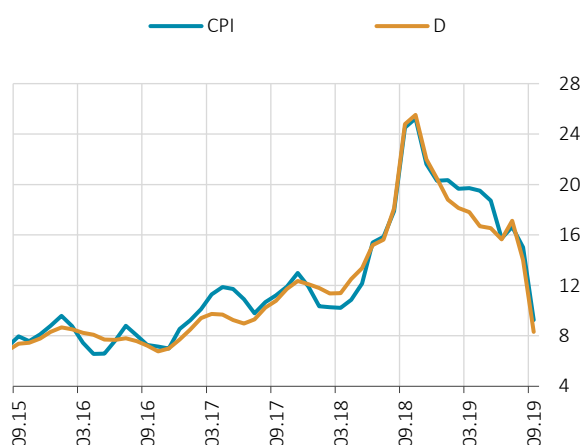


3. Inflation Developments

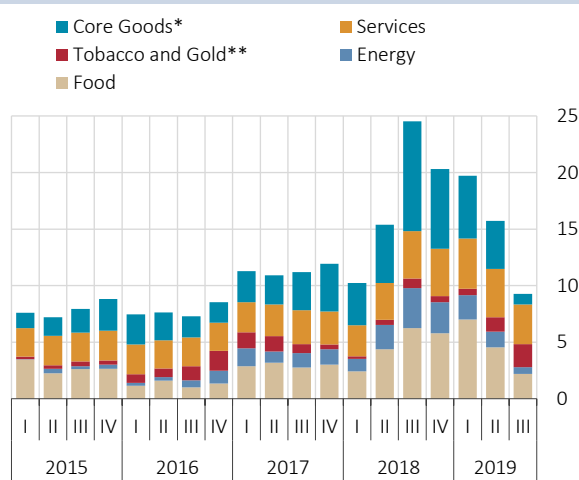
In the third quarter of 2019, consumer inflation dropped by 6.46 points to 9.26% and remained lower than forecasts stated in the July Inflation Report (Chart 3.1). While the fall in inflation was mainly driven by food and core goods, all main groups excluding tobacco products supported the decline (Chart 3.2). In this period, the significant deceleration in annual inflation in consumer prices and core indicators was mainly driven by last year's base effect, as well as the recent stable course of the Turkish lira, improvement in inflation expectations, and the outlook of domestic demand conditions. In the third quarter, international oil prices displayed a volatile course and slightly decreased compared to the end of the previous quarter. In this period, imported prices denominated in US dollars decreased too, and compared to the previous quarter, the contribution of import prices to consumer inflation was downwards. Nevertheless, pressures on inflation stemming from real unit labor costs slightly increased. Overall, producer prices-driven cost pressures on consumer prices decreased significantly.

Chart 3.1: CPI and D Index* (Annual % Change)



Source: TURKSTAT.
* CPI excluding unprocessed food, alcoholic beverages and tobacco products.

Chart 3.2: Contributions to Annual CPI (% Points)



Source: CBRT, TURKSTAT.
* Core Goods: Goods excluding food, energy, alcoholic beverages tobacco and gold.
** Tobacco and Gold: Alcoholic beverages, tobacco products and gold.

Annual inflation in the food group, which is one of the key factors driving consumer inflation down, decreased to 9.52%. This decline was mainly caused by last year's strong base effect as well as increased supply of agricultural products, especially fresh fruits and vegetables, thanks to favorable weather conditions and by the moderate outlook of price increments in processed food. As the temporary tax cuts in durable goods ended, annual inflation in core goods group increased temporarily in July, but resumed a decline in the following months owing to the high base effect, the outlook of exchange rates and the mild course of economic activity. Although energy prices increased in the third quarter mostly due to adjustments in electricity and natural gas prices, the annual group inflation decreased owing to the base effect. In this quarter, the developments in transport services prices came to the fore in the services inflation outlook. Despite the uptrend due to lagged price increases and backward inflation indexation, services inflation decreased in this quarter mostly owing to food prices and the mild course of domestic demand. However, the rapid rise in tobacco products prices curbed further decline in consumer inflation. In sum, the indicators of the underlying inflation trend and the short-term outlook significantly improved in the third quarter. The high base effect from the previous year, as well as the stable course of the Turkish lira, the favorable outlook in food prices, mild domestic demand conditions and improvement in inflation expectations all played an important part in the fall in inflation indicators. Import prices in US dollars also supported the disinflation process; nevertheless, the price increase in tobacco products

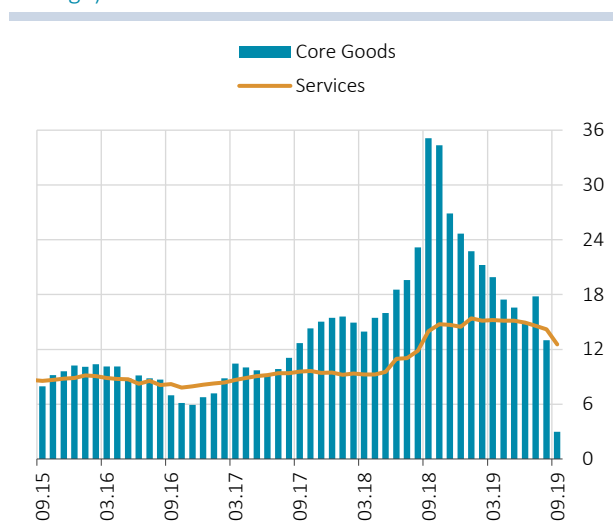
curbed a more favorable outlook in consumer inflation. Consumer inflation is expected to maintain a mild course in October and increase slightly in the last two months of the year due to the adverse base effect. The course of the Turkish lira is the primary risk factor that may affect the short-term inflation outlook. The indirect effects of administered price adjustments such as electricity and natural gas on consumer inflation are closely monitored. Despite the restrictive impact of domestic demand conditions on inflation, the elevated levels of inflation expectations continue to pose an upside risk to medium-term inflation outlook.

3.1 Core Inflation Outlook

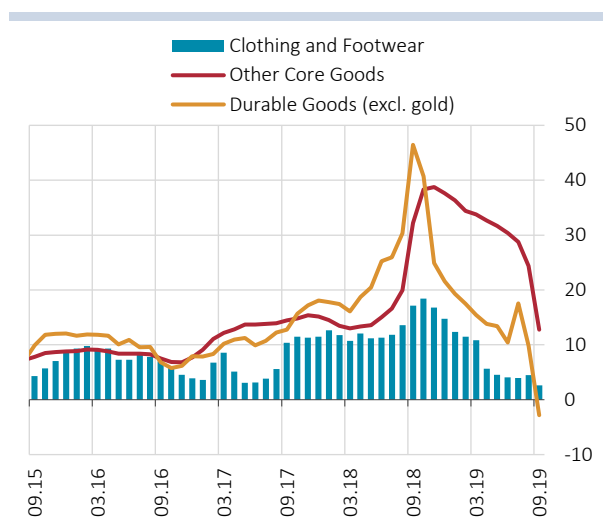
Annual core goods inflation was down by 11.81 points to 2.98% in the third quarter of the year (Chart 3.1.1). The decline in annual inflation was mainly driven by the high base effect from last year's depreciation in the Turkish lira, and recently, this outlook has been supported by the stable Turkish lira and the mild domestic demand conditions. In this quarter, annual inflation was down across all subcategories, particularly in durable goods and other core goods groups (Chart 3.1.2).

