

## Box 2.5

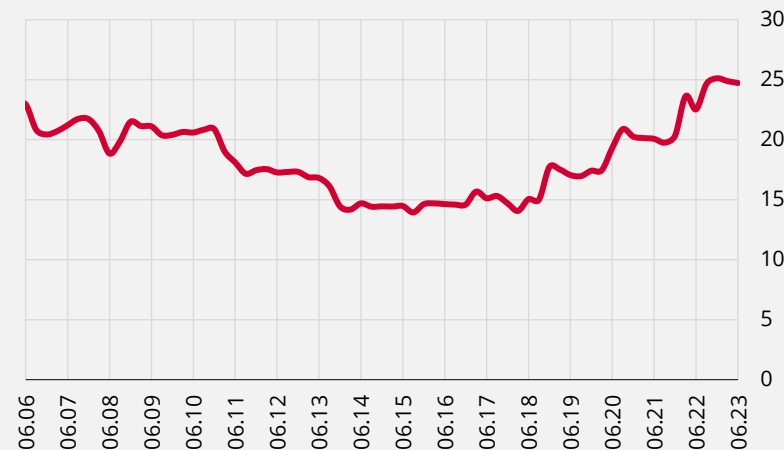
### Exchange Rate Pass-Through to Consumer Prices: Size, Course over Time, Impact Channels and Sectoral Differentiation

The exchange rate is one of the important determinants of inflation in emerging countries. Determining the size of the inflationary pressure caused by exchange rate movements, the speed of pass-through, its course over time, the channels of impact and which sectors are sensitive to exchange rate movements is important for a sound analysis of pricing dynamics. Therefore, in this box, the pass-through from exchange rates to consumer prices, which is an important factor in inflation dynamics, is analyzed in terms of these dimensions.

#### Size of the Pass-Through and Its Course over Time

At the CBRT, the size of the exchange rate pass-through is monitored through models ranging from the standard vector autoregression (VAR) model, to Bayesian VAR and time-varying parameter (TVP) models. This box first analyses the pass-through effect through a reduced-form Phillips curve TVP model (Chart 1), as it is considered to better reflect the course of the pass-through over time. Recent estimations indicate that the pass-through effect from the exchange rate to consumer prices, which started to slow down after the transition to a floating exchange rate regime in Türkiye, started to increase again in 2018 and accelerated especially in 2020. They further suggest that the pass-through effect, which was spread over time in the past, has been reflected on consumer prices at a faster pace in recent years. The model results signal that the pass-through effect from the cost channel is around 25% for the last one-year period. In other words, controlling for the role of inflation expectations, the cost-push impact of a 10% increase in the exchange rate basket on consumer prices is estimated to be around 2.5% points over a one-year period.<sup>1</sup> This figure is an average estimate and the pass-through from exchange rates to inflation in any given period may vary depending on cyclical factors. In fact, studies on the subject indicate that factors such as the cyclical state of the economy, exchange rate expectations (the perception that movements are permanent/temporary) and the size of the exchange rate shock can significantly affect the size of the pass-through.<sup>2</sup>

**Chart 1: Exchange Rate Pass-Through from the Cost Channel in the Phillips Curve TVP Model (%)**



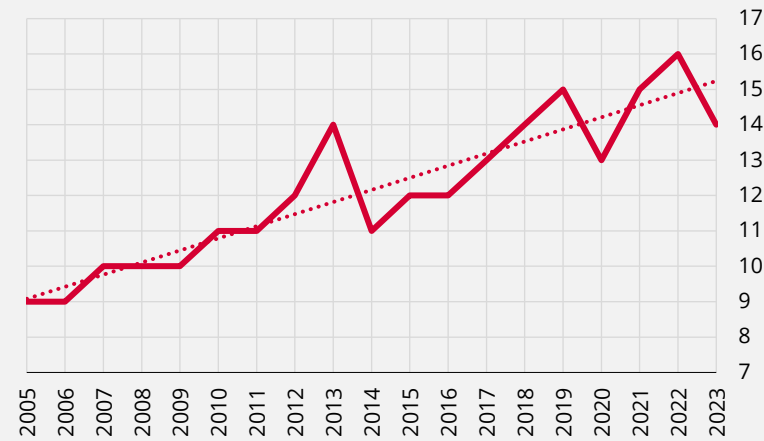
Source: Authors' calculations.

