Consensus Economics Inc., "Consensus Forecasts."

Notes: 1. All models include a constant term. The lagged dependent variables are the averages of the previous two quarters. The dotted lines in the figure represent ±2 standard errors. The bars for Model 4 in the figure represent the coefficients of the DIs for domestic supply and demand conditions.
2. The output gap is based on staff estimations.
3. Figures for medium- to long-term inflation expectations from 2014 onward are estimated using principal component analysis of figures in the *Tankan* for 5-year-ahead expectations of output prices by industry and enterprise size. Figures before 2014 are from the "Consensus Forecasts" (average for 6-10 years ahead).
4. The DIs used in Model 4 are those in the *Tankan* for domestic supply and demand conditions for products and services. Specifically, the DI for "wholesaling and retailing" is used to estimate figures for "goods, less fresh food and energy" and the average of the DIs for "services for individuals" and "accommodations, eating and drinking services" is used for "general services." The DIs for the period from 2004 through 2020 are standardized to have zero mean and unit variance.
5. The CPI figures exclude the effects of the consumption tax hikes, policies concerning the provision of free education, and the "Go To Travel" campaign, which covers a portion of domestic travel expenses. The figures from 2020/Q2 onward are based on staff estimations, and exclude the effects of measures such as free higher education introduced in April 2020. Goods exclude water charges.

whereas goods prices -- which are more sensitive to economic activity -- have been underpinned by a tailwind of demand for stay-at-home consumption.

Taking a more detailed look, there are some goods items of which prices are not sensitive to economic activity, such as tobacco and newspapers, and some services items of which prices are relatively sensitive to economic activity, such as hotel charges and dining-out. To examine this point, it is useful to estimate the price indicator of cyclically sensitive inflation (CSI), which is compiled by aggregating the rates of price change for only the goods and services items that have high correlation with the output gap.[26] The results of estimating CSI for the CPI (all items less fresh food and energy) show that, although CSI has declined recently compared with a while ago, it has remained slightly positive, which is different from at the time of the GFC, when deterioration in the output gap resulted in a substantial decline in CSI (Chart B4-3).[27] This suggests that, supported by increased demand for stay-at-home consumption of goods (e.g.,

Chart B4-3: Developments in CSI and Non-CSI



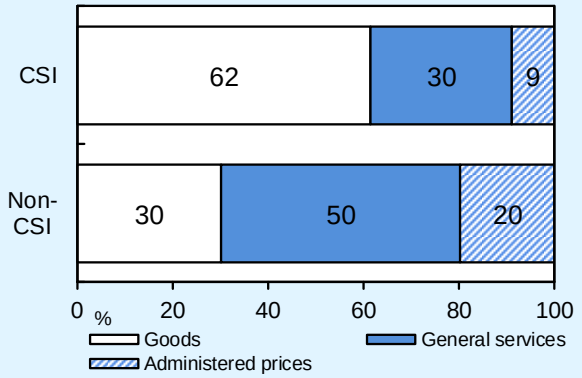
Sources: Ministry of Internal Affairs and Communications; Bank of Japan.
Notes: 1. CPI items (less fresh food, energy, and house rent; seasonally adjusted q/q change) are regressed on 0 to 4 quarter lags of the output gap, and items for which any of the coefficients are positive and significant at the 5 percent level are classified cyclically sensitive. Figures for CSI are the average inflation rate of these items, while those for non-CSI are the average of all other items and house rent. The estimation period is 2000/Q2-2019/Q4. Figures in angular brackets show the weights in the CPI (less fresh food and energy).
2. The output gap is based on staff estimations. The CPI figures exclude the effects of the consumption tax hikes, policies concerning the provision of free education, and the "Go To Travel" campaign, which covers a portion of domestic travel expenses. The figures from 2020/Q2 onward are based on staff estimations, and exclude the effects of measures such as free higher education introduced in April 2020.

[26] Earlier U.S. studies that compiled price indicators sensitive to business cycles include Mahedy and Shapiro (2017) and Stock and Watson (2020). CSI and non-CSI in this box are based on the compilation methods developed by Mahedy and Shapiro for procyclical inflation and acyclical inflation, respectively. For details on these studies, see Mahedy, T. and Shapiro, A., "What's Down with Inflation?" *FRBSF Economic Letter*, no. 2017-35 (2017); Stock, J. and Watson, M., "Slack and Cyclically Sensitive Inflation," *Journal of Money, Credit and Banking*, vol. 52, issue 52 (2020): 393-428.

[27] CPI items (less fresh food, energy, and house rent; seasonally adjusted quarter-on-quarter change) are regressed on 0 to 4 quarter lags of the output gap, and items for which any of the coefficients are positive and significant at the 5 percent level are classified as CSI while all other items and house rent are classified as non-CSI. The estimation period is from the April-June quarter of 2000 through the October-December quarter of 2019.

household electrical appliances and daily necessities), which comprise a large share in CSI items, there may have been a relatively low necessity for firms to stimulate demand by competitively cutting the prices of such goods at retail stores (Chart B4-4). Meanwhile, non-CSI for the CPI -- in which services have large weights -- has stayed at around 0 percent.

Chart B4-4: Breakdowns of CSI and Non-CSI



Sources: Ministry of Internal Affairs and Communications; Bank of Japan.
Notes: 1. CPI items (less fresh food, energy, and house rent; seasonally adjusted q/q change) are regressed on 0 to 4 quarter lags of the output gap, and items for which any of the coefficients are positive and significant at the 5 percent level are classified as CSI items. Non-CSI items are all other items and house rent. Figures in the bars show the weight of each component in CSI and non-CSI items. The estimation period is 2000/Q2-2019/Q4.
2. The output gap is based on staff estimations. The CPI figures exclude the effects of the consumption tax hikes and policies concerning the provision of free education.
3. Administered prices consist of "public services" and "water charges."

Such a difference in price sensitivity to economic activity between goods and services may have implications for examining risks to future price developments in the course of private consumption heading toward "normalization" as vaccinations progress. In terms of the outlook for private consumption, for the time being, goods consumption and services consumption as a trend are highly likely to be relatively strong and relatively weak, respectively, due to the continuing impact of COVID-19. From the second half of the projection period, however, it is highly likely that goods consumption will be under some downward pressure amid a recovery in private consumption -- mainly of services -- taking hold. Given this, the CPI is likely to remain firm for the time being. However, thereafter, there is a possibility that the rate of change in the overall CPI will not increase easily (i.e., the slope of the observed Phillips curve will remain flat) because of the slow pace of increase in services prices, which are sticky relative to the overall economic recovery, and of downward pressure on the rate of increase in goods prices. That said, there are high uncertainties regarding the likelihood of this happening and the degree of the slope of the observed Phillips curve, because the relative strengths between goods consumption and services consumption after the widespread

vaccinations depend on the extent to which the changed behaviors of private economic entities during the pandemic will take hold in the post-COVID-19 era.