

1. Overview

Although economic activity lost some momentum in the second quarter of 2021 due to the pandemic-induced restrictions and tighter financial conditions, it remained above the long-term trend. In the second quarter of 2021, Gross Domestic Product (GDP) increased by 21.7% on an annual basis and by 0.9% on a quarterly basis. As for production, the industrial sector and the services sector were the main drivers of annual and quarterly growth, while construction and agricultural sectors restricted quarterly growth. On the expenditure side, both domestic demand and net exports contributed to quarterly growth. The contribution from domestic demand was led by private consumption, while public expenditures and investments displayed a moderate course. The contribution from net exports to growth was driven by both strong exports, and declining imports with the help of decelerating gold imports.

Leading indicators show that domestic economic activity remains strong, with the help of robust external demand. In the July-August period, the industrial production index continued its uptrend, with a 1.2% rise compared to the previous quarter. Turnover indices suggest that in the third quarter, foreign demand continued to support industrial production, particularly in intermediate and capital goods sectors. The spread of vaccination throughout domestic population facilitates the recovery in services, tourism and related sectors, which have been adversely affected by the pandemic, and leads to a more balanced composition in economic activity. The retail sales volume index posted a strong increase on the back of the re-opening. As for goods, while the demand for durable consumer goods slows down, a recovery is observed in non-durable consumer goods. The impact of the re-opening on economic activity is also observed in the labor market. In July and August, non-farm employment continued to increase, led by services employment. With the recovery in services employment, non-agricultural employment and all sub-components have exceeded their pre-pandemic levels.

The improvement in the current account balance continues. In the third quarter, exports remained strong owing to the rapid recovery in global demand and the rise in export prices. Despite the sharp increase in international commodity prices and the strength of economic activity, imports posted a milder uptrend in the third quarter compared to the previous quarter. The relatively stronger rise in import prices limits the impact of the rebalancing in foreign trade in real terms on the current account balance. Meanwhile, the recovery in services gained momentum on the back of the acceleration of vaccination and lifting of restrictions. In the rest of the year, the improvement in the annualized current account balance is expected to continue with the strong uptrend in exports underpinned by favorable external demand conditions.

In the third quarter of the year, the global risk appetite remained volatile. With the expectation that the accommodative policies of central banks of advanced economies would continue, there were portfolio inflows to emerging market economies (EME) in August and early September. However, as of mid-September, the communication of central banks of developed countries regarding a likely reduction in bond purchases coupled with the rise in energy prices and negative developments in the Chinese financial and real estate markets led to a significant slowdown in capital flows to EMEs. In this period, capital flows to Turkey weakened too. While the risk premium and implied exchange rate volatility increased in the EMEs group including Turkey, their currencies depreciated with the impact of the rise in the dollar index.

In the third quarter, consumer inflation increased due to supply-side factors such as the rise in food and import prices and disruptions in supply chains, the rise in administered prices, and demand developments due to the re-opening. In this period, consumer inflation, which was 19.58%, realized above the forecast range presented in the July Inflation Report, while the year-on-year rise in the B index remained within the forecast range at 18.63%. Meanwhile, the rise in producer prices persisted, and continued to exert pressure on consumer prices. The rise was mainly driven by international commodity prices, developments in energy prices, lingering supply constraints and ongoing problems in supply chains.

In the third quarter, annual inflation was up compared to previous quarter in the B index but slightly down in the C index. The third quarter's inflation trend was volatile due to periods of shutdown and reopening. In this period, the inflation trend decelerated in core goods, but rose in processed food and - with reopening - in services. Developments in processed food prices caused the trends of the B and C indices to diverge.

The decelerating impact of monetary tightening on credit and domestic demand continues. Regarding the composition of loans, as of the third quarter the impact of the tight monetary stance on commercial loans turned out to be more restrictive, while personal loans remained strong. However, the strengthened macroprudential policy framework has started to curb personal loan growth. High-frequency loan data indicate that the growth rate of general-purpose loans slowed due to these measures, while their maturities somewhat shortened. The course and composition of loans are monitored in terms of macroeconomic stability.

The CBRT cut the policy rate in September and October, after keeping it constant at the MPC meeting in August. At the September and October meetings, the CBRT emphasized that the decelerating impact of the monetary tightening on credit and domestic demand continued. Considering that the recent rise in inflation was due to transitory supply-side factors, the CBRT lowered the policy rate by a total of 300 basis points to 16% in September and October. The CBRT also noted that there was limited room for a downward adjustment in the policy rate until the end of the year.