Chart 3.1.1: Prices of Core Goods and Services (Annual % Change)

Chart 3.1.2: Prices of Core Goods (Annual % Change)



Source: TURKSTAT.



Source: TURKSTAT.

In the third quarter, durable goods prices increased by 6.33% with the impact of the expiry of temporary tax cuts in the automobile, white goods and furniture groups in June.¹ Nevertheless, in this quarter, annual inflation in durable goods receded by 13.26 points to -2.82% on the back of last year's high base effect. In the third quarter, prices of furniture, white goods and automobiles, increased by 11.73%, 8.12% and 6.28%, respectively (Table 3.1.1). The price increases observed after tax changes in white goods and furniture were higher than implied by the tax changes, although they were lower in the automobile group. The discrepancy between groups can be partly explained by demand indicators. Accordingly, while domestic sales of automobiles in the first nine months of 2019 decreased by 36.92% compared to the same period last year, the fall in white goods manufacturing stood at 1.96%. This points to domestic demand-led downside pressures on durable goods group inflation, with the automobile group in the lead (Chart 3.1.3). An analysis of other sub-categories in the core goods group reveals that the ratio of seasonal discounting on the clothing group in the third quarter was higher than in previous year, while the quarterly price increase in other core goods, which was 1.44%, was relatively moderate. The impact of economic activity on inflation may vary across sub-categories. A detailed evaluation on this issue is presented in Box 3.1.

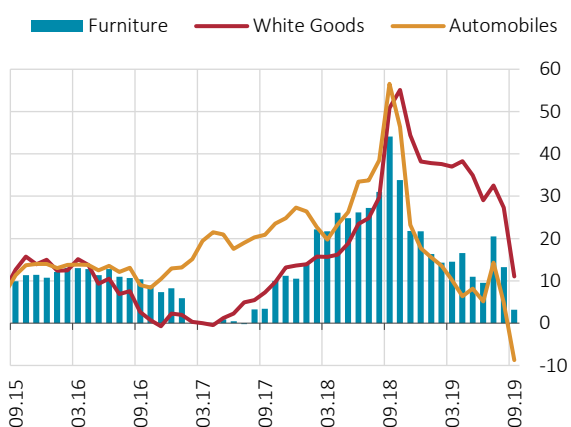
¹ Temporary tax cuts were implemented in the period between 1 November 2018 and 31 June 2019. In this period, the VAT on furniture groups was lowered from 18% to 8%; the SCT on white goods was decreased from 6.7% to 0% and SCT on automobile group was lowered by 15 points.

Table 3.1.1: Prices of Goods and Services (3-Month and Annual % Change)

	2018			2019			
	III	IV	Annual	I	II	III	Annual
CPI	9.34	0.78	20.30	2.27	2.69	3.24	9.26
1. Goods	10.72	0.55	22.68	1.87	2.29	3.07	7.99
Energy	12.34	-0.25	20.82	-1.62	0.20	6.64	4.86
Food and Non-Alcoholic Beverages	6.17	3.56	25.11	10.01	-1.45	-2.46	9.52
Unprocessed Food	2.68	3.10	27.09	18.98	-8.46	-8.24	3.04
Processed Food	9.91	4.02	23.22	1.56	6.28	3.03	15.69
Core Goods	14.64	-0.81	24.67	-2.96	4.02	2.84	2.98
Clothing and Footwear	-0.95	10.85	14.75	-12.26	8.06	-2.37	2.60
Durable Goods (excl. gold prices)	20.84	-10.69	21.57	-1.15	3.53	6.33	-2.82
Furniture	18.65	-9.39	21.71	1.00	0.89	11.73	3.16
Electrical and Non-Electrical Devices	20.52	-1.00	26.87	-0.98	0.84	3.26	2.08
Automobiles	22.41	-17.09	17.72	-2.25	5.95	6.28	-8.73
Other Durable Goods	14.45	4.44	31.44	1.39	2.59	4.50	13.52
Core Goods excl. Clothing and Durable Goods	17.30	7.36	37.63	1.42	2.09	1.44	12.76
Alcoholic Beverages, Tobacco Products and Gold	6.76	-2.67	8.65	1.96	14.86	18.77	35.39
2. Services	5.85	1.39	14.46	3.29	3.67	3.66	12.54
Rent	3.14	1.96	9.61	2.46	2.28	3.09	10.15
Restaurants and Hotels	9.15	2.26	19.81	2.64	5.49	3.76	14.87
Transport	7.52	-1.73	11.70	0.28	4.91	9.00	12.67
Communication	1.45	2.57	9.96	1.54	0.77	0.63	5.61
Other Services	5.55	1.27	15.56	5.86	3.32	2.91	13.99

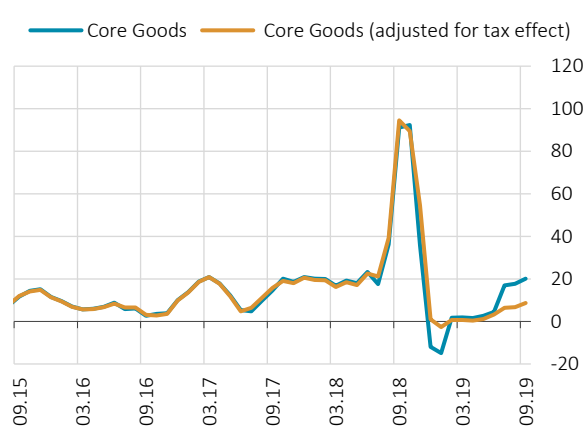
Source: TURKSTAT.

Chart 3.1.3: Selected Durable Goods Prices (Annual % Change)



Source: CBRT, TURKSTAT.

Chart 3.1.4: Prices of Core Goods (Seasonally-Adjusted, Annualized 3-Month Average % Change)

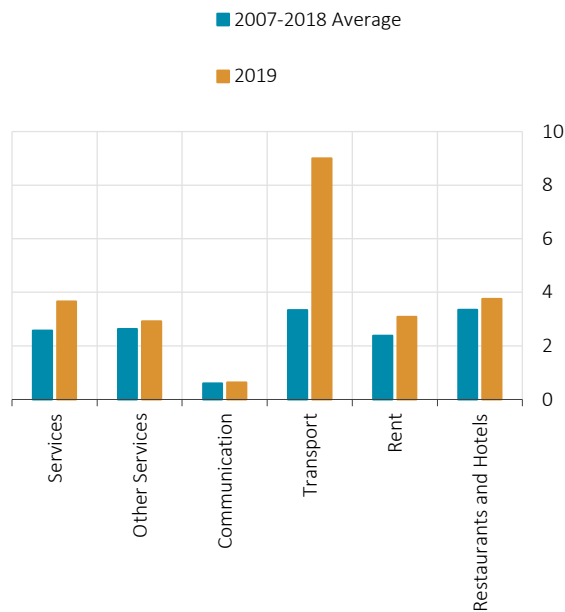


Source: CBRT, TURKSTAT.

In this period, the underlying trend of core goods inflation displayed a rise mostly due to the expiry of tax cuts, but the trend is moderate when it is adjusted for this effect (Chart 3.1.4).

