

**GALATASARAY UNIVERSITY  
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**SUPPLY SHOCKS AND FISCAL POLICIES (THE CASE OF THE  
COVID-19 PANDEMIC IN TURKEY)**

**MASTER THESIS**

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## **PREFACE**

I would like to express my sincere gratitude to all the people who have given me their help and contribution in the preparation of this thesis.

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## **LIST OF ABBREVIATION**

**AD** :Aggregate Demand

**ARDL** :Auto Regressive Distributive Lag

**AS** :Aggregate Supply

**BDI** :Baltic Exchange Dry Index

**BIE** :Business Inflation Expectations

**BITT** :Banking and Insurance Transactions Tax

**BPVAR** :Bayesian Panel Vector Auto Regressive

**CA** :Current Account

**CBO** :Congressional Budget Office

**CBRT** :Central Bank of the Republic of Turkey

**CC** :Cubic Centimeter

**CGF** :Credit Guarantee Fund

**CPI** :Consumer Price Index

**DSGE** :Dynamic Stochastic General Equilibrium

**GDP** :Gross Domestic Product

**GNP** :Gross National Product

**IST** :Investment Specific Technology

**MTF** :Ministry of Treasury and Finance

**NAICS** :North American Industry Classification System

**OECD** :Organisation for Economic Co-operation and Development

**PSB** :Presidency of Strategy and Budget

**PSVAR** :Panel Structural Vector Auto Regression

**PPI** :Producer Price Index

**R&D** :Research and development

**RLI** :Remote Labor Index

**SCT** :Swiss Certified Treasurer

**SME** :Small and Medium-sized Enterprises

**TFP** :Total Factor Productivity

**TL** :Turkish Lira

**TURKSTAT** :Turkish Statistical Institute

**UIP** :Uncovered Interest Rate Parity

**VAT** Value Added Tax



## LIST OF SYMBOLS

$\infty$	:Infinity
$\alpha$	:Measure of price rigidity
$\beta$	:Discount factor
$\epsilon$	:Exogenous shock
$\eta$	:Weight of leisure on total utility
$\lambda$	:Lagrange multiplier
$\partial$	:Partial deviation
$\phi$	:Reaction of the interest rate to deviation of bond
$\pi_H$	:Producer price index inflation in the home country
$\pi_{CPI}$	:Inflation of CPI
$\rho_A$	:Degree of persistence of the technology shock
$\rho_{C^*}$	:Degree of persistence of the export shock
$\theta$	:Substitution elasticity between goods
$a$	:Home country size
$B_t$	:Private bond
$C^w$	:World consumption
$C_t$	:Home country good consumption
$C_t^*$	:Foreign country good consumption
$E_t$	:Expected value
$e_t$	:Exchange rate
$i^w$	:Constant world interest rate
$i_t$	:Home country nominal interest rate
$L_t$	:Hours worked
$P$	:Home country price index
$P^*$	:Foreign country price index

$P_F$  :Foreign country producer price index

$P_H$  :Home country producer price index

$r_t$  :Home country real interest rate

$W_t$  :Real wage

$Y_t^d$  :Aggregate output demand

$Y_t$  :Output



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## 1. INTRODUCTION

The COVID-19 crisis is one of the biggest global economic crises since the Great Depression of 1929. As a result of the crisis, Turkey, like many other countries, experienced health problems, many people lost their jobs, economic confidence indices collapsed, inflation increased and social panic set in. With the COVID-19 crisis, Turkey quickly turned to various expansionary fiscal and monetary policies to counter the economic effects of the crisis. In this chaotic environment, fiscal policy, which had been put on the back burner since the 1980s, regained its former importance with the COVID-19 crisis. However, in order for these policies to be effective in the face of such an unprecedented crisis, it is crucial to determine how this pandemic and the quarantine regulations it brought with it led to an economic crisis.

The main purpose of this study is to determine what kind of a crisis the COVID-19 crisis is for the Turkey's economy. For this purpose, two different negative shocks to the small open economy are included in the DSGE model. The COVID-19 crisis is a very rare crisis in the history of the world that endangered the lives of people all over the world and in Turkey and at the same time had a profound impact on the economy. As regards the effects of this crisis on the economy, it affected the consumption decisions of individuals and caused some changes in the production chain and the labour market. Therefore, in order to identify the changes caused by COVID-19 in both the labor market and the production chain, a negative supply shock is introduced into the DSGE model. Then, it is aimed to analyse a negative demand shock to see the impact of COVID-19 on domestic and external demand.

The methodology of the study is to analyze the impulse response functions obtained by introducing AR(1) exogenous productivity shocks and AR(1) negative export shocks into the established DSGE model. The results of both versions of the model are then compared with the changes in Turkey's economic variables over the ten-quarter period between 2020 and 2022.

While there are many empirical studies that analyze both negative supply shocks and negative demand shocks, there are very few theoretical studies that consider both types of negative shocks together. In particular, those that have been conducted to identify the COVID-19 crisis

are mostly empirical studies using the Bayesian structural vector auto regression model (Brinca et al. 2021, Sadiq et al. 2021). Our study makes an important contribution to the theoretical literature by modeling the COVID-19 crisis in a DSGE model with supply and demand shocks and analyzing the results together. On the other hand, it should be mentioned that the fiscal policies implemented by the government during the COVID-19 period are only mentioned as a data review in our study, and the inclusion of these fiscal policies in the DSGE model is left for future studies.

The results of the study indicate that the COVID-19 pandemic and associated lockdowns sharply and significantly reduced national income (GDP) and total employment. This led to a decline in the disposable income of households and small businesses, and aggregate private consumption demand and investment expenditure contracted. In addition, Turkey was also affected by the restrictions and measures imposed on foreign trade, and Turkey's exports fell dramatically. This contraction in aggregate demand led to price and general equilibrium effects that were felt in all sectors of the economy and slightly reduced the rise in inflation in Turkey. In this sense, it would not be correct to define this contraction in Turkey as a supply shock or a demand shock. In fact, the effects of both negative productivity and negative export shocks modelled in a small open economy have many similarities with the outcomes of the COVID-19 pandemic in Turkey. Accordingly, a comparison of the first scenario and Turkey's variables during the pandemic suggests that the COVID-19 crisis in Turkey can be characterized as a negative supply shock in terms of the sharp decline in household consumption and capacity utilization. On the other hand, in terms of its devastating impact on GDP, weekly hours worked, employment rate and exports, Turkey's economy is consistent with the results of a negative demand shock.

The study is divided into four sections. Following the introduction, in the second section, It is observed how economic variables in Turkey changed from the first quarter of 2020, when COVID-19 was created, to the end of the second quarter of 2022. For this purpose, chained volume index data of TURKSTAT (2022c) is used to remove the effect of inflation in the study. First, we show how capacity utilization rates, GDP, unemployment rate, weekly hours worked, unemployment rate, capacity utilization rates, GDP, unemployment rate and weekly hours worked have changed in these ten quarters compared to the same periods of the previous

year to get a detailed picture of how Turkey's supply conditions have responded to COVID-19. Second, post-COVID-19 export rates are presented to capture Turkey's external demand, and household final consumption and household private investment rates are presented to capture Turkey's domestic demand. Chapter 2 concludes by answering the key question regarding the government's fiscal policy during the pandemic. To this end, it first provides an economic classification of public expenditures and shows which types of expenditures were concentrated during the pandemic. It then analyzes the evolution of total tax revenues and public debt to show how the government financed public spending during this period.

The third chapter first presents the theoretical and empirical studies on negative supply and demand shocks by conducting a literature review on studies that analyze negative supply and demand shocks together. In the rest of the chapter, Turkey is modeled as a small open economy in a DSGE general equilibrium model assuming monopolistic competition in the goods market and a Calvo price mechanism. It is also assumed that there is imperfect competition in capital mobility and that bonds are risky in a small open economy. These two different shocks are modeled to model the impact of COVID-19 in the economy of Turkey. After solving the model mathematically, an economic interpretation of the impulse response functions is presented.