1.1 Monetary Policy Decisions

The CBRT kept the policy rate unchanged at 19% at its August meeting. Noting that commercial loans followed a moderate course in August, the Bank stated that it had been monitoring whether the macroprudential measures taken in July were adequate to bring personal loans back on a moderate course after an acceleration due to the reopening and pent-up demand. The Committee re-emphasized that a moderate personal loan growth was important to limit the risks to the inflation outlook and external balance. In this context, it was underlined that the course and composition of loans were closely monitored in terms of macroeconomic stability. Following this decision, the BRSA took an additional macroprudential step and introduced a regulation regarding consumer loans (Table 1.1).

Prior to the September MPC meeting, the CBRT made adjustments in required reserves to increase the efficiency of the monetary transmission mechanism, and altered the terms of use and repayment of rediscount credits to support the increase in FX reserves. On 1 July 2021, the CBRT announced that FX reserve requirement ratios were raised by 200 basis points for all maturity brackets, and the facility for holding FX for Turkish lira reserve requirements would be gradually decreased and eventually terminated in October. On 15 September 2021, the Bank announced that the reserve requirement ratios for FX deposits/participation funds would be 200 basis points higher for all maturity brackets by 1 October 2021, the date on which the above facility would be terminated.

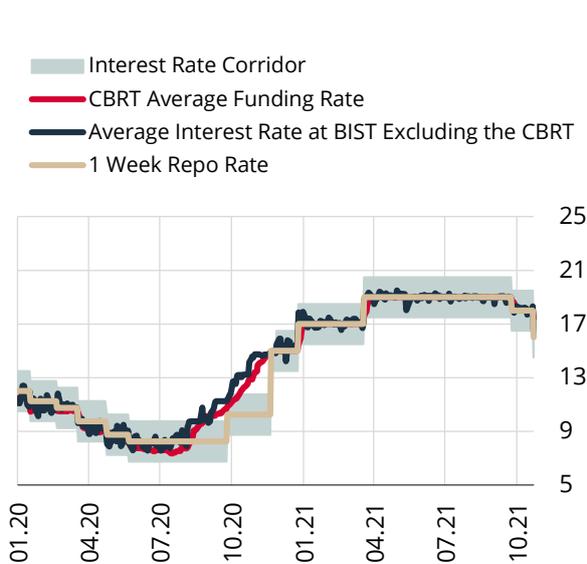
At its September meeting, the CBRT assessed that a revision in monetary policy stance was needed based on analyses decomposing the demand-side factors that can be influenced by monetary policy, core inflation developments and the effects of supply shocks (Box 1.1). At the September meeting, the Bank attributed the recent rise in inflation to supply-side factors such as rising food and import prices and ongoing supply constraints, hikes in administered prices as well as changes in demand driven by the reopening, and said that these effects were caused by transitory factors. In addition, the Bank stated that the monetary tightening continued to have a decelerating impact on credit and domestic demand, and emphasized that the tightness in the monetary stance had started to have a higher than envisaged contractionary effect on commercial loans. Accordingly, judging that a revision in monetary policy stance was needed, the Committee decided to cut the policy rate by 100 basis points.

At its October meeting, the CBRT reiterated that the recent increase in inflation was driven by transitory factors, and decided to reduce the policy rate by 200 basis points. Additionally, it emphasized that the tightness in the monetary stance had started to have a higher than envisaged contractionary effect on commercial loans, and the strengthened macroprudential policy framework had begun to curb personal loan growth. However, the Committee assessed that, till the end of the year, supply-side transitory factors leave limited room for the downward adjustment to the policy rate.

At its October meeting, in order to contain climate-based and other environmental risks, the CBRT also decided to support sustainable finance initiatives as a long-term policy without prejudice to the main objectives of monetary policy (Box 1.2).

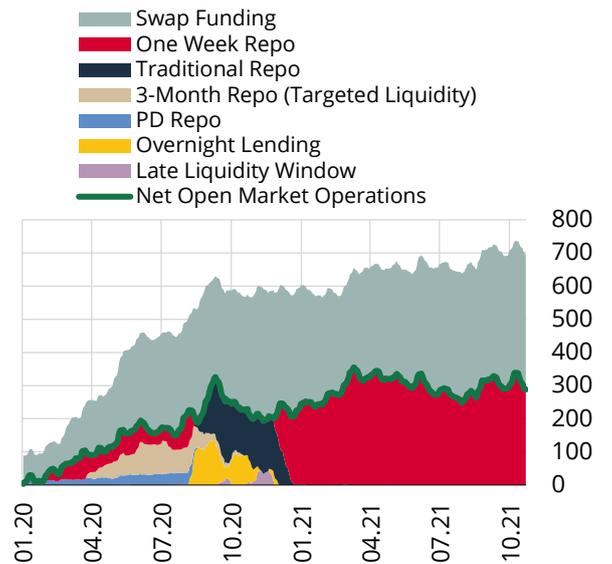
In the current reporting period, the CBRT continued to provide funding within a simple operational framework through OMO and swap transactions, and the overnight interest rates materialized around the CBRT policy rate. Owing to the CBRT's predictable liquidity management framework, BIST overnight repo rates continued to hover around the CBRT policy rate (Chart 1.1.1). The amount of swap transactions, which was TRY 384 billion as of 30 July 2021, increased to TRY 417 billion as of 22 October 2021. In the same period, the net OMO funding rose to TRY 302 billion from TRY 252 billion with the effect of the decisions taken regarding reserve requirements (Chart 1.1.2).