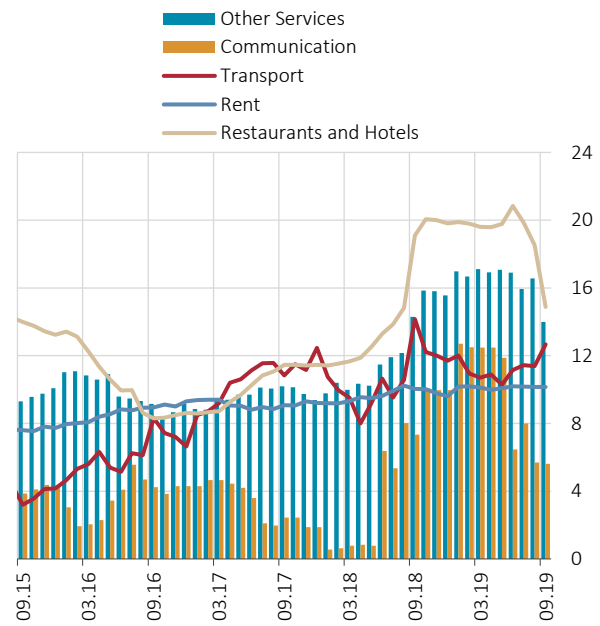
Prices of services picked up by 3.66% in the third quarter, while the group's annual inflation decreased by 2.38 points to 12.54% (Chart 3.1.1 and Table 3.1.1). However, quarterly rates of price increases in services prices stood above historical averages across subgroups, more manifest in the transportation group (Chart 3.1.5).

Chart 3.1.5: Prices of Services by Subcategories (Q3 % Change)



Source: TURKSTAT.

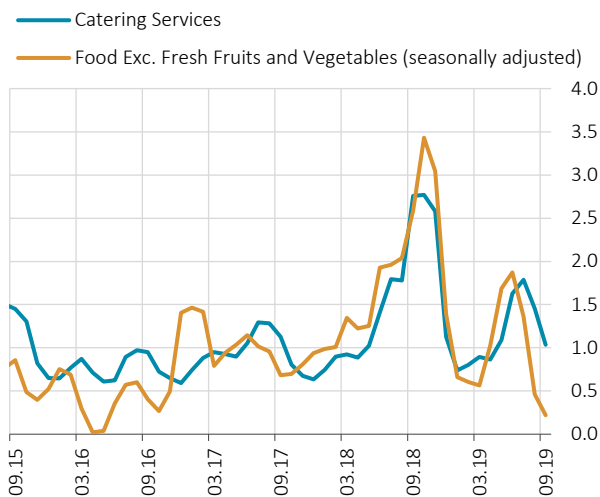
Chart 3.1.6: Prices of Services by Subcategories (YoY % Change)



Source: TURKSTAT.

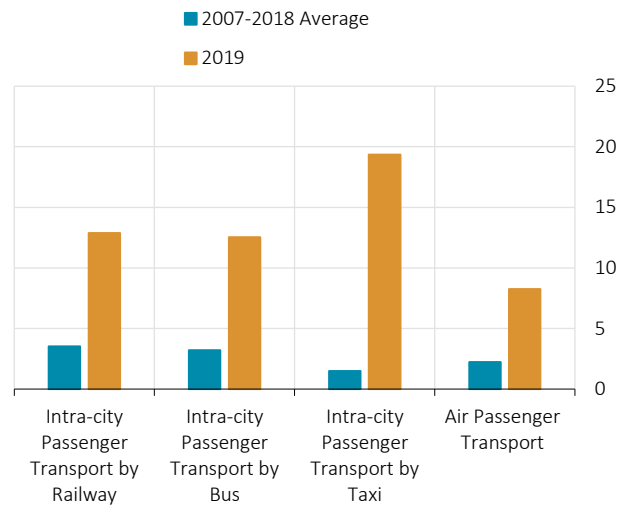
Among subcategories of services, annual inflation in transport services increased, while it decreased in restaurants-hotels, other services and communication services and remained flat in rents (Chart 3.1.6). In this quarter, annual inflation in the restaurants- hotels group decreased both in catering and accommodation services, while the catering services-led decline was affected by the fall in food inflation (Chart 3.1.7). The quarterly rise in transport services prices was driven by the rises in urban transport fares (municipality bus, taxi, train, school bus etc.) and airline transport prices (Chart 3.1.8). Accordingly, it has been observed that the response of urban passenger transport fares to the rise in consumer inflation over the last year has been lagged. In this quarter, the rise in other services groups' prices was led by education services. To sum up, in the third quarter, the outlook of services prices was mostly determined by transport services-led developments and annual services inflation remained high despite some decline.

Chart 3.1.7: Catering Services and Food Prices (3-Month Average of Monthly % Changes)



Source: CBRT, TURKSTAT.

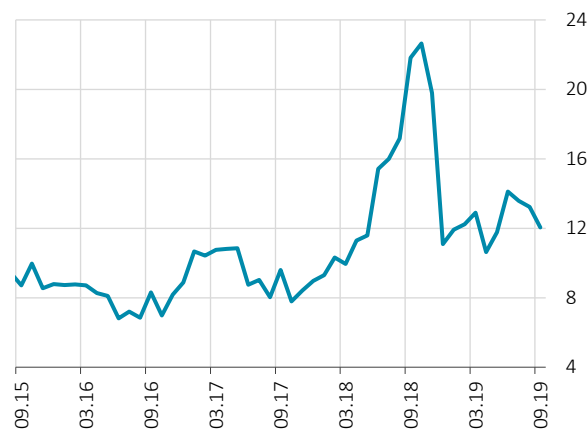
Chart 3.1.8: Prices of Selected Transport Services Sub-categories (Q3 % Change)



Source: CBRT, TURKSTAT.

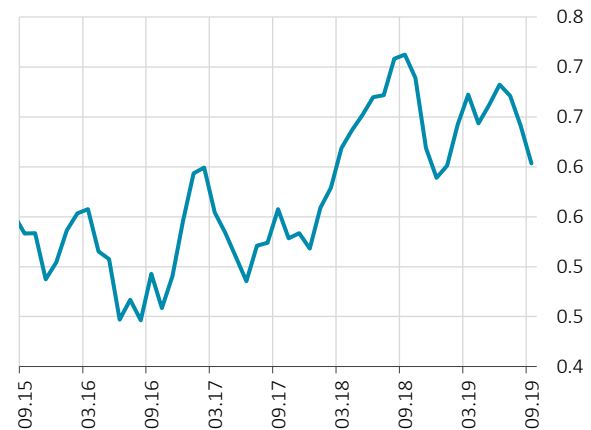
In light of these developments, the underlying trend of services inflation and the diffusion index, which signifies price increasing tendency, decreased quarter-on-quarter (Chart 3.1.9 and Chart 3.1.10). Even if these indicators imply a certain degree of improvement in pricing behavior compared to the previous quarter, they are still high compared to historical averages.

Chart 3.1.9: Services Prices (Seasonally-Adjusted, Annualized 3-Month Average % Change)



Source: CBRT, TURKSTAT.

Chart 3.1.10: Diffusion Index for Services Prices* (Seasonally-Adjusted, 3-Month Average)



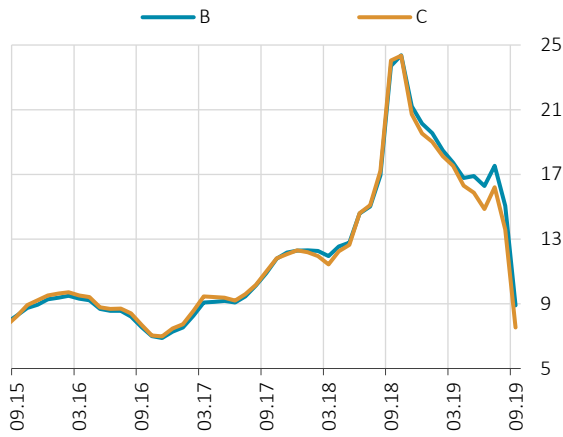
Source: CBRT, TURKSTAT.