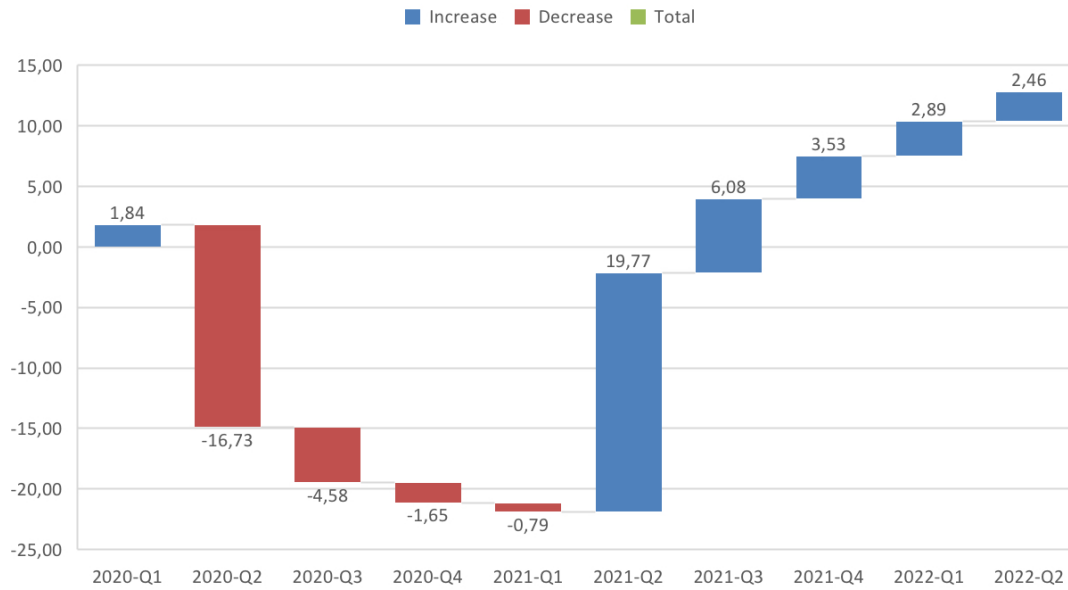
Finally, this chapter compares the changes in Turkey's economic variables in chapter 3 with the results of our model. In this way, we show the extent to which the results of our DSGE model are representative of Turkey in 2020-2022. Finally, chapter 4 concludes our study by evaluating the results of chapters 2 and 3 together.

## **2. DATA REVIEW ON SECTORS AND FISCAL POLICIES IN TURKEY DURING COVID-19**

COVID-19, which hit China in December 2019 and Europe in January and February 2020, was first seen in Turkey on March 11, 2020. First, direct flights from countries where the virus is widespread were restricted. Then, schools and universities in Turkey were closed and people coming from abroad were quarantined in government dormitories for 14 days. In the following days, many places such as museums, shopping malls, movie theaters, wedding organizations, cafes, gyms, and hair salons were temporarily closed. Then, with the mandatory wearing of masks, social distancing, curfews in 30 major cities and other measures, the country's economy faced an unprecedented crisis. This COVID-19 pandemic and the accompanying quarantine regulations have affected every individual in Turkey and in different dimensions. The crisis has led to significant changes in the consumption decisions of many segments of society, such as students, retirees, families, and the investment decisions of traders, large and small companies. As a result of this global crisis that has affected the whole world, countries have experienced a decline in their foreign trade and Turkey has also taken its share of the falling foreign demand.

### **2.1. Supply Conditions**

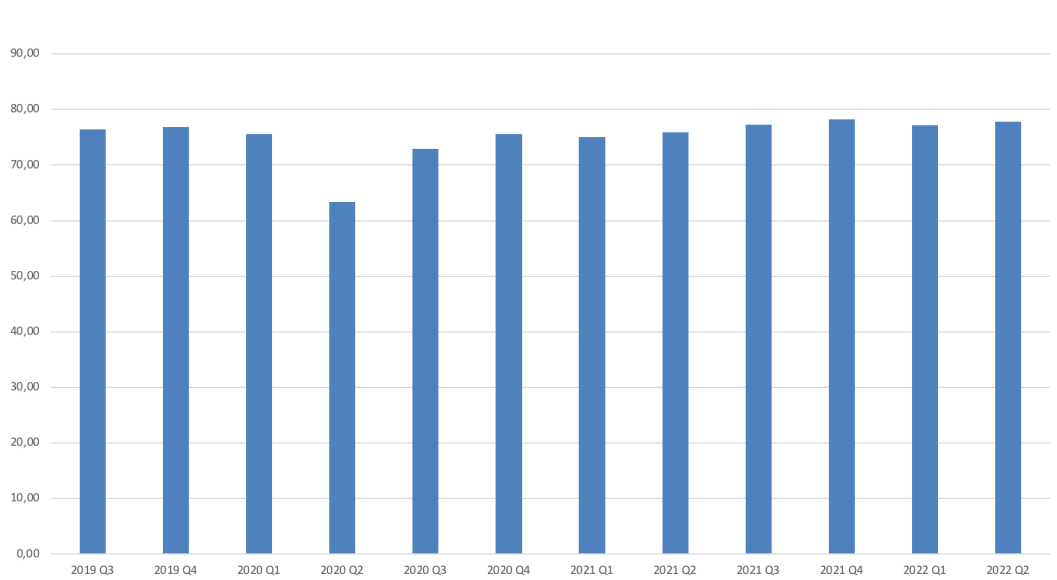
This section analyzes the change in capacity utilization rates before understanding what happened to the supply side in Turkey after COVID-19. Here, seasonally adjusted data of capacity utilization rates are considered in order to neutralize the seasonal effect on economic variables. Then, the change in Turkey's GDP after the COVID-19 crisis until the end of the second quarter of 2022 is analyzed. Moreover, the GDP data based on the chained volume index is analyzed in order to eliminate the inflationary effect on prices. The four main sectors of Turkey - agriculture, industry, construction and services - are analyzed one by one. Finally, in order to understand how the supply in the labor market has changed, we will first observe the change in the unemployment rate and the weekly hours worked. Thus, this section will show what is the supply-side effect of the COVID-19 crisis on the goods and labor markets in Turkey.



**Figure 2.1:** Progress of the Turkey's manufacturing industry capacity utilization rate-seasonally adjusted( % , left column)

Source:CBRT (2022)

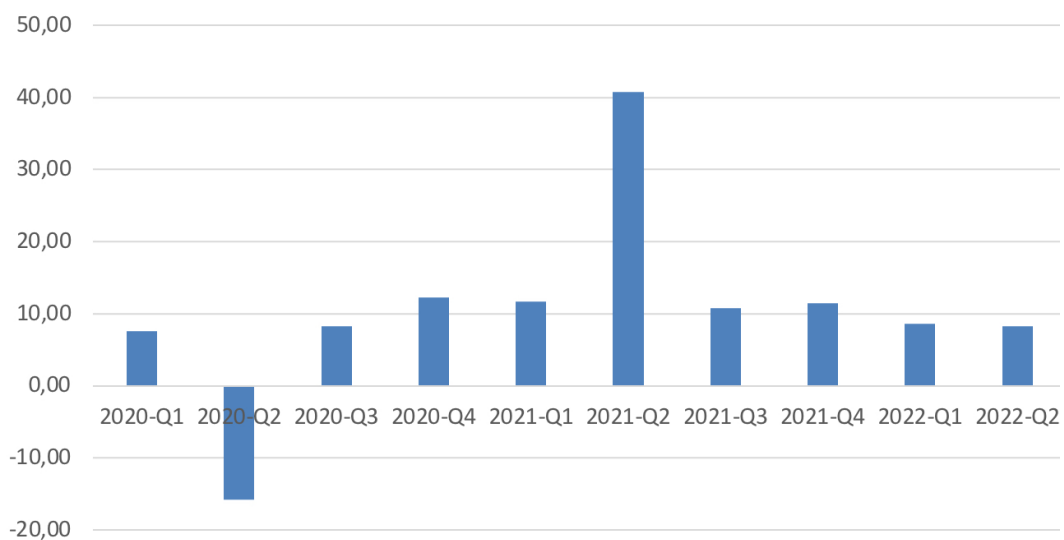
According to Figure 2.1, in the second quarter of 2020, when many facilities were closed and many factories switched to temporary operation, the capacity utilization rate decreased by 16.73% compared to the same quarter of the previous year. This is the sharpest decline in the manufacturing sector. After the second quarter of 2020, the industrial sector gradually recovered. Accordingly, the capacity utilization rate decreased less in each quarter until the second quarter of 2021 compared to the previous year. In the last quarter, the capacity utilization rate of factories increased significantly. In the second quarter of 2021, this rate increased by 19.59% compared to the same quarter of the previous year.