Chart 1.1.1: CBRT Rates and Short-Term Interest Rates (%)



Sources: BIST, CBRT.

Chart 1.1.2: CBRT Open Market Operations and Swap Transactions (One-Week Moving Average, TRY Billion)



Source: CBRT.

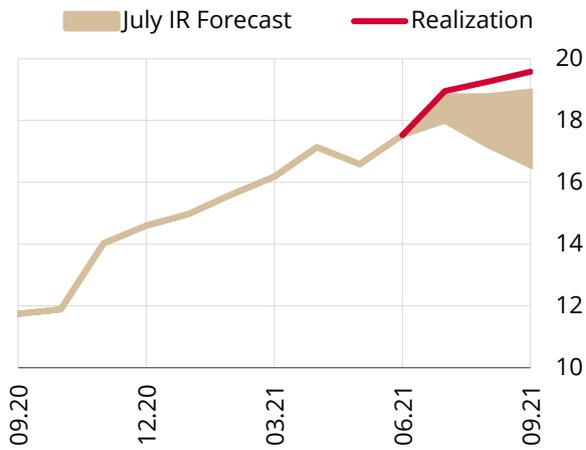
Table 1.1: Monetary Policy Implementations

Date	Institution	Policy Decision
15 September 2021	CBRT	<ul style="list-style-type: none"> To be effective as of 1 October 2021, the termination date of the facility that allowed the holding of FX for Turkish lira reserve requirements, the reserve requirement ratios for FX deposits/participation funds were increased by 200 basis points for all maturity brackets.
16 September 2021	BRSA	<ul style="list-style-type: none"> The maximum term for consumer loans set at 36 months by the BRSA Decision of 04.09.2020 and No. 9131 was reduced to 24 months for loans over 50,000 Turkish liras.
17 September 2021	CBRT	<ul style="list-style-type: none"> The total rediscount credit limit was increased to USD 30 billion, the USD 20 billion of which was allocated to the credits to be extended via the Export Credit Bank of Turkey (Turk Eximbank), and USD 10 billion to the credits to be extended via other banks. The Turkish lira equivalent of USD 5 billion of the aforementioned total limit could also be used for rediscount credits in Turkish lira. In addition to the increase in limit, it was also decided that: <ul style="list-style-type: none"> Credits would be extended to net exporter firms with an export amount that was at least 10% more than their import amount in the last three years or the last year. Credits could only be used for payments of the specified expenditures in Turkish lira. Credit repayments would be made only with export proceeds, The maximum maturity of credits was updated to 180 days from 240 days. For credits extended to finance exports to new markets, exports of high technology products and foreign exchange earning services, the maximum maturity would remain as 360 days. The maximum commission rates that could be charged by intermediary banks would be 100 basis points. For firms that made a commitment to the CBRT to sell additional export proceeds, the interest rate applicable to the credit would be discounted.

1.2 Medium-Term Projections

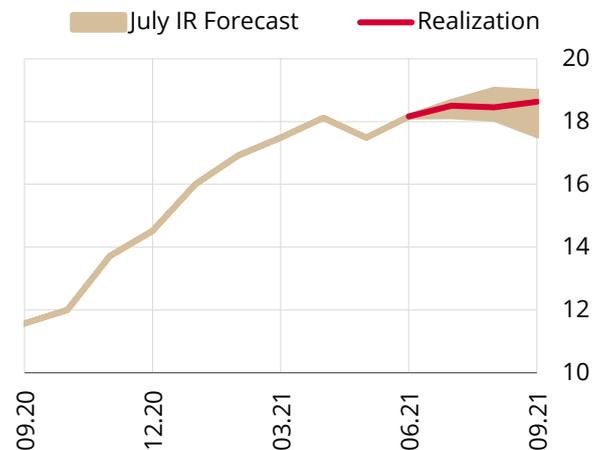
In the third quarter of 2021, consumer inflation stood at 19.58%, materializing above the forecast range of the July Inflation Report. In this period, the B index, one of the core indicators, was consistent with projections with 18.63% (Charts 1.2.1 and 1.2.2). Demand developments led by re-opening and supply-side factors such as import prices, transportation costs, agricultural drought and supply constraints drove consumer inflation upwards due to higher costs. Forecasts for consumer inflation and core inflation and their realizations diverged due to the soaring international agricultural commodity prices, cumulative exchange rate effects and a higher-than-projected rise in unprocessed food prices caused by agricultural drought.