* The diffusion index is calculated as the ratio of the number of items with increasing prices minus the number of items with decreasing prices to total number of items.

The outlook for the underlying trend of inflation serves as an important pillar while making monetary policy decisions. The underlying trend of inflation that is adjusted for temporary effects and short-term volatilities denotes the level that inflation will assume in the medium term. In this framework, for example adjusting the volatility in fresh fruits-vegetables prices, temporary price movements stemming from tax cuts or changes in tobacco prices which are beyond the control of monetary policy contributes to a better understanding of inflation. Nevertheless, there is a consensus in literature that there is no single indicator that is viable in all circumstances. Therefore, while evaluating the underlying trend of inflation, several indicators are simultaneously taken into account such as: the trends of core indicators calculated by exclusion method and adjusted for temporary effects and seasonal factors (B and C indices,

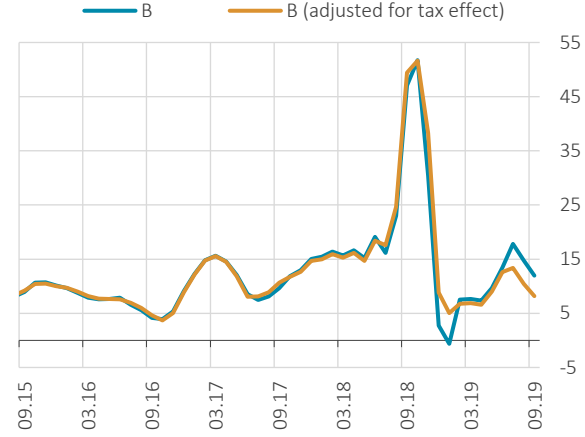
etc); core indicators calculated by alternative statistical methods (SATRIM, median inflation etc.); diffusion indices indicating the tendency to increase prices; other micro data and survey indicators pertaining to inflation expectations and pricing behavior, and trends implied by short-term forecasts.

Chart 3.1.11. Indices B and C (Annual % Change)



Source: TURKSTAT.

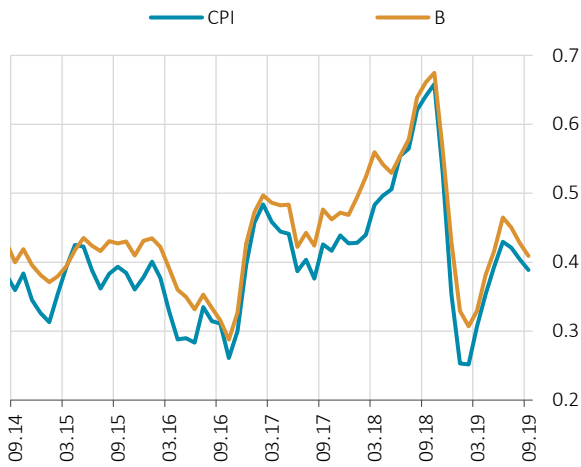
Chart 3.1.12. B and Tax-adjusted B Index (Seasonally Adjusted, Annualized 3-Month Average % Change)



Source: CBRT, TURKSTAT.

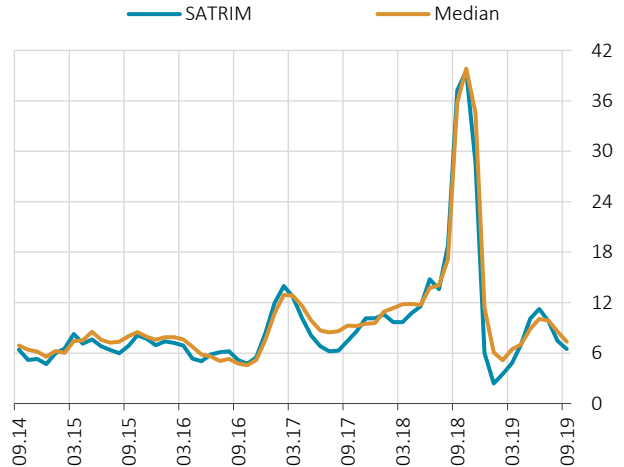
The annual inflation in the core inflation indicators significantly decelerated in this quarter. Even if the rise in annual inflation in B and C indices slightly increased in July due to the expiry of temporary tax cuts, the rise in each index decreased by 7 points quarter-on-quarter to 8.90% and 7.54%, respectively, on the back of the waning cumulative effects of exchange rate on core goods inflation (Chart 3.1.11). When underlying trend of inflation is adjusted for seasonal factors and temporary tax cuts to allow a healthier evaluation, it is observed that the underlying trend of B index has decelerated compared to July (Chart 3.1.12). This can be attributed to exchange rate developments, the improvement in inflation expectations and the effects of domestic demand developments. In this quarter, as captured by diffusion indices, the tendency to increase prices partly decreased (Chart 3.1.13). A similar trend was observed in the alternative core inflation indicators such as the SATRIM and Median monitored by the CBRT (Chart 3.1.14). In sum, indicators pertaining to tendency and pricing behavior suggested an improvement in the underlying trend of inflation in the third quarter.

Chart 3.1.13. CPI and B Diffusion Indices (Seasonally Adjusted 3-Month Average)



Source: CBRT, TURKSTAT.

Chart 3.1.14. Core Inflation Indicators SATRIM* and Median (Annualized 3-Month Average, %)**



Source: CBRT, TURKSTAT.

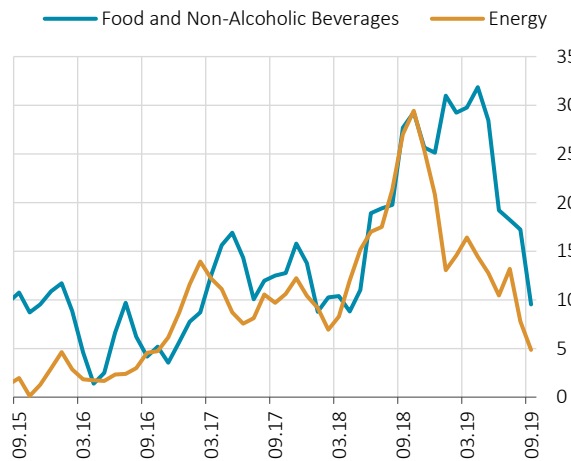
*SATRIM: Seasonally adjusted, trimmed mean inflation.

**Median: Median monthly inflation of seasonally adjusted 5-digit sub-price indices.

3.2 Food, Energy and Alcohol-Tobacco Prices

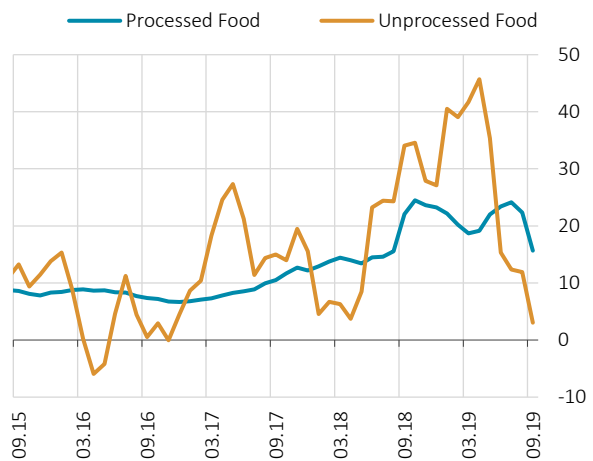
In the third quarter, annual inflation in food and non-alcoholic beverages decreased by 9.68 points to 9.52% (Chart 3.2.1). This decrease was driven by both unprocessed and processed food groups (Chart 3.2.2). The slowdown in food inflation can be attributed to last year's high base effect, and favorable weather conditions spurring agricultural production, particularly of fresh fruits-vegetables. Thus, annual food inflation remained lower than projected in the July Inflation Report. Annual inflation in fresh fruits and vegetables was down to -5.29% and in food excluding fresh fruits and vegetables, it was down to 12.74% (Chart 3.2.3).