**Figure 2.2:** Progress of the Turkey's manufacturing industry capacity utilization rate-seasonally adjusted

Source: TURKSTAT

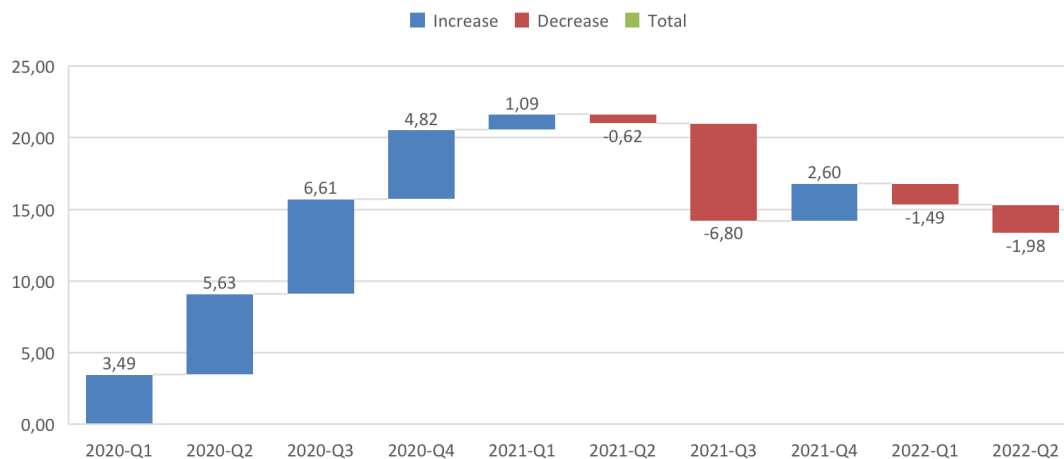
During this period, the temporary unavailability of factories and transportation links, as well as restrictions on access to inputs, significantly reduced capacity utilization rates, as shown in Figure 2.2. Shortages of inputs and delivery delays led to lower production levels and productivity. As a result of this decline in capacity utilization, industrial production declined and total output fell.



**Figure 2.3:** Progress of the Turkey's industrial sector (% change, left column)

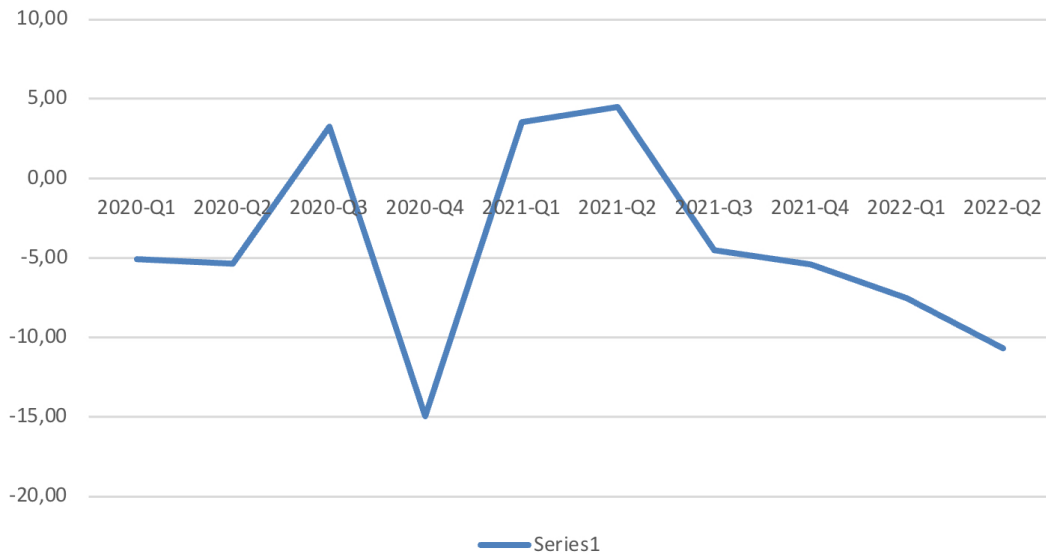
Source: TURKSTAT (2022c)

In the second quarter of 2020, there was a sharp decline in the industry sector. As seen in the Figure 2.3, one of the biggest effects of the COVID-19 pandemic on the economy was on the industrial sector. According to the figure, during the period of COVID-19 outbreak, the industry sector fell by 15.84% compared to the same period of the previous year.



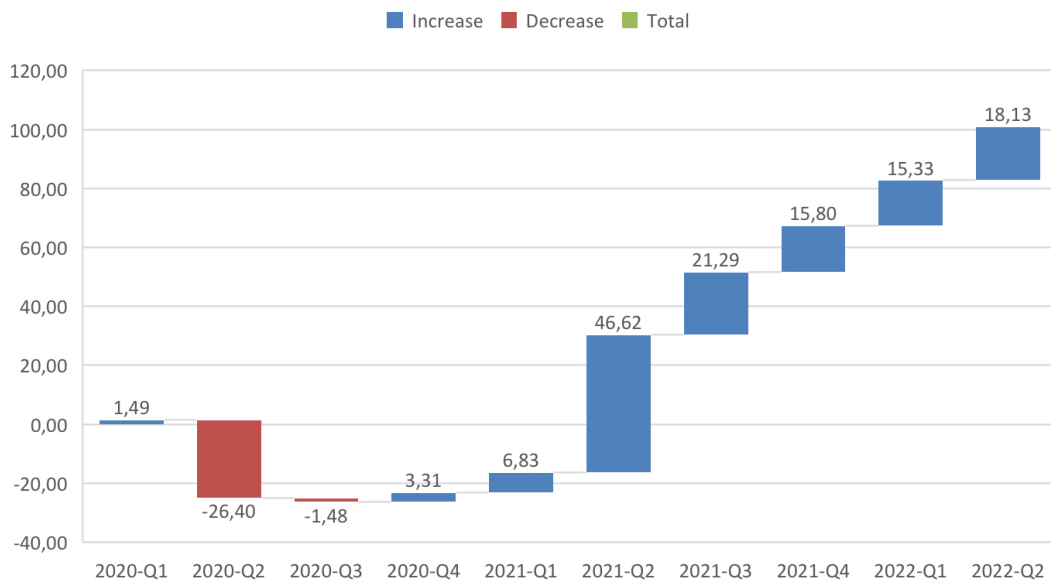
**Figure 2.4:** Progress of the Turkey's agriculture sector (%), left column)  
Source: TURKSTAT (2022c)

As shown in Figure 2.4, among Turkey's four main sectors, agriculture and fisheries were the least affected by the COVID-19 crisis. This is due to the fact that people interact less with each other due to the production mode in agriculture.



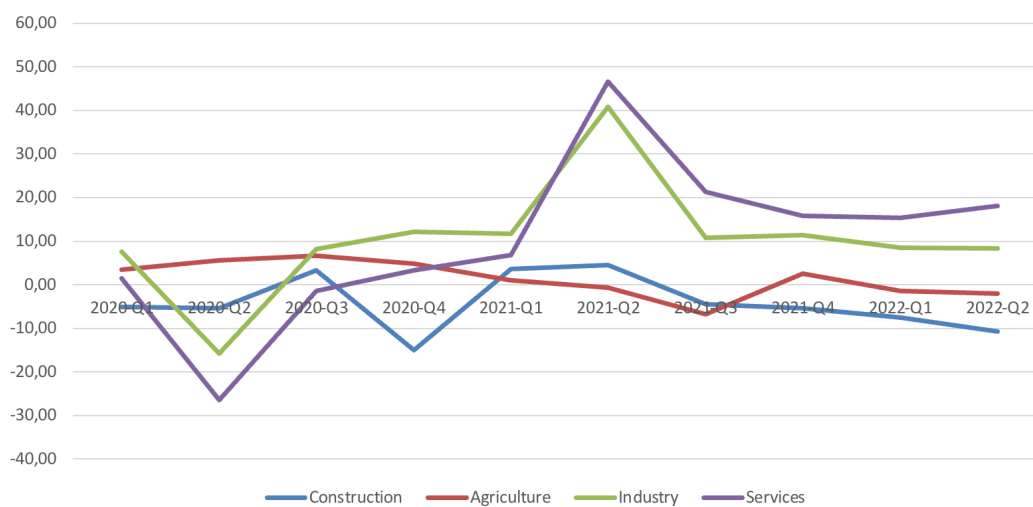
**Figure 2.5:** Progress of the Turkey's construction sector (% , left column)  
Source: TURKSTAT (2022c)

Looking at the Figure 2.5, which shows the growth trend of Turkey's construction sector after the COVID-19 pandemic compared to the previous year, the construction sector, which fell by an average of 5.24% in the first two quarters of 2020 compared to the previous year, fell by 14.96% in the last quarter of 2020.



**Figure 2.6:** Progress of the Turkey's service sector (% , left column)  
Source: TURKSTAT (2022c)

One of the most important sectors in Turkey is undoubtedly the service sector. In the second quarter of 2020, when all cafes, restaurants and entertainment venues were suddenly closed, the service sector fell by 26.40% compared to the previous period. In 2021, there was a significant jump in the service sector in the second quarter, as seen in the industrial sector. During this period, the service sector grew by almost 50%, as seen in Figure 2.6. The main reason for this growth is the complete lifting of the lockdown and the removal of domestic and international travel restrictions.