Chart 1.2.1: July CPI Inflation Forecast and Actual Inflation* (%)



Sources: CBRT, TURKSTAT.
 * Shaded area denotes the 70% confidence interval for the forecast.

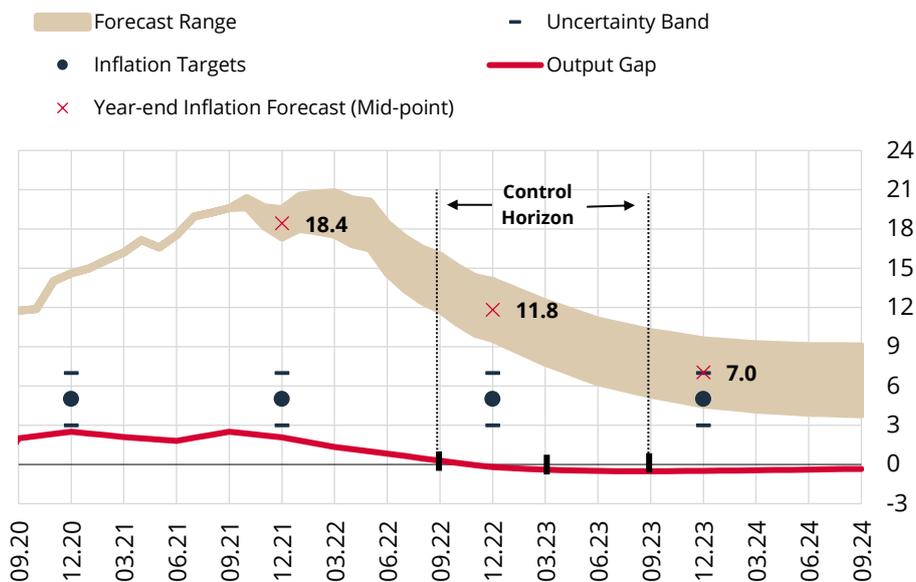
Chart 1.2.2: July Forecast and Actual Rates for Inflation Excl. Unprocessed Food, Energy, Alcohol-Tobacco and Gold (B Index)* (%)



Sources: CBRT, TURKSTAT.
 * Shaded area denotes the 70% confidence interval for the forecast.

Based on main assumptions and short-term projections, and under the scenario in which the monetary policy stance would continue to be tight enough to allow inflation to re-settle into a downward trend once the temporary effects disappear, inflation is projected to gradually converge to the target. Accordingly, inflation is projected to be 18.4% at the end of 2021 and fall to 11.8% at the end of 2022 and to 7% at the end of 2023 before stabilizing around 5% in the medium term. With a 70% probability, inflation is expected to be between 17.3% and 19.5% (with a mid-point of 18.4%) at end-2021, between 9.6% and 14.0% (with a mid-point of 11.8%) at end-2022 and between 4.6% and 9.4% (with a mid-point of 7%) at end-2023 (Chart 1.2.3).

Chart 1.2.3: Inflation and Output Gap Forecasts* (%)



Sources: CBRT, TURKSTAT.
 * Shaded area denotes the 70% confidence interval for the forecast.

Despite the recovery in global economic activity in the first half of the year, recently-released confidence indices started to fall due to the pandemic. Despite the increase in the vaccination rate, new variants keep the downside risks to global economic activity alive. The rebound in global demand, the high course of commodity prices, supply constraints in certain sectors and the rise in transport prices push producer and consumer prices upwards internationally. Unfavorable effects of weather conditions in major agricultural commodity exporting countries are observed in global food prices. While the effects of high global inflation on inflation expectations and international financial markets are closely monitored, central banks in advanced economies assess that the rise in inflation will be mostly temporary along with normalization in demand composition, easing of supply constraints and waning base effects. Accordingly, central banks in advanced economies continue their supportive monetary stances and asset purchase programs. On the other hand, in many emerging economies, both current inflation and the year-end inflation expectation hover above the target. Nonetheless, expectations imply that inflation will return to the tolerance range at end-2022.