Chart 3.2.1: Food and Energy Prices (Annual % Change)



Source: TURKSTAT.

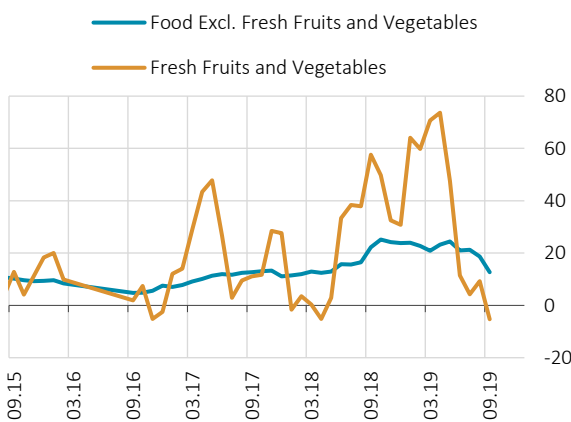
Chart 3.2.2: Food Prices (Annual % Change)



Source: TURKSTAT.

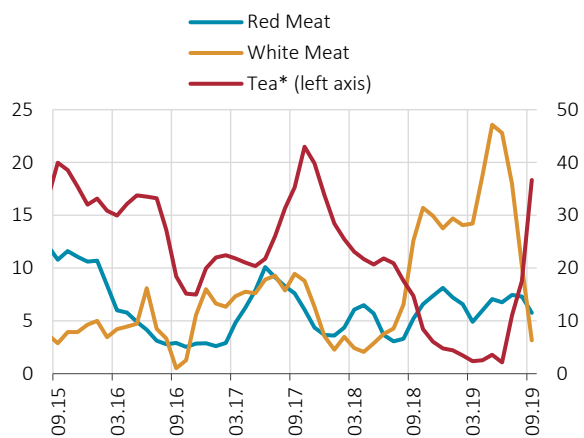
Seasonally adjusted unprocessed food prices decreased by 4.3% in the third quarter. Thus, annual unprocessed food inflation decreased by 12.27 points quarter-on-quarter to 3.04% (Chart 3.2.2). In this quarter, particularly the fresh fruits and vegetables inflation displayed a downtrend owing to domestic supply conditions (Chart 3.2.3). In the third quarter, the contribution of other unprocessed food prices was also to the downside. While prices of white meat significantly decreased in this quarter, those of red meat remained flat (Chart 3.2.4). Meanwhile, as the National Dairy Council raised raw milk purchasing prices from TL 2 to TL 2.30 per liter to be effective as of 15 November 2019, prices of milk and milk products are expected to rise in the upcoming months.

Chart 3.2.3: Prices of Fresh Fruits and Vegetables and Other Food (Annual % Change)



Source: CBRT, TURKSTAT.

Chart 3.2.4: Selected Food Items (Annual % Change)

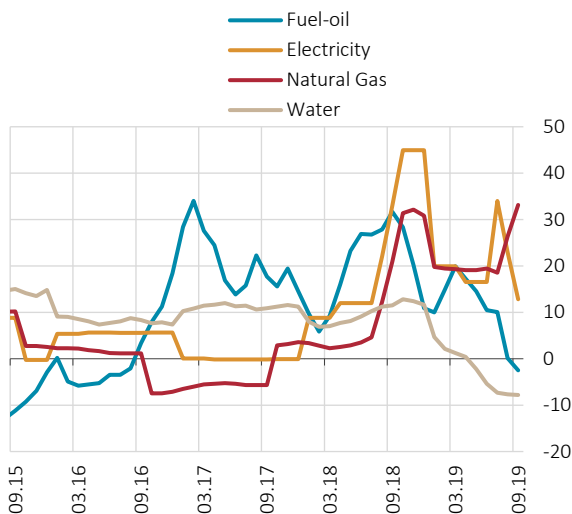


Source: CBRT, TURKSTAT.
* Tea and other brewed drinks.

Annual processed food inflation, which had increased in the second quarter, decreased by 7.72 points to 15.69% in the third quarter (Chart 3.2.2). Processed food prices, which have displayed significant monthly rises since May due to accumulated cost effects, increased moderately in August and September. In this quarter, the uptrend in bread-cereals decelerated as well. The outlook for other processed food sub-categories except for tea has been favorable. In the third quarter, tea prices increased by 21.69% due to accumulated cost effects as well as the impact of the 25% increment in fresh tea purchasing prices in May (Chart 3.2.4).

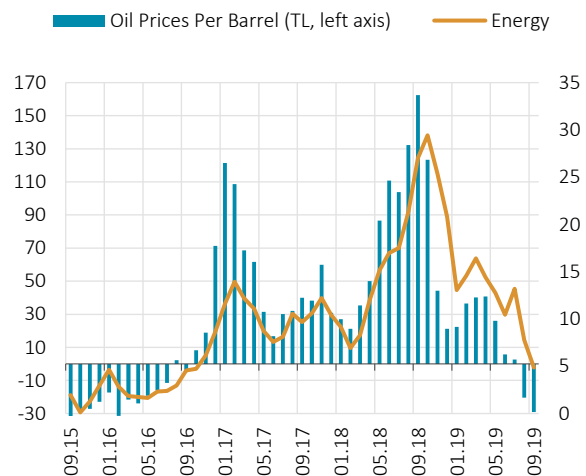
Energy prices increased by 6.64% in the third quarter of the year (Table 3.1.1). The increase was driven by the price adjustments in administered prices. While electricity prices increased by 15% in July, natural gas prices were up by a total 29.96% in two episodes in August and September (Chart 3.2.5). The price of Brent crude oil per barrel has been volatile: from USD 63 at the end of the previous quarter, it decreased to USD 59 in August and rebounded to USD 62 in September. In addition to these developments in oil prices, fuel prices decreased by 1.90% on the back of the exchange rate outlook in the third quarter. In September, thanks to the reintroduction of the sliding-scale tariff system, the rise in fuel prices remained limited. As a result, annual energy inflation went down by 5.60 points to 4.86% on the back of the base effect and the outlook of oil prices in Turkish lira (Chart 3.2.6). However, it is projected that energy inflation will increase in October due to the price adjustments in electricity prices.

Chart 3.2.5: Domestic Energy Prices (Annual % Change)



Source: TURKSTAT.

Chart 3.2.6: Energy Prices (Annual % Change)



Source: CBRT, TURKSTAT.

Prices of alcoholic beverages and tobacco products were up 22.16% in the third quarter. Prices of cigarettes, which increased by 17.88% in the last quarter, increased by 23.29% in this period. Meanwhile, prices of alcoholic beverages increased as well due to the implementation stipulating increasing the lump-sum SCT on alcoholic beverages by indexing them to the six-month change in D-PPI. As a result, annual inflation in alcoholic beverages and tobacco products increased by 24.62 points to 43.86% and curbed further improvement in consumer inflation.