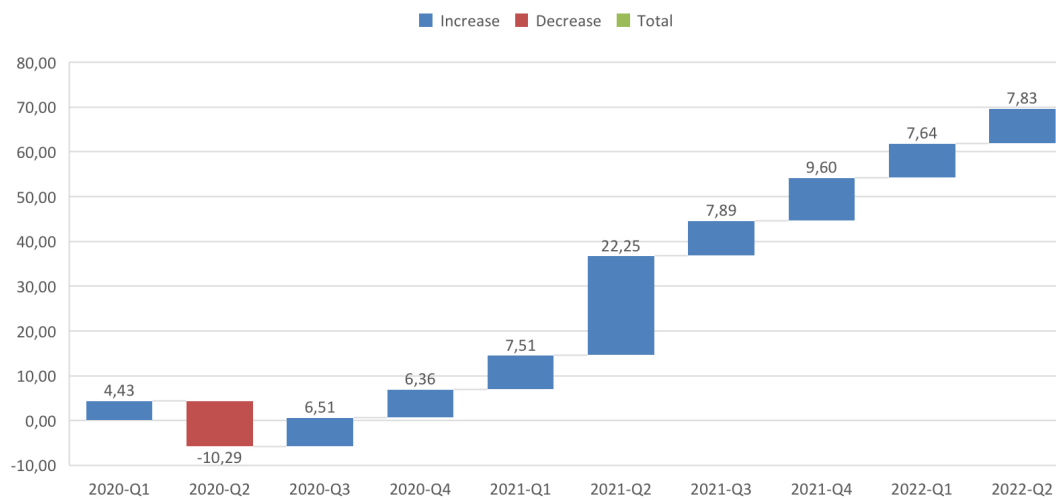


**Figure 2.7:** Progress of the Turkey's four main sectors (% , left column)  
Source: TURKSTAT (2022c)

The Figure 2.7 above shows the changes in Turkey's four main sectors - construction, agriculture, services, and industry - over the ten quarters since the outbreak of COVID-19. As can be seen, the services sector has been hit the hardest by this pandemic, as a result of the economic contraction caused by COVID-19 and the government's quarantine policy. The service sector contracted by exactly 26.4% in the second quarter of 2020. After the service sector, industry is the second most affected sector by the pandemic, contracting by 15.84%. While the construction, industry, and service sectors show negative growth in the second quarter of 2020, the only sector that shows positive growth is agriculture. As a result, the agriculture sector is the least affected by the pandemic, as shown in the Figure.

The second quarter of 2020 was the period in which the negative effects of the crisis were felt most. Figure 2.8 shows that in the year of the COVID-19 crisis, Turkey's GDP decreased by

10.29% compared to the same quarter of the previous year. The decline in industrial capacity utilization, the decline in industrial production, and the ban on many activities in the service sector due to quarantine regulations had a direct and supply-side impact on this negative growth. On the other hand, as discussed in detail in the section on demand conditions below, the significant decline in demand and net exports in the transportation, tourism, and entertainment sectors is the direct demand-side cause of this negative growth.

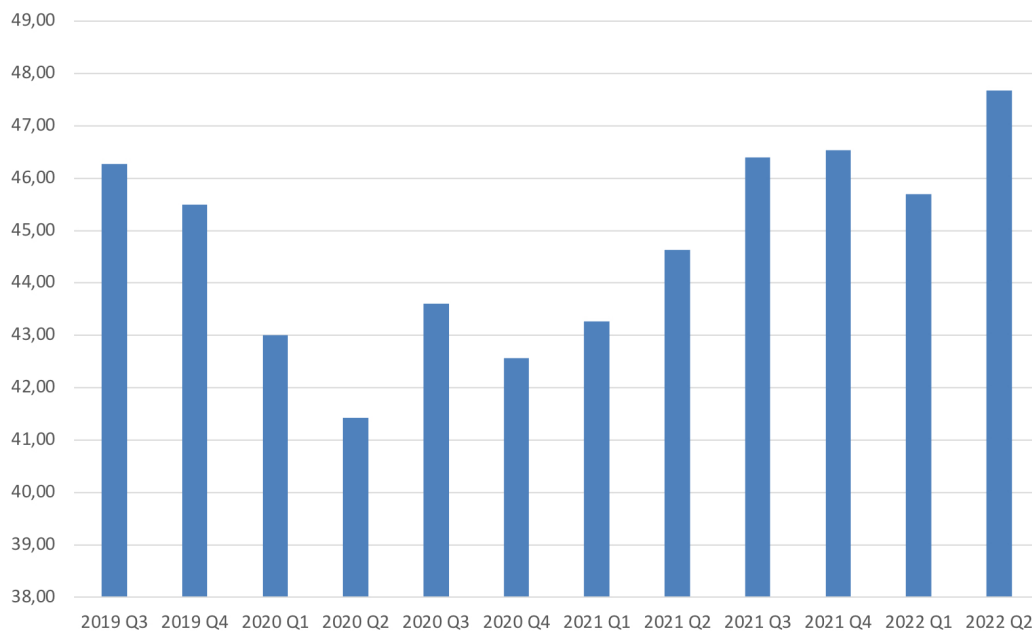


**Figure 2.8:** Progress of the Turkey's GDP (% , left column)  
Source: TURKSTAT (2022c)

In addition, COVID-19 and quarantine regulations have an indirect impact on the economy at the level of production and consumption. Taymaz (2020) considers the input-output relationship at the production level when analyzing the impact of COVID-19 and quarantine rules on GDP. For example, oil is used as an input for air transportation, so the decline in production in the air transportation sector, which was restricted during the COVID-19 period, also led to a decline in demand and production in other oil-using sectors. The second relationship is at the level of consumption. According to this relationship, during COVID-19, workers in the restricted sectors consumed not only their own products but also the products of other sectors. thus, the decline in income of workers in the restricted sectors reduced the demand for the products of other sectors. thus, the result was indirect losses in output and income in other sectors as well.

In summary, analyzing the impact of the pandemic at the sectoral level, the five sectors with the largest declines in real output compared to 2019 are accommodation and food services,

tourism, construction, air transport, and iron and steel. Private consumption expenditure is also down significantly in air transport, accommodation and catering services and tourism. This contraction in output also has an impact on the sectoral distribution of employment (Voyvoda and Yeldan, 2020).