<sup>1</sup> The pass-through effect is measured higher when the role of inflation expectations is not taken into account. In specifications where the impact channels are decomposed separately (when a separate channel for inflation expectations is defined), the pass-through coefficient from the cost channel is estimated to be around 25%. In the literature on Türkiye, when shocks to inflation are not well-identified in the model (demand, expectations, wage, commodity and other supply shocks, etc.), the effect of exchange rate shocks tends to be overestimated. For an assessment of the TVP model and the role of inflation expectations, see Koç et al. (2021).

<sup>2</sup> See Kara et al. (2017).

When the sources of the increase in exchange rate pass-through are analyzed, one of the striking factors is the changes in consumption patterns. Analyses show that the weights of items in the basket of consumer prices with relatively high exchange rate pass-through have tended to increase over time. For instance, the weight of durable goods, one of the groups with high exchange rate pass-through, almost doubled compared to 2005 due to the increase in the number of households in line with the changes in the demographic structure (Chart 2).

**Chart 2: The Weight of Durable Goods in the CPI Basket (%)**



Source: TURKSTAT.

### Impact Channels

Besides cost channel, the pass-through of exchange rate developments to inflation also happens through expectations and balance sheet channels. Although the most prominent of these channels is the cost channel, Ertuğ et al. (2020) show that exchange rate pass-through in Türkiye can be higher than the cost increases implied by the rate of imported input utilization and that other possible channels should also be considered.

The cost channel mainly affects prices through imported inputs used in production and directly imported products in consumption. While exchange rate developments directly affect the prices of imported goods, they also affect the prices of domestically produced goods through foreign inputs such as imported intermediate goods and energy. The higher the share of imported goods and import-intensive products in the consumption basket, the higher the exchange rate pass-through of the consumer price index.

The balance sheet channel comes into play as firms with high foreign currency indebtedness come under pressure during periods of depreciation of the local currency. This pressure through the balance sheet channel adversely affects firms' sales and investments and firms may raise prices to alleviate this pressure. Fendoğlu et al. (2019) show that sectors with high foreign currency indebtedness increase producer prices more after an exchange rate shock.

The effect of exchange rate developments through the expectations channel arises as a result of the inclusion of expectations for the period until the next price update in pricing behavior during price setting. Through this channel, the inflationary environment and deterioration in expectations caused by exchange rate developments affect items that are not directly affected by exchange rate developments through backward indexation. This movement, which emerges especially in services items, causes backward-indexation-intensive items such as rent, education and health to be indirectly affected by the exchange rate-driven inflationary environment.

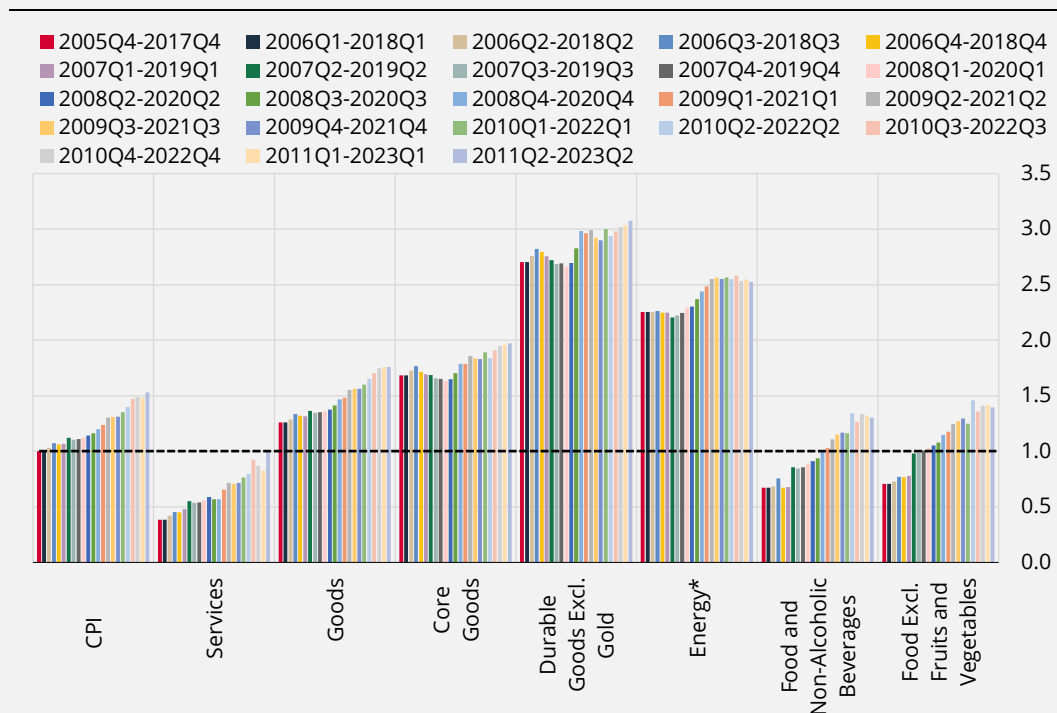
The pass-through of exchange rate developments to consumer prices through these channels varies from period to period and from country to country. The size of pass-through may vary depending on factors such as the level and persistence of inflation, the share of imported inputs in production, the