3.3 Domestic Producer Prices

Domestic producer prices (D-PPI) decreased by 1.45% in the third quarter. In this quarter, the mild course of Turkish lira and the decline in oil and metal prices in international commodity markets had positive repercussions on producer prices in Turkey. Annual producer prices inflation decreased by 22.59 points to 2.45% due to base effects (Table 3.3.1 and Chart 3.3.1).

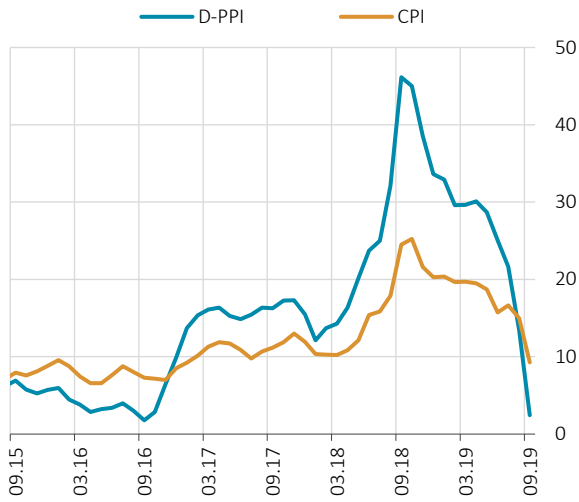
Table 3.3.1: D-PPI and Sub-Categories (3-month and Annual % Change)

	2018			2019			
	III	IV	Annual	I	II	III	Annual
D-PPI	20.29	-3.83	33.64	2.14	5.83	-1.45	2.45
Mining	12.62	-3.14	24.34	5.72	5.92	-0.59	7.83
Manufacturing	19.15	-4.44	31.11	2.68	5.34	-1.89	1.41
Manufacturing excl. Petroleum Products	18.50	-3.48	30.95	2.42	5.51	-1.82	2.41
Manufacturing excl. Petroleum and Base Metal Products	17.41	-2.16	30.81	2.61	5.49	-1.25	4.58
Production and Distribution of Electricity and Gas	39.90	1.75	75.02	-5.24	14.30	3.88	14.50
Water Supply	3.65	2.02	9.13	-7.65	-1.74	0.91	-6.59
D-PPI by Main Industrial Groupings							
Intermediate Goods	22.02	-5.37	34.14	2.04	4.87	-2.28	-1.04
Durable Consumption Goods	14.90	-1.61	24.92	1.39	2.97	1.94	4.71
Durable Consumption Goods (excl. jewelry)	13.91	-1.08	24.31	1.19	2.72	1.71	4.58
Non-Durable Consumption Goods	12.56	-0.69	25.49	3.26	7.79	-1.85	8.49
Capital Goods	19.63	-3.11	32.92	3.76	3.67	-0.64	3.55
Energy	34.48	-6.06	57.13	-1.23	8.54	0.82	1.54

Source: CBRT, TURKSTAT.

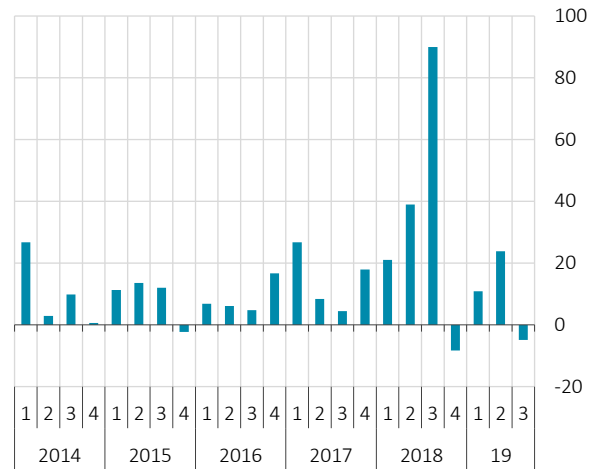
By main industrial groupings, prices of durable goods and energy increased while prices of intermediate goods and non-durable goods decreased in this period (Table 3.3.1). While the rise in durable goods was mainly driven by the increase in furniture prices, the price increases in the energy group were driven by gas manufacturing and distribution. In this quarter, the fall in the prices of intermediate goods was led by iron-steel products, while the decline in non-durable goods was driven by meat and meat products. The decrease in the prices of capital goods was led by other special purpose machinery and metal construction products. Meanwhile, the underlying trend of manufacturing prices excluding petroleum and base metal, which contains information on the underlying trend of producer prices, posted a significant decline compared to the previous quarter. Against this background, producer prices-driven cost pressures on consumer prices decreased significantly as well (Chart 3.3.2).

Chart 3.3.1: Domestic Producer and Consumer Prices (Annual % Change)



Source: TURKSTAT.

Chart 3.3.2: Manufacturing Prices excl. Petroleum and Base Metals (Seasonally-Adjusted, Annualized QoQ % Change)

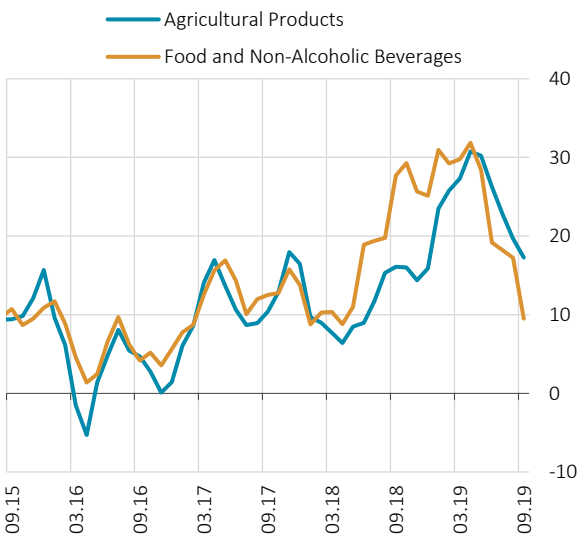


Source: CBRT, TURKSTAT.

3.4 Agricultural Producer Prices

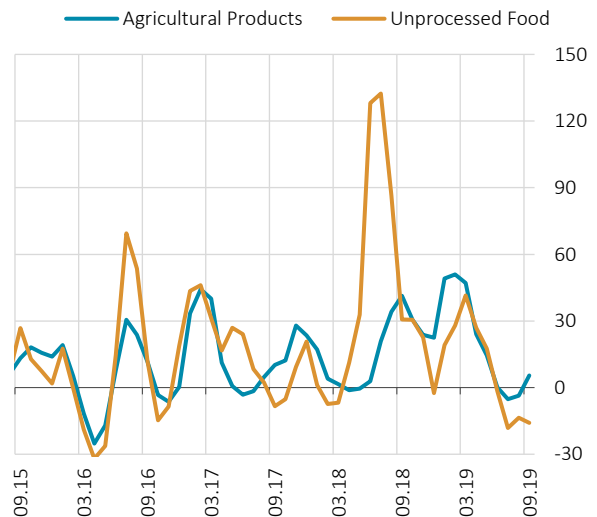
Annual inflation in agricultural producer prices receded by 9 points from the previous quarter to 17.27% in the third quarter (Chart 3.4.1). In this period, annual inflation decreased in fruits and vegetables, livestock and animal products while it increased in cereals and legumes. An analysis of seasonally-adjusted three-month averages reveals that the underlying trend of agricultural product prices remained mild and with the support of this development the underlying trend of unprocessed food prices decelerated in the third quarter (Chart 3.4.2).

Chart 3.4.1: Prices of Agricultural Products and Food (Annual % Change)



Source: TURKSTAT.