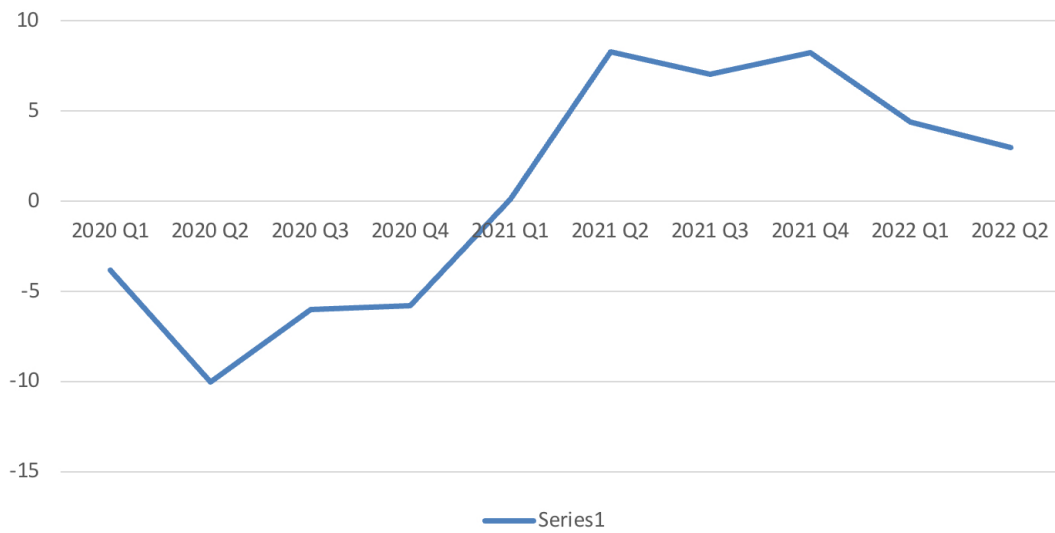


**Figure 2.9:** Progress of the Turkey's employment rate (% , left column)

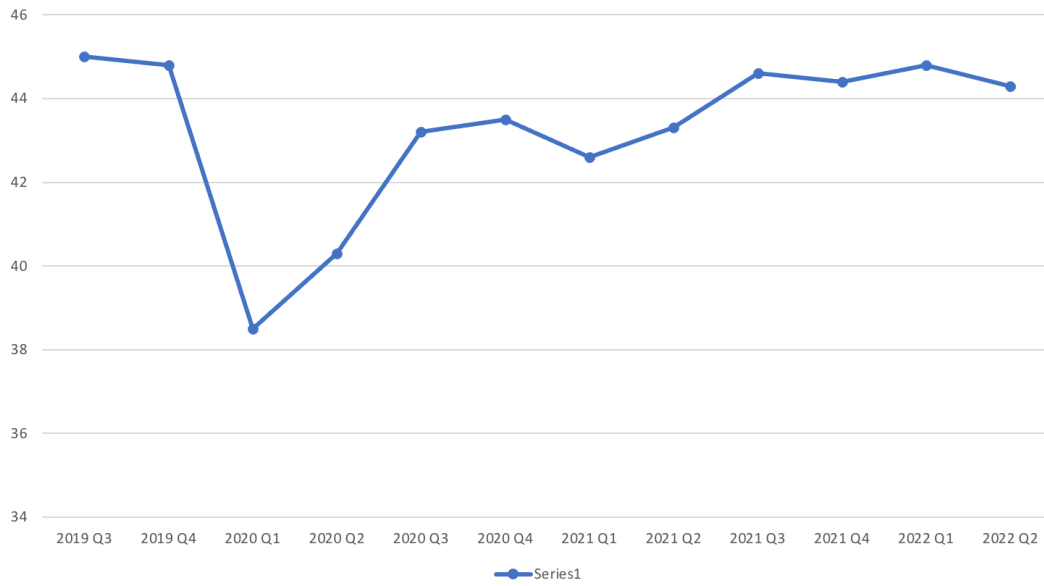
Source: TURKSTAT (2022e)

As shown in Figure 2.10, while the employment rate in Turkey was 45.5 percent before COVID-19, it decreased significantly to 41.43 percent after COVID-19. The restrictions due to the COVID-19 pandemic and the sharp decline in aggregate demand have significantly decreased the national income (GDP) and output. Shock waves from the restricted sectors reduce total employment and increase the unemployment rate. In particular, the sectors most affected by the pandemic are accommodation and food services, travel agencies, performing arts and entertainment services, library, archives, and museum services, sports and recreation services, and air transportation services. As a result of the contraction in these sectors, the overall demand for labor contracted. In fact, many employers in the service sector laid off workers and operated with fewer employees during this period. For example, in accordance with the quarantine regulations, operators reduced the number of tables in cafes and restaurants, thereby reducing their customer service capacity. Such measures that reduce the service capacity

of the service sector and the decline in demand for the service sector have reduced the need for employers to hire workers such as waiters, cleaners, etc. In April 2020, 56.7% of Turkey's employment was in services, 20.9% in industry, 17.5% in agriculture and 4% in construction. During this period, the most significant job loss occurred in the service sector (Çalışkan et al., 2020). As a result, the fact that the largest job losses occurred in the service sector is a significant factor in the decline in the overall employment rate.



**Figure 2.10:** Progress of the Turkey's unemployment rate- düzey  
Source: TURKSTAT (2022e)

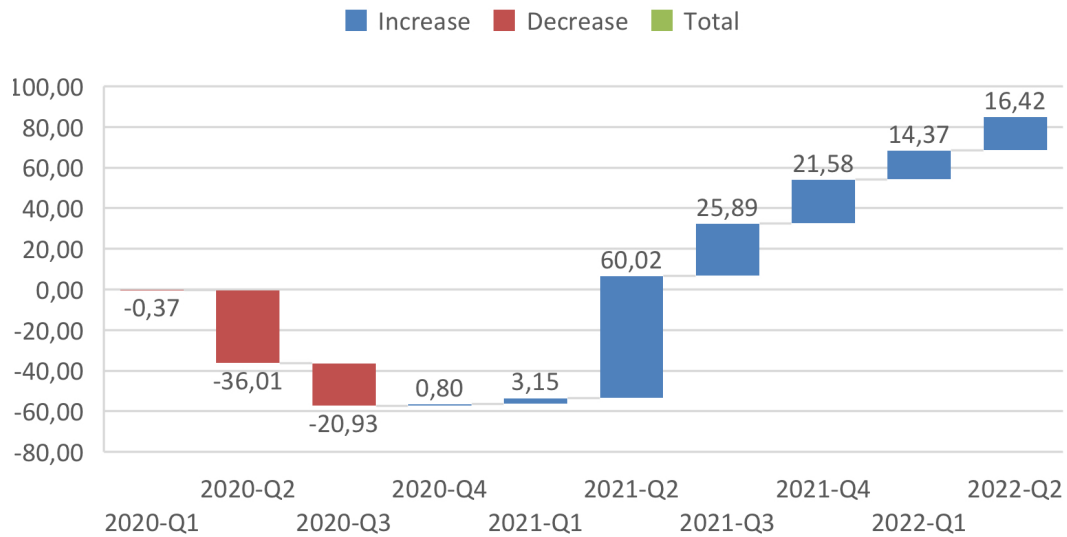


**Figure 2.11:** Progress of the seasonally and calendar adjusted actual working hours of employed (level)

Source: TURKSTAT (2023e)

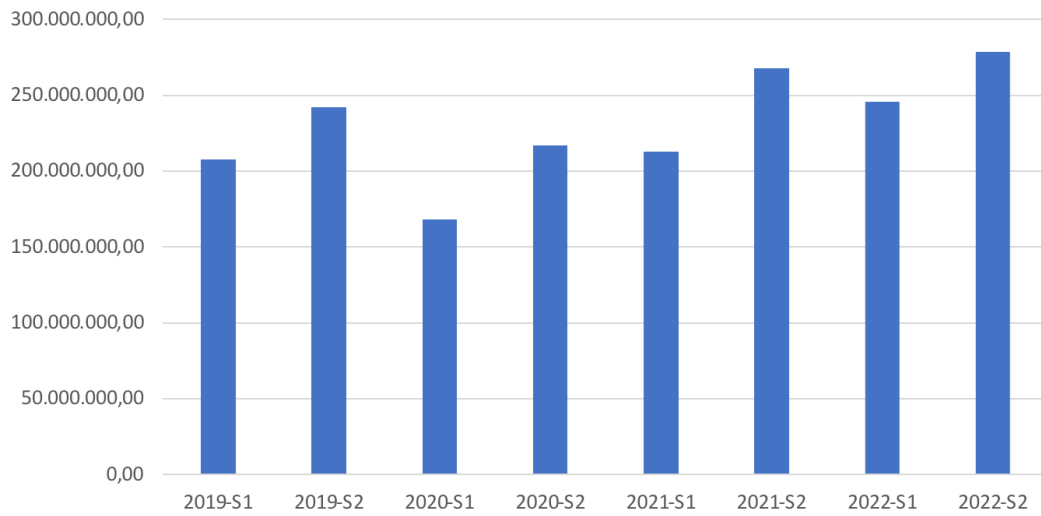
Before COVID-19, the average weekly working hours in Turkey was 44.8. There was a significant decrease in the first quarter of 2020, when COVID-19 arrived in Turkey, and in the second quarter of 2020, when the impact of the pandemic was felt the most. As shown in Figure 2.11, average weekly working hours decreased by four hours on average in the second quarter of 2020 compared to the pre-COVID-19 period. Aytun and Özgüzel (2020) emphasize that a number of measures taken to contain the pandemic, particularly lockdowns, have resulted in a significant portion of the labor force being unable to find work or reducing the number of hours worked.

## 2.2. Demand Conditions



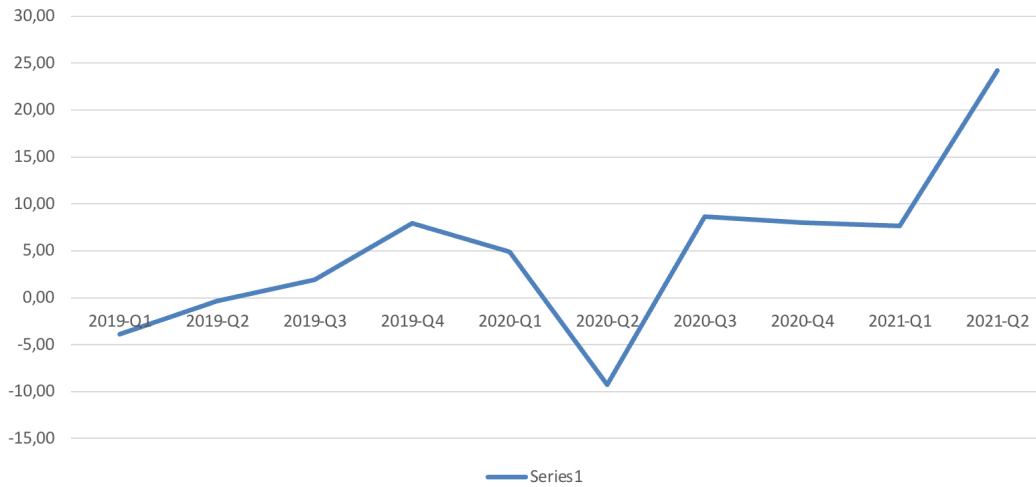
**Figure 2.12:** Progress of the Turkey's net export (% , left column)  
Source: TURKSTAT (2023d)

Protectionist tendencies in foreign trade have increased in most countries of the world and the volume of international trade has decreased. Turkey has also had its share in this decline in world demand. Looking at the Figure 2.12 above, exports fell by 36.01% in the second quarter, the largest decline in recent times. Although the economy began to recover in the third quarter of 2020, new waves of the pandemic led to the reintroduction of restrictive measures around the world. The volatility of the pandemic is a determinant of the volatility of foreign trade.