Demand conditions are expected to follow a more moderate course as of the last quarter of 2021, following the recovery in the third quarter due also to the re-opening. Leading indicators show that domestic economic activity remains strong, with the help of robust external demand. Following the normalization steps in the third quarter of the year, aggregate demand was fostered by domestic and foreign demand. In addition, with the rebound in services, tourism and related sectors, which were adversely affected by the pandemic, economic activity gained a more balanced composition. Accordingly, the effects of post-pandemic normalization steps on aggregate demand are expected to diminish as of the last quarter of the year. In addition, economic activity is projected to maintain a more balanced composition. Against these developments, it is estimated that the effect of aggregate demand conditions on inflation has decreased. Inflation developments suggest that commodity prices, disruptions in the supply chain and demand conditions cause producer inflation to remain on an upward track. Thus, cost pressures on consumer prices persist. Inflation is expected to return to its downward trend once the effects of temporary factors disappear.

1.3 Key Risks to Forecasts

The outlook underlying the medium-term projections presented in the Inflation Report is based on the Monetary Policy Committee's judgments and assumptions. The major downside and upside macroeconomic risks that may lead to a change in the baseline projections and the associated monetary policy stance are as follows:¹

The accelerated vaccine rollout and the normalization steps have triggered upside risks to economic activity. Aggregate demand conditions remain strong on the back of both domestic and external demand. The recovery in the global economy continues, albeit at a somewhat decelerated pace. Nonetheless, despite the increase in the vaccination rate, new variants keep the downside risks to global economic activity alive. The speeding up of vaccination and the easing of travel restrictions on Turkey have facilitated the recovery in services, tourism and related sectors, which had been adversely affected by the pandemic, and led to a more balanced composition in economic activity. The improvement in the current account balance is expected to continue until the end of the year due to the strong course of exports and the recovery in tourism. On the other hand, changes in the number of coronavirus cases and deaths as well as the developments regarding new variants and new waves of pandemic and the effects of these developments on demand conditions are closely monitored.

High international commodity prices continue to pose a risk to the inflation outlook. Producer prices-driven risks have materialized due to the recent increases in coal and natural gas prices in the international energy markets. In the upcoming period, the normalization to be seen once the effects of the pandemic fade out with accelerated vaccination may affect commodity prices. On the other hand, while factors such as the rise in commodity prices and supply constraints are still deemed to be temporary, some countries signal a tightening in monetary policy. This may affect financial markets through capital flows and global risk appetite.

¹ Evaluations of how and through which channel these risks may affect the inflation forecasts cited in the previous section are summarized in Table 3.3.1. in Chapter 3.

Food price developments continue to pose a risk to the inflation outlook. Unfavorable effects of weather conditions in major agricultural commodity exporting countries are observed on global food prices. Food inflation remains elevated due to continued increases in international agricultural commodity and food prices, cumulative exchange rate effects, adverse weather conditions (agricultural drought, floods, wildfires), supply constraints in certain products, and the reopening.

Ongoing disruptions in supply chains keep supply-side risks to inflation alive. Despite a limited decline in October, freight costs continue to display an unfavorable outlook. Although there is some improvement in the suppliers' delivery times, the current levels are significantly above historical averages. The pass-through from producer prices to consumer prices as well as the causes of the disruptions are monitored closely.

Survey-based indicators and inflation break-evens suggest a rise in inflation expectations. The volatility in financial markets poses risks to pricing behavior and the inflation outlook.

The tightness in the monetary stance has started to have a higher than envisaged contractionary effect on commercial loans. The strengthened macroprudential policy framework has started to curb personal loan growth. In addition to macroprudential measures, the effects of the adjustment in monetary policy on loan growth and composition will also be monitored. The composition of loan growth affects the inflation outlook through aggregate demand, current account balance, external financing, and risk premium channels. In this respect, indicators of credit supply and demand will be monitored closely.

The disinflation process may be delayed, should the path of administered price and tax adjustments exceed the path envisaged in this Report. Endorsement of inflation targets by all stakeholders and commitment to the price stability efforts with a common understanding and public accord, along with determination of macro policies in a coordinated manner in line with the projected disinflation path, will strengthen the effectiveness of the monetary policy.