Chart 3.4.2: Prices of Agricultural Products and Unprocessed Food (Seasonally-Adjusted, Annualized 3-Month Average % Change)

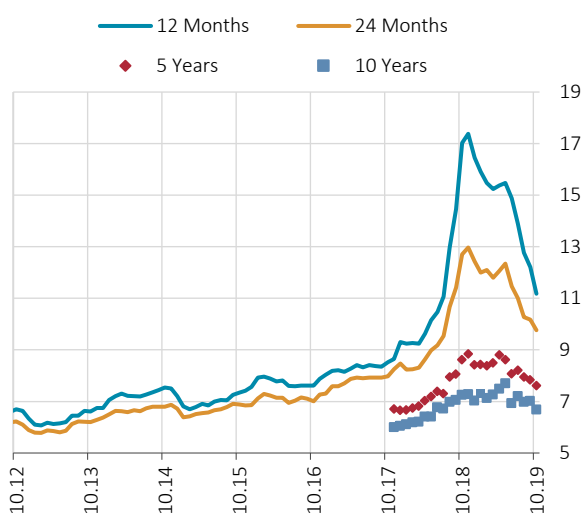


Source: CBRT, TURKSTAT.

3.5 Expectations

Thanks to the improvement in inflation outlook, the downtrend in inflation expectations continued in the third quarter. In October, the year-end inflation expectation decreased to 12.69%, getting closer to the CBRT forecast. The 12-months ahead inflation expectation decreased by 2.72 points to 11.18%, a significant fall compared to previous report period. Another remarkable development is that the 24-months ahead inflation expectation decreased to single digits at 9.76% (Chart 3.5.1). Even if the 5-year and 10-year-ahead inflation expectations decreased in this quarter, they are still hovering above the medium-term inflation target. Inflation expectations across all terms have been revised downwards compared to the previous quarter, with short-term expectations in the lead (Chart 3.5.2).

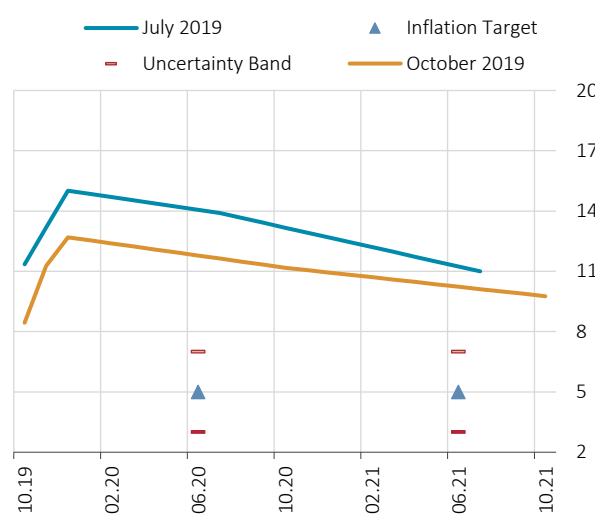
Chart 3.5.1: CPI Inflation Expectations* (%)



Source: CBRT.

* Second survey period results for the pre-2013 period derived from the CBRT Survey of Expectations that polls corporate sector and financial sector representatives as well as professionals.

Chart 3.5.2: Medium-Term Inflation Expectations Curve* (%)

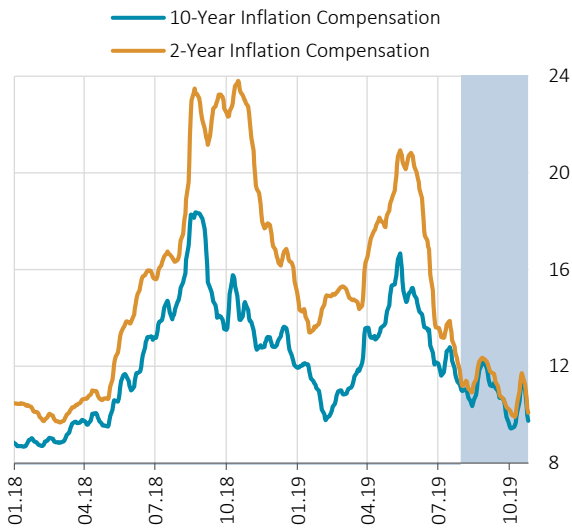


Source: CBRT.

* Calculated by linear interpolation of expectations for different time spans using the CBRT Survey of Expectations that polls corporate sector and financial sector representatives as well as professionals.

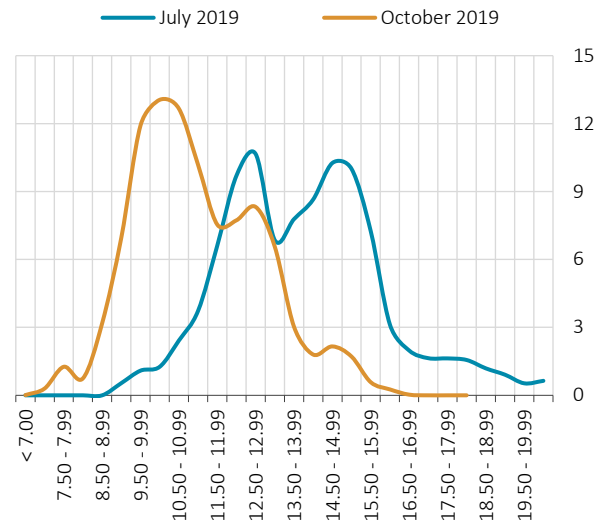
Recently, the inflation compensation calculated by using bond prices has decreased as well (Chart 3.5.3). Probability distributions of inflation expectations suggest that the peak values of distributions are lower than the previous quarter. Moreover, compared to July, expectations display an outlook closer to normal distribution, suggesting that the decline in medium-term inflation uncertainty continues (Chart 3.5.4).

Chart 3.5.3: Inflation Compensation (5-Day Moving Average, %)



Source: CBRT.

Chart 3.5.4: Probability Distribution of 12-Month-Ahead Inflation Expectations* (%)



Source: CBRT.

* Horizontal axis denotes the expected inflation rate, while the vertical axis denotes the respective probability. For further details, see Statistics/Tendency Surveys/Survey of Expectations/Metadata at the CBRT's website.

Box 3.1

An Evaluation of the Impact of Output Gap on Inflation

The relationship between aggregate demand conditions and inflation is often studied by using Phillips curve models in the literature. In such equations, the outlook for demand conditions is measured by the output gap and the magnitude of the effects of the output gap on inflation is estimated. Although the general consumer price index is used in these calculations, the effect of demand conditions on inflation may vary across the sub-groups of consumer prices. For instance, Atuk et al. (2014) showed that a significant portion of inflation does not react significantly to the output gap. Similarly, Özmen and Sarıkaya (2014) found that prices of services are more commonly affected by the output gap than core goods.

In addition, there are many studies in the literature on whether the Phillips curve is linear or whether the effect of the output gap on inflation is asymmetric. For example, it can be argued that during periods of stagnation, when the output gap is too deep, the decline in inflation may be more limited than implied by linear models, or that there is no significant impact on inflation unless the output gap decreases to sufficiently negative levels. In this box, considering its role in the decline of inflation, the output gap-inflation relationship in Turkey is analyzed both to include non-linear effects and in terms of core goods and services separately.