**Figure 2.13:** Level of exports in Turkey with chained volume index data  
Source: TURKSTAT (2022a)

Also, with regard to the period before the arrival of COVID-19 to Turkey, the level of net exports was 241,913,320.56 thousand TL in the second season of 2019. With COVID-19, there has been a very high decrease in the level of net exports. The strong negative impact of the COVID-19 shock on external demand has been mitigated, as the impact of the shock has decreased. As it can be seen in the Figure 2.13, in the second season of 2020, net exports increased again above 200,000,000.00 thousand TL. In the second season of 2021, it reached and even exceeded the export level of the pre-COVID-19 period.



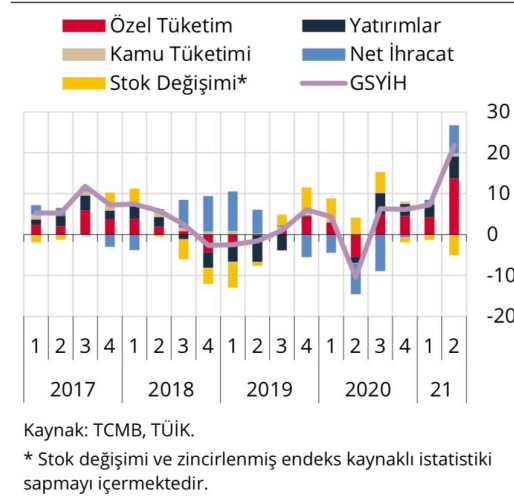
**Figure 2.14:** Progress of the Turkey's household final consumption (% , left column)  
Source: TURKSTAT (2023d)

As can be seen in the Figure 2.14, in the second quarter of 2020, household final consumption decreased by about 9% compared to the same quarter of the previous year. There are several reasons for this decline in household consumption. First of all, one reason for the decline in household consumption is the decline in national income and hence in the purchasing power of households. As a result of income losses due to unemployment and wage contraction during the pandemic period, the private disposable income of households and firms, and thus the demand ratio of total private consumption expenditure, declined.

Second, the atmosphere of uncertainty brought by the pandemic led individuals to postpone their demand for goods other than basic necessities. Thus, while demand for basic necessities, especially food, cleaning and health, increased, demand for education, entertainment, arts and culture fell to its lowest level. In addition to the panic experienced by consumers during the pandemic, the quarantine measures implemented in addition to the panic experienced by consumers during the pandemic caused market imbalances by changing the usual consumption patterns of households (McKibbin and Fernando, 2021). In particular, the service sector, where consumption activities are carried out in environments where people are concentrated and involve direct physical contact, has been greatly affected by this process (Wren-Lewis, 2020). For example, quarantine rules imposed on sectors such as eating and drinking out, entertainment, education, bans on going out on weekends, etc., are factors that directly and

indirectly increased the contraction of aggregate demand, especially in the service sector. As a result, people's desire to avoid the virus and mandatory quarantine rules occurred as a negative consumption shock in the economy of Turkey, and the decline in aggregate demand had a significant negative impact on GDP and production.

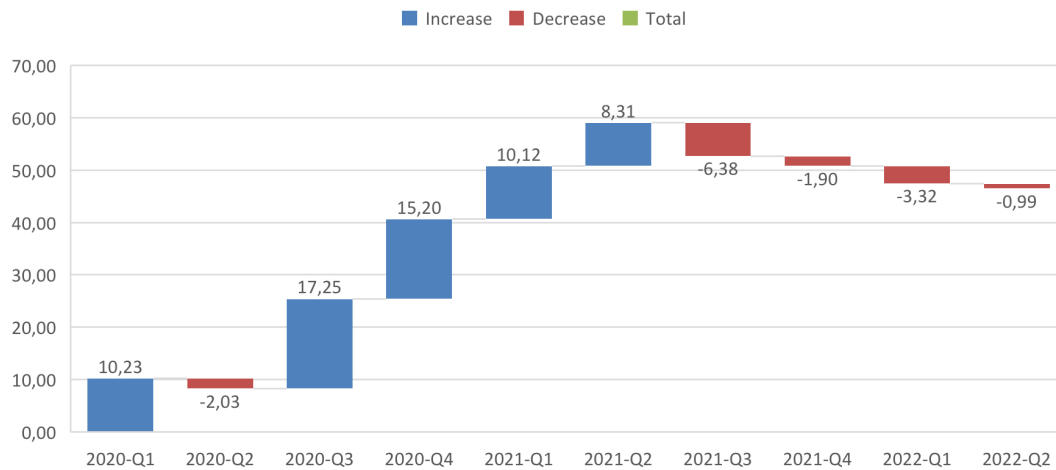
**Grafik 2.3.3: GSYİH Yıllık Büyümesine  
Harcama Yönünden Katkılar (% Puan)**



**Figure 2.15:** Contributions to GDP growth in terms of expenditure (% , left column)  
Source: TURKSTAT

The Figure 2.15, which shows private consumption, private investment and net exports together, shows which type of demand contributes more to GDP growth. Looking at the path of private investment, there was a decline in investment with the COVID-19 pandemic. With the arrival of COVID-19 in Turkey in March 2020, uncertainties have arisen regarding the epidemiologic course of COVID-19 and what economic measures will be taken and how they will be implemented. The sudden decline in economic activity and the unknown timing of the end of the pandemic have increased the uncertainties in the economy. These uncertainties that prevailed in the economy during this COVID-19 period disrupted individuals' investment expectations. As a result, individuals limited their investment expenditures to be cautious during this crisis period. Thus, most firms reduced and postponed their investment expenditures. In the third quarter of 2020, there was a significant increase in private investment. The reason for this increase could undoubtedly be the supportive policies of the government, such as tax cuts to support businesses. This increase in private investment continued until the end of the

second quarter of 2021.



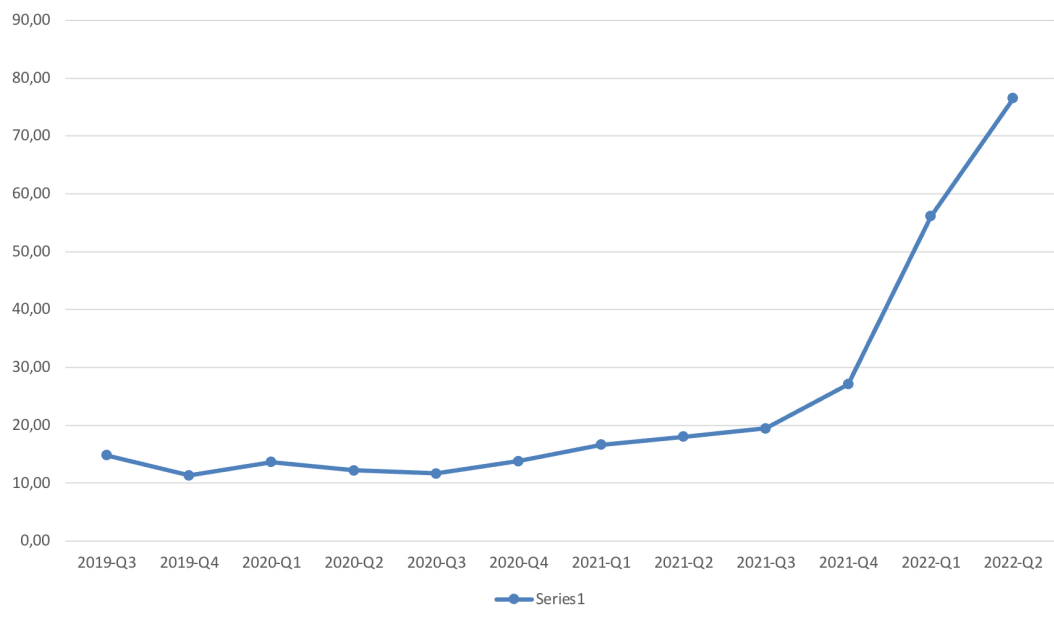
**Figure 2.16:** Progress of the Turkey's tax subsidy (% , left column)  
Source: TURKSTAT (2022b)

The Figure 2.16 above shows how much the tax cuts implemented by the government have changed compared to the previous year on a quarterly basis. As can be seen in the Figure, in the second quarter of 2020, when COVID-19 appeared, the government's tax cuts decreased compared to the previous year. As can be seen in the Figure, in the third quarter of 2020, the tax cuts increased significantly. This increase continued to decrease thereafter. In the second quarter of 2020, tax cuts decreased compared to the same quarter of the previous year, while in the 3rd quarter of 2020, tax cuts increased by 17.25% compared to the third quarter of the previous year. The reason for this increase, which began in the third quarter of 2020 and continued thereafter, is the government's implementation of the Economic Stabilization Shield package. With this package, the government granted tax cuts and tax deferrals to many small businesses. This is the answer to why companies significantly increased their private investments after the third quarter of 2020 compared to the previous year.