Box 1.1

Decomposing Supply and Demand Shocks Affecting Inflation

The pandemic affected some sectors such as transportation, entertainment, and services, where social contact is relatively high, more negatively than others. The pandemic caused both a negative supply shock, which limited the capacity of economies to produce goods and services at a specific price, and a negative demand shock, which reduced consumers' willingness or ability to purchase goods or services at a specific price.¹ These different shocks that emerged at the same time may have had different effects on inflation dynamics. For example, fundamental supply shocks such as technology shock, inter-sectoral production shock, change in pricing behavior, labor supply shock, labor productivity shock, and disruptions in the supply chain restrict economic activity and cause inflationary pressures. In addition, adverse demand-side shocks such as a decrease in domestic demand, a change in consumption preferences between sectors, and a contraction in global demand put pressure on prices to fall. Understanding how supply and demand-side shocks affect global inflation has recently gained great importance, especially in academia and central banks. This box includes the main methods that decompose the effects of supply and demand shocks on inflation and the current results obtained using these methods.

Since Sims (1980) introduced vector autoregression (VAR) models in the article "Macroeconomics and Reality," VAR models have been one of the most widely used models in the field of empirical macroeconomics. A significant output from VAR models is the historical decomposition results of shocks. This method allows the all-time series in VAR to be expressed as the sum of different shocks and an exogenous variable. In other words, by summing the contributions of all shocks at any time "t", the original time series at time "t" can be obtained. Also, historical decomposition allows determination of how much of an endogenous variable's deviation from the mean is due to a particular shock.

However, the Bayesian VAR (BVAR) model can also be preferred in decomposing the effects of shocks because of the necessity of making strong assumptions or calibrations about parameter values in VAR models. BVAR models differ from standard VAR models in that the model parameters are treated as random variables with a predetermined probability distribution instead of fixed values. Due to the limited number macroeconomic data sets compared to the number of parameters, BVAR models have become an essential method of eliminating the need to make rigid assumptions or calibrations about parameters. In addition, while running BVAR models, sign restrictions are determined and reflected in the model by the theory or expectations. BVAR models have recently been widely used to decompose supply and demand shocks. For example, the European Central Bank published the results of the BVAR model operated under sign restrictions in its report in September 2021. According to this report, the effects of inflationary supply shocks on Eurozone inflation in the second quarter of 2020 are more substantial than the effects of disinflationary demand shocks. This report also shows that the pandemic's effects were felt more intensely in sectors that are more exposed to supply constraints. Likewise, the number of studies on the decomposition of shocks has been increasing recently in developing countries. For example, for Mexico, the effects of sectoral supply and demand shocks on economic activity are shown using BVAR models with sign restrictions (Chavarin et al., 2021). According to this study, while it was found that the demand shock had more substantial effects in many sectors at the beginning of the pandemic, it was shown that, despite the positive effects of demand shocks in the later stages of the pandemic, supply constraints began to affect many sectors negatively, especially the manufacturing sector.

¹ While it is observed that the pandemic caused an increase in demand in some sectors, such as durable consumer goods, the aggregate demand shock is considered to be harmful when viewed from the point of view of aggregate demand.

In addition to these, Dynamic Stochastic General Equilibrium (DSGE) models are also used in the historical decomposition of shocks. These models, unlike VAR models, rely on general equilibrium theory and microeconomic principles to relate variables. For example, model-based estimates have shown how different shocks affect Eurozone consumer price inflation from the first quarter of 2000 to the first quarter of 2021 (Cardani et al., 2021). Temporary quarantine measures have been found to have little effect on inflation. While demand and international trade shocks have a disinflationary effect, supply-side shocks have been shown to have had substantial inflationary effects in the later stages of the epidemic, especially from the second quarter of 2020. In addition, by adding the dynamics related to the pandemic, temporary demand shocks, and supply shocks to the New York Fed DSGE model, and using the most recent data, the new forecasts are reported by comparing the previous forecasts of the model (Chen et al., 2021). The model to which pandemic dynamics is added gives a higher inflation forecast than the other model. In September 2021 forecasts, it was stated that cost shocks caused higher inflation projections.

Supply constraints, such as increases in import prices and disruptions in supply processes, also play a role in the rise of inflation in the Turkish economy. In this context, analyzes are made with different model approaches summarized above using domestic and international supply, demand, and cost indicators. The results indicate that more than one shock has been influential in the rise of inflation in the last year. The increase in commodity prices and the supply constraints caused by the supply-demand mismatch that emerged in the post-pandemic period play an essential role in inflation dynamics.