As a benchmark, reduced-form Phillips curve models in Koca and Yılmaz (2018) are constructed for core goods and services equations. The Phillips curve models are extended by the addition of the square of the output gap, which will test the presence of nonlinear effects. Models are estimated for the period between 2006Q4-2019Q3. Estimated equations for core goods and services are given below:

$$\pi_t^{CG} = \alpha_{0,t} + \sum_{i=1}^3 \alpha_{i,t} \Delta e_{t-i+1}^{USD/TRY} + \alpha_{4,t} \Delta p_t^m + \alpha_{5,t} \tilde{y}_t + \alpha_{6,t} (\tilde{y}_t)^2 + \tau_t + \varepsilon_t \quad (1)$$

$$\pi_t^S = \beta_{0,t} + \beta_{1,t} \Delta food_{t-1} + \beta_{2,t} \Delta e_t^{BASKET/TRY} + \beta_{3,t} \Delta w_{t-1} + \beta_{4,t} \pi_{t-1} + \beta_{5,t} \tilde{y}_t + \beta_{6,t} (\tilde{y}_t)^2 + \varepsilon_t \quad (2)$$

where π_t^{CG} is seasonally adjusted core goods inflation and π_t^S is seasonally adjusted services inflation excluding communication services; π_t is seasonally adjusted headline inflation; $e_t^{BASKET/TRY}$ and $e_t^{USD/TRY}$ are the quarterly average of Basket/TRY (USD/TRY and EUR/TRY average) and USD/TRY exchange rate, respectively; \tilde{y}_t is the two-quarter moving average of the output gap; $\Delta food_t$ is seasonally adjusted food inflation excluding fresh fruits and vegetables; w_t is the four-quarter moving average of real unit labor cost; p_t^m is the quarterly average of import prices, and finally, τ_t is the contribution of tax adjustments to core goods inflation. Δ stands for the logarithmic difference.

The output gap contribution to inflation is calculated by using output gap coefficients from model estimations and the level of the output gap, and thus information on the relationship between economic activity and inflation is obtained.¹ The nature of the relationship and the factors that determine this relationship will contribute to a better understanding of the support that aggregate demand conditions can provide to the disinflationary process. In this context, Table 1 presents the coefficients and significance levels of the output gap variable.

¹ Findings that the relationship between inflation and the output gap is not linear were also confirmed by the results obtained by the Markov Switching method.

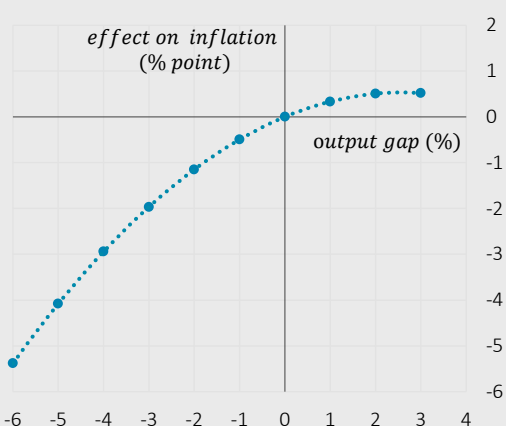
Table 1: Estimation Results

Dependent Variable:	<i>Core Goods</i>	<i>Services</i>
\tilde{y}_t	0.104*	0.108**
\tilde{y}_t^2	-0.020**	0.005*

* and ** represent statistical significance at the 10% and 5% level, respectively.

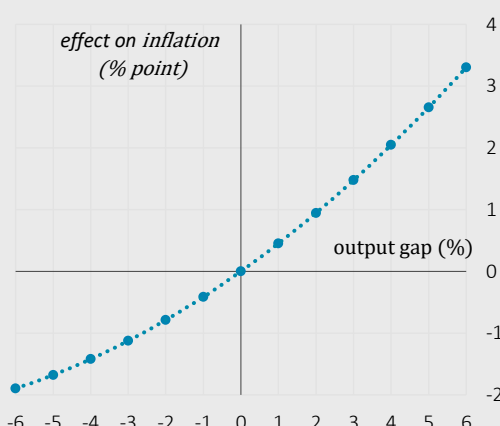
Chart 1 and 2 show the contribution of the output gap to annual inflation with the coefficients obtained from core goods and services equations and the change of this contribution across different levels of the output gap.

Chart 1: Effect of the Output Gap on Core Goods Inflation



Source: Authors' calculations.
 Note: The horizontal axis shows the level of the output gap and the vertical axis shows the effect of the output gap on inflation.

Chart 2: Effect of the Output Gap on Services Inflation*



Source: Authors' calculations
 (*) Services inflation excluding communication services.
 Note: The horizontal axis shows the level of the output gap and the vertical axis shows the effect of the output gap on inflation.

The estimation results suggest that the unit contribution of the output gap to core goods inflation is much stronger in times of weak demand conditions (Chart 1). In times of negative output gap, inflation becomes more sensitive to the output gap and the disinflationary effect from the core goods channel becomes more significant. It is concluded that the output gap has a smaller effect on core goods inflation in terms of unit contribution in periods of strong economic activity compared to periods of weak demand.

Calculations for the services group excluding communication are different from the results obtained for the core goods group (Chart 2). The effect of a one unit increase in the output gap on inflation rises with the increase in the level of the output gap. This indicates that a demand-driven inflationary pressure is felt more strongly in the services group during the positive and high output gap. The effect on disinflation is lower in magnitude in times of negative output gap, compared to that of a positive output gap at the same level.

Possible causes of this divergence between the responses to the output gap in core goods and services may first include the differences in competition across services and core goods sectors. Since the core goods sector is more competitive, in periods when demand is high, companies may not go for strong price increases in order not to lose their market shares. Otherwise, consumers may demand lower-priced substitutes for products in a highly diversified sector. In times of negative output gap, besides competitive conditions, the cost of keeping physical stock can be considered as a factor that accelerates the decline in

prices. In the services sector, in times of strong demand conditions, capacity constraints may be more determinant in a non-competitive market structure. Therefore, the inflationary effect of the output gap can be expected to be stronger in the services group in periods when supply growth lags behind demand growth. Moreover, the high rigidity in the services group stemming from the backward indexation behavior and wage inflation stickiness may limit the lowering effect of a weakening in economic activity.

As a result, our findings suggest that the relationship between core goods and services inflation and economic activity may not be linear. Services inflation is more sensitive to the output gap in periods of strong economic activity compared to periods of weak activity. On the other hand, the effect of the output gap on core goods inflation is greater in periods of weak economic activity compared to periods in which economic activity is high. This analysis indicates that contribution of the output gap, which has been on negative territory in 2019, to the downward trend in core goods and services inflation has been about 2.5 and 1.3 percentage points respectively. Considering the contribution of disinflationary effect resulting from the output gap in core goods and services inflation to the fall in annual inflation of index C, which is composed of these two groups, it is inferred that approximately two-thirds of the contribution has stemmed from core goods, and the remaining one-third has arisen from the services group. In this respect, analyzing the inflation-demand relationship by sub-groups and by considering non-linear effects as well, contributes to a more accurate assessment of the impact of the output gap on inflation.

References

- Atuk, O., Aysoy, C., Özmen, M. U., Sarıkaya, Ç. (2014). Sensitivity of Inflation to Business Cycles in Turkey: Determining CPI Sub-items Sensitive to Output Gap. CBRT Working Papers No: 14/37.
- Koca, Y.K. and Yılmaz, T. (2018). A Closer Look at Core Inflation Dynamics with a Historical Perspective. CBRT Research Notes, No: 18/07.
- Özmen, M.U. and Sarıkaya, Ç. (2014). Sensitivity of Inflation to Output Gap and Credit. CBRT Research Notes. No: 14/17.