Private investment, which was declining before the COVID-19 pandemic, continued to decline after the pandemic. Disregarding the government's business support policies, the impact of COVID-19 on private investment is negative. Net exports, which were on an upward trend before COVID-19, continued to have a positive impact on GDP in the first two quarters of the crisis. However, with the rapid spread of COVID-19 around the world, there has been a

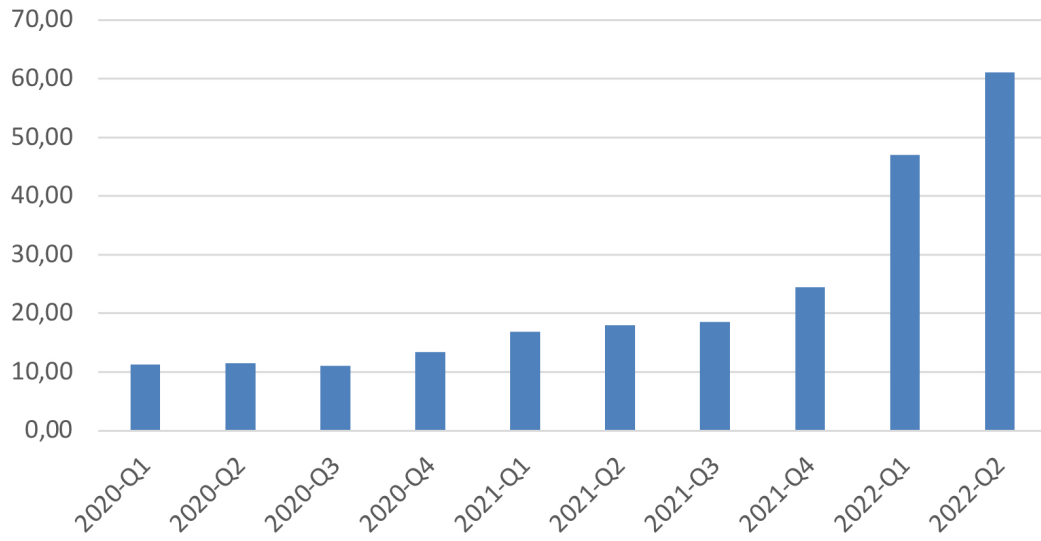
decline in exports over time due to restrictions on foreign trade, etc. By 2021, when the effects of the crisis had subsided and foreign trade restrictions had been completely lifted, exports had risen sharply again. Household consumption, the most important variable of aggregate demand, was slightly negatively affected in the first two quarters of 2019. After the second quarter of 2020, the negative impact of the crisis on household consumption has completely disappeared. In summary, the COVID-19 crisis had a negative impact on private investment, household consumption and net exports.

### 2.3. Price Evolution



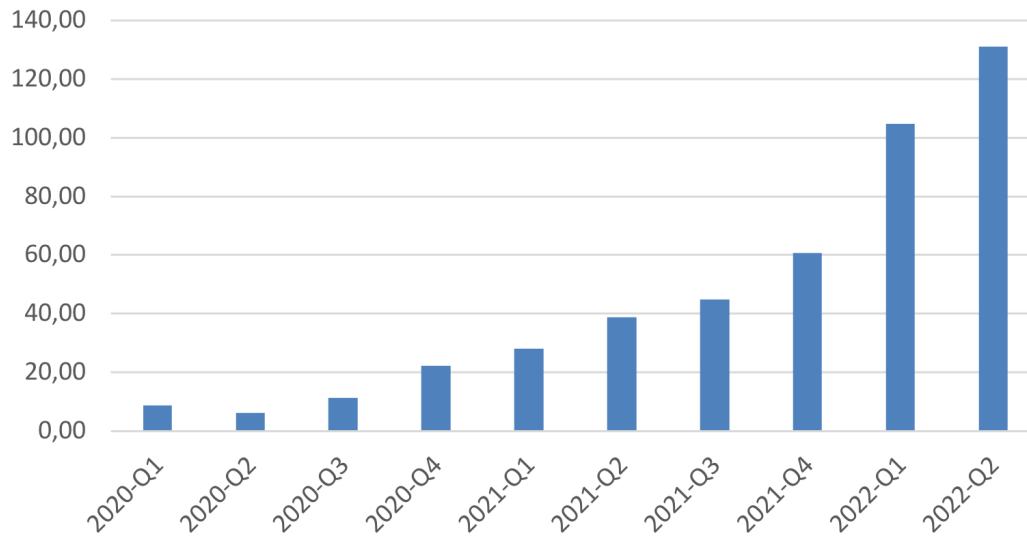
**Figure 2.17:** Progress of the Turkey's seasonally adjusted CPI (% , left column)  
Source: TURKSTAT (2022d)

In the pre-COVID-19 period, the average seasonally adjusted CPI increased by 13.04% year-on-year. With COVID-19, there was a slight increase in the rate of increase of the CPI in the first and second quarters of 2020 compared to the previous quarter. However, it should be emphasized that this was only an average increase of 1%. By 2022, there will be significantly larger increases in the CPI. As the Figure 2.17 shows, the increase in this inflation in 2022 is more than 50%.



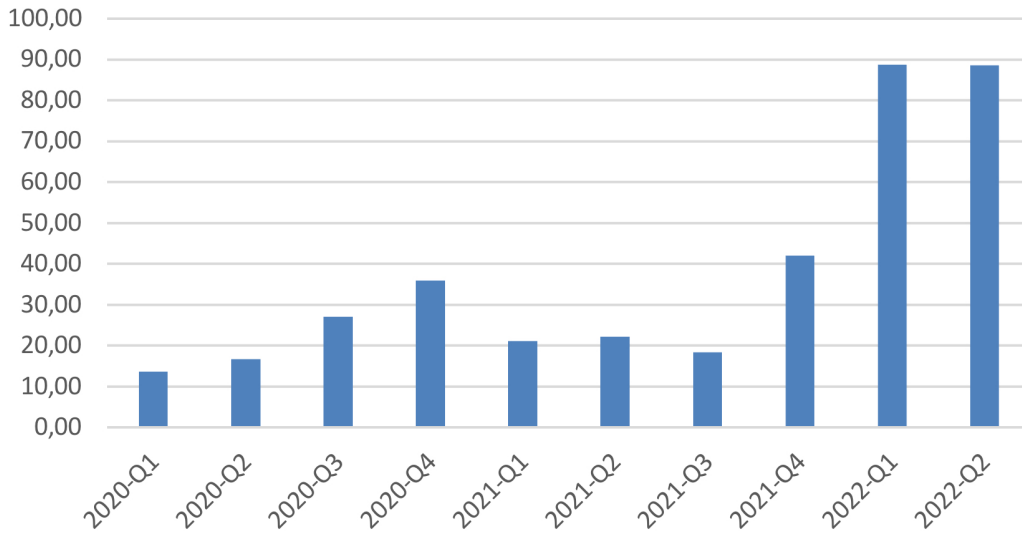
**Figure 2.18:** Progress of the Turkey's core CPI (% , left column)  
Source: TURKSTAT (2022d)

Accordingly, the core CPI in the first quarter of 2020 will increase by 11.23% compared to the same quarter of the previous year. From the second quarter of 2020 to the second quarter of 2021, the average rate of increase in the core CPI is about 11.99%. This shows that after COVID-19, the growth rate of the core CPI has slowed down year on year. In the following years, the rate of increase of the core CPI continues to increase significantly.