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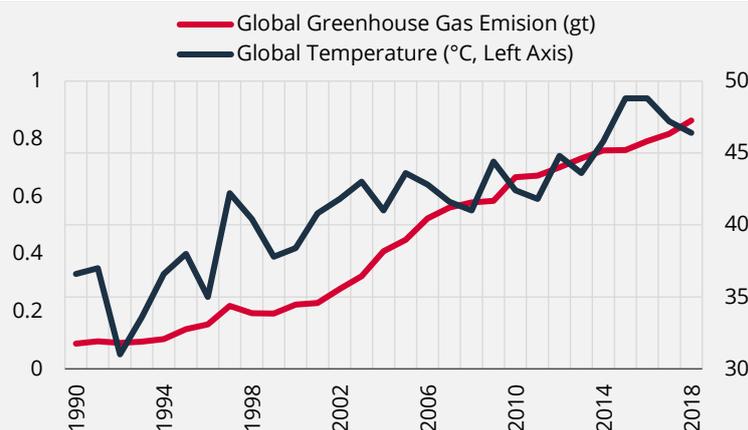
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Box 1.2

Monetary Policy and Central Banking during Global Climate Change

Improvements in technology and rapid industrialization caused higher emissions of greenhouse gases such as carbon dioxide and methane, which led to global warming and global climate changes. Global greenhouse gas emissions have increased over years, and the global temperature has increased in parallel (Chart 1). Global climate change not only shapes the overall economy through its impacts on economic activity, inflation and labor productivity, but it also affects the financial system by creating financial risks. The fact that these issues are factors affecting price stability and financial stability necessitated that the developments regarding global climate change should also be monitored by central banks. In fact, global climate changes are frequently analyzed in recent studies by major central banks and international financial institutions. In its latest decision announcement, the CBRT also stated that it decided to support sustainable finance practices as a long-term policy, without changing the main objectives of the monetary policy, in order to limit climate and other environmental risks.

Chart 1: Global Greenhouse Gas Emission and Global Temperature*



Source: <https://www.climatewatchdata.org/>, <https://www.ncdc.noaa.gov/>
 *Global greenhouse gas emission is denoted in gigaton carbon dioxide equivalent (GtCO₂e) while global temperature is the deviation of yearly surface temperature from the 20th century average.

The idea that global climate change developments should be included in the monetary policy strategy was first expressed by the Bank of England in 2015. In this context, global climate change was defined as the "tragedy of the horizon" and it was underlined that central banks should take action today in order to eliminate the problems that may arise in the financial system due to climate change and to ensure the efficient functioning of the markets (Carney, 2015).

Currently, global climate changes are thought to affect financial stability mainly through three channels: physical risks, transition risks and liability risks.¹ Physical risks refer to negative effects of the increased default risk and credit risk on financial sector balance sheets arising from compensation for physical damage caused by natural events due to climate change. As a matter of fact, a recent study indicates that due to physical risks, the credit risk may rise from around 10% for banks operating in the Eurozone to 30% in 2050 (Alogoskoufis et al., 2021).

¹ Physical risks and transition risks posed by global climate change on the financial system are discussed extensively in Box II.1.1 of the Financial Stability Report May 2021 issue (CBRT, 2021).

Transition risks refer to the risks to financial stability that arise from the reallocation of resources and the possibility that some sectors will become inoperable or face serious costs during adaptation to policy (Paris Agreement) or technology changes regarding global climate change. On the other hand, transition risks are viewed as limited compared to physical risks (de Guindos, 2021). In this context, a similar finding in a study conducted by the International Monetary Fund (IMF) predicts that the short-term cost of the transition to a carbon-neutral economy can be more than compensated in the long term (IMF, 2020).

Finally, liability risk refers to the risk arising from the claims of compensation for losses by persons or businesses exposed to physical risk or transition risk. Managing these risks caused by global climate change falls within the scope of central banks' mandate and regulatory institutions in line with their objective of safeguarding financial stability. However, the magnitude of these risks and the difficulties in their pricing may affect financial stability and also the related policies. In addition, these risks to the financial system may also appear on the balance sheets of central banks through open market operations (OMO). This is because the bonds and bills subject to OMO may carry climate risk, which may cause the central bank balance sheets to be exposed to this risk as well (Schnabel, 2021).

On the other hand, global climate change not only poses risks to the financial system, but it also creates a new potential in terms of meeting the financing needed to manage these risks. Financial instruments developed to fund environmental projects are called "green bonds". According to literature and policy debates, the inclusion of green bonds in central banks' balance sheets may help to lessen the risks discussed above.

Global climate change hits price stability through negative shocks that affect economic activity and increase prices (de Galhau, 2021). In addition, the transition effects created by global climate change may cause inflationary pressure and slowdown in economic activity through cost increases such as carbon tax. Moreover, weather events driven by global climate change negatively affect the agricultural sector, causing an increase in food prices. What is more, it is predicted that global climate change may reduce labor productivity in the long run (Somanathan et al., 2015).