share of imported products in consumption, the extent of foreign currency indebtedness, market structure, and the nature of exchange rate shocks.<sup>3</sup> Kazdal and Yılmaz (2021) indicate that increases in external vulnerabilities such as high dollarization, high current account deficit, high foreign currency indebtedness and a high-risk premium increase exchange rate pass-through. In addition to demographic effects, exchange rate pass-through may change over time due to changes in the structure of these channels.

### Sectoral Differentiation

The distribution of this effect across sectors is as important as the average effect itself. In this context, a strategy based on sub-item modeling has been adopted, as in the study of Özmen and Topaloğlu (2017), in order to look at the differing effects of exchange rate movements on CPI sub-items. In order to obtain sectoral exchange rate pass-through coefficients, customized fixed-parameter equations are estimated for 144 sub-item prices in the CPI at the 5-digit level.<sup>4</sup> The resulting exchange rate pass-through coefficients are aggregated with respective item weights to achieve the exchange rate pass-through estimates of the main groups. In order to test robustness, seven models are estimated under different specifications, and the average values of the pass-through estimates of these models are reported. In addition, the change in the magnitude of the pass-through over time were also examined using the rolling estimations with 10-year window size (Chart 3). In order to make the size of sectoral differentiation and its changes over time comparable, the pass-throughs relative to the CPI are reported instead of the direct exchange rate pass-through coefficients.

**Chart 3: Exchange Rate Pass-through Into Inflation Under Different Samples (2005Q4-2017Q4=1)**



Source: Authors' calculations.

\* Excluding electricity and natural gas. In order to better capture the internal dynamics of sub-groups, exchange rate pass-through of LPG, fuel oil and diesel oil items are calculated separately.

<sup>3</sup> For an assessment of why exchange rate pass-through differs across countries based on these factors, see CBRT (2021).

<sup>4</sup> In the modeling of sub-items, a general model including all selected variables was first established, and then variables with insignificant or negative coefficients for each sub-item were deleted one by one and the necessary outliers were assigned and variables were selected using the general to specific method. Lagged values of the relevant price variable, basket exchange rate, import prices, output gap, wages and Brent oil prices are used as explanatory variables.

As expected, the main groups with relatively high exchange rate pass-through are tradable core goods and energy. An analysis of the source of the high exchange rate pass-through in core goods reveals that durable consumption goods with high import intensity stand out, while the main determinant in this group is automobile prices. As for the energy group, the high external dependence of its components increases the exchange rate pass-through. As expected, exchange rate pass-through is more limited in the services group, which is highly sensitive to domestic developments and has a limited capacity to be subject to international trade. Although the level of exchange rate pass-through varies across subgroups, exchange rate pass-through has increased over time in all subgroups, including groups with low exchange rate sensitivity such as services. Especially when the level of inflation rises and inflation expectations are not anchored, the pass-through effect may also increase in non-tradable goods through the backward indexation mechanism or deterioration in pricing setting behavior.

In sum, the pass-through from exchange rates to consumer prices has increased in recent years. In periods of high inflation, exchange rate pass-through may increase, especially as the backward-indexation tendency in inflation strengthens. Current estimates suggest that the pass-through effect through the cost channel is around 25% over a one-year period, but the pass-through effect may vary depending on underlying economic environment such as the course of economic activity or exchange rate expectations.

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