In 2017, the Network for Greening the Financial System (NGFS) was established under the leadership of the Bank of France, to consider the effects of global climate change on price stability and financial stability in implementing monetary policy. NGFS focused its work on five main themes: (i) microprudential/audit, (ii) macrofinancial, (iii) scaling up green finance, (iv) bridging data gaps, and (v) research.

In this context, the following themes can be listed as the main areas of research by the NGFS: (i) examining the extent to which a financial risk differential exists between green bonds and other assets, (ii) reviewing and assessing existing methodologies to measure climate-related and environmental financial risks at a micro level, (iii) keeping track of supervisory developments and update the mapping of supervisory practices to integrate climate-related and environmental risks into microprudential supervision, (iv) developing climate scenarios for central banks and supervisors; (v) providing guidance to central banks and supervisors on integrating climate risk analysis into macroeconomic and financial stability surveillance, (vi) sizing the macrofinancial impact of climate-related risks, (vii) promoting the adoption of sustainable and responsible principles in central banks' investment approaches, (viii) understanding and fostering the market transparency of green finance, (ix) providing a joint central banks' view on the various challenges climate change raises for the conduct of monetary policy, and (x) encouraging the adoption of climate-related financial disclosure by central banks.

Meanwhile, the Bank of France, which pioneered the establishment of the NGFS, states that central banks' mandate should be amended to take into account the negative effects of global climate changes on price stability. The Bank of France also argues that central banks should include green bonds in their balance sheets, considering that the financial risks caused by global climate changes will also be visible in the balance sheets of central banks and thus influence monetary policy.

The inclusion of green bonds in the balance sheets of the central banks, which is called the “greening of monetary policy”, has been implemented by the European Central Bank (ECB) within the Corporate Sector Purchase Program since 2016. In addition, green bonds are purchased through the Public Sector Purchase Program. Lastly, the ECB submitted an action plan on July 8, 2021 to incorporate climate change considerations into its monetary policy strategy. Accordingly, the ECB announced that it will expand its analytical capacity in macroeconomic modelling, statistics and monetary policy with regard to climate change; will include climate change considerations in monetary policy operations in the areas of disclosure, risk assessment, collateral framework and corporate sector asset purchases; and will implement the action plan in line with European Union (EU) policies.

Another initiative regarding the greening of monetary policy and the inclusion of global climate change issues within the monetary policy strategy took place in the United Kingdom. In a statement made by the HM Treasury in March 2021, it was stated that the Bank of England MPC’s remit was updated *“to reflect the government’s economic strategy for achieving strong, sustainable and balanced growth that is also environmentally sustainable and consistent with the transition to a net zero economy”*. Accordingly, the Bank of England announced in May 2021 that it would start purchasing green bonds in order to support its goal of reducing carbon emissions to zero by 2050.

Another step in taking global climate changes into account in monetary policy was taken by the Bank of Japan. Being actively involved in international platforms regarding global climate change, the Bank of Japan announced its climate change strategy on July 16, 2021. In this context, a new fund-provisioning measure was introduced so that financial institutions that disclose a certain level of information on their efforts to address climate change can receive funds from the Bank of Japan against their investment or loans made as part of such efforts. In addition, it was announced that financial institutions will be supported in identifying and managing their climate-related financial risks to maintain financial stability and ensure the smooth functioning of financial intermediation. It was also stated that necessary actions will be taken to collect climate-related data and improve analytical tools to better analyze the effects of climate change on economic activity, prices and the financial system.

The US Federal Reserve (Fed) also established two different committees in 2021 to examine the effects of global climate change on financial institutions and the financial system. The first of these, the Supervision Climate Committee examines the effects of global climate change from a microprudential perspective, while the other committee, the Financial Stability Climate Committee investigates these effects from a macroprudential point of view.

Lastly, various other central banks have taken action in global climate change and green finance issues. In addition, there are initiatives led by international organizations to monitor the financial risks caused by global climate changes and to include climate-related issues in monetary policy design. The Bank for International Settlements (BIS) also makes a significant contribution to green finance through its technical reports and research publications, as well as its collaborations with various international organizations such as NGFS and the Sustainable Insurance Forum (SIF). In addition, the BIS issued green bonds in US dollars and euros in 2019 and 2021 for use by central banks. It also pioneered research in green finance through new technologies such as artificial intelligence and blockchain in its innovation center.

In sum, there are many international organizations acting to solve the problems posed by global climate change. Research publications and initiatives on the reflections of developments stemming from global climate change on central banking have also increased.

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