**Figure 2.19:** Progress of the Turkey's PPI (% , left column)  
Source: TURKSTAT (2023b)

Looking at the Figure 2.19 the average PPI in 2020, when COVID-19 revealed, is only a small figure of 12.14%. However, in 2021, the PPI increases significantly in each quarter. In 2022, the average PPI of the first two quarters increased by 117.83% compared to the same quarters of the previous period. As can be seen from the CPI, core CPI and PPI charts, although the depreciation of the Turkish lira in recent years has had an inflationary effect, the decline in aggregate demand during the pandemic period has largely mitigated this inflationary effect. The COVID-19 crisis had a negative impact on production, investment, household consumption, employment, exports, and household consumption in the economy of Turkey, leading to recession. As can be seen, the contraction in demand led to price and general equilibrium effects that spread to all sectors of the economy.



**Figure 2.20:** Progress of the exchange rate - USD (foreign currency purchases) (% , left column)

Source: TURKSTAT (2023c)

According to the Figure 2.20, in the first period of 2020, the exchange rate increased on average by 13.70% compared to the first quarter of the previous year. In the fourth quarter of 2020, it increased significantly by 35.89% compared to the previous year. In the first two quarters of 2020, the exchange rate increased significantly, by an average of 88.65

## 2.4. Fiscal Policies

The COVID-19 crisis had a profound impact on both the economy and human health. As a result of the crisis, Turkey faced a decline in demand, loss of production and employment due to shutdowns, and stagnation or sudden stop of portfolio investments from abroad. During this period, the government implemented various policies to prevent these problems caused by COVID-19. While some of these policies consisted of health spending to strengthen the health infrastructure, an important part of these policies consisted of various fiscal policies to reduce the impact of the crisis on the economy. The government provided subsidies to protect workers' incomes. It also provided liquidity support to companies and guarantees on their debts to prevent them from going bankrupt during this period. The government directly increased the fiscal burden during this period by increasing transfer spending, wage subsidies and tax cuts. Increase in transfer spending, wage subsidies and tax cuts. On March 18, 2020, the government

announced the Economic Stabilization and Development Package, which covers these major public expenditures and various public expenditures. The package introduced a number of transfer and current expenditures and various tax cut measures to support households and firms, as detailed in the section on public spending and tax revenues below. One of these expenditures is the short-time work allowance to support unemployed workers and firms that interrupt their activities. An additional 2 billion TL has been allocated for social policies to support families in need. With the Economic Stability and Development Package, non-classical policies such as credit support to enterprises in need through public banks have been implemented.

Some of these guidelines are as follows;

- The down payment for housing loans under 500 thousand TL has been reduced to 10%.
- Arrangements have been made for the Turkey Wealth Fund to acquire or become a partner in strategically important private companies.
- Principal and interest payments on the debts of crisis-affected companies to banks have been postponed for three months.
- For tradesmen and craftsmen, the principal and interest payments on loans to Halk Bank for the months of April, May and June were postponed for three months.
- The CGF limit has been increased from 25 billion to 50 billion in order to meet the liquidity needs of SMEs.
- Agricultural loans due in May and June were deferred for six months.
- Three public banks (Ziraat Bank, Halk Bank and Vakıf Bank) provided loans with a 6-month grace period and a 36-month maturity at an interest rate of 7.5% in order to allow companies to maintain their current employment structure (MTF, 2022).

The above-mentioned provision of low-cost loans by public banks and loan repayments indirectly affect public policy as they are reflected in the budget. However, since the model will only include public expenditure in the classical sense, these indirect government supports and measures will not be mentioned in our study.

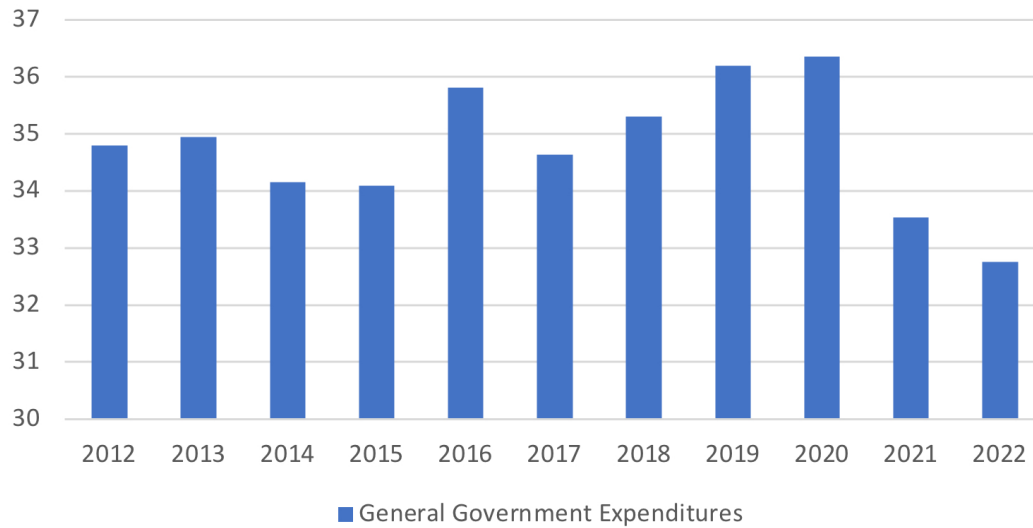
Some of the fiscal policies in post COVID-19 Turkey are policies with contractionary economic effects. These policies stem from the search for new financing due to the increase in the budget deficit in 2020. Because tax cuts and public expenditures create an additional burden on the budget. In this regard, contractionary fiscal policies have been implemented in Turkey in order to finance public deficits. In line with this contractionary fiscal policy, additional tariffs have been imposed on imports of 400 products on May 11, 2020. Some of these products include white goods, precious jewelry, sports equipment, and industrial equipment. This section will first discuss the government's fiscal policy, then the various public expenditures that were made during this period to mitigate the effects of the economic crisis, and then how the government financed these public expenditures.

#### **2.4.1. General Government Expenditures**

Turkey, like many other countries, has made various public expenditures against the damages caused by COVID-19 in public health and economy. For this purpose, while some of the existing public expenditures have been reduced, the amount of some of them has been increased considerably. In addition, many public services that were not on the agenda before were added to the agenda during this period. For example, a health monitoring system was introduced for citizens over 80 years old who live at home alone. Aid of up to 6 million TL was provided to local companies producing disinfectants, masks, protective equipment for health workers, gloves and goggles. New expenditures, such as the distribution of protective masks and cologne for citizens over 65 in Ankara and Istanbul, were included in the government's policy, which led to the diversification of public expenditures. On the other hand, many new hospitals were opened. It was also decided that the minimum pension would be 1500 Turkish Liras (MTF, 2022). The purpose of this subsection is to analyze the behavior of the government that makes these and many other public expenditures mentioned below. According to the economic classification, the changes in current, investment and transfer expenditures over the last ten years are analyzed separately. This shows how much each type of expenditure increased or decreased before and after the pandemic.

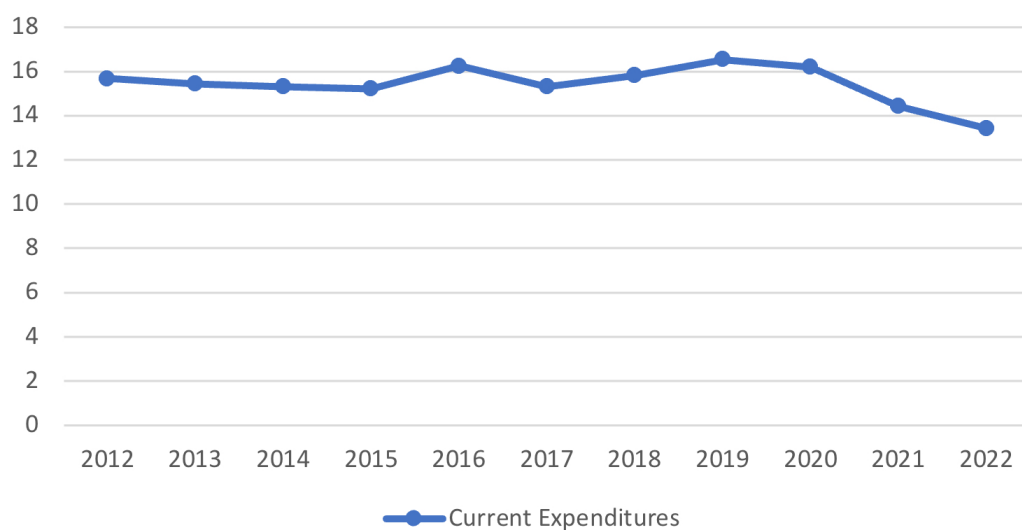
Looking at general government expenditure from an overall perspective, it is clear that general government expenditure has been on a growth trend for a long time. However, it must

be said that the ratio of general government spending to GDP peaked in 2020, as shown in Figure 2.21.



**Figure 2.21:** Progress of general government expenditures (as of GDP, left column)  
Source: PSB (2022a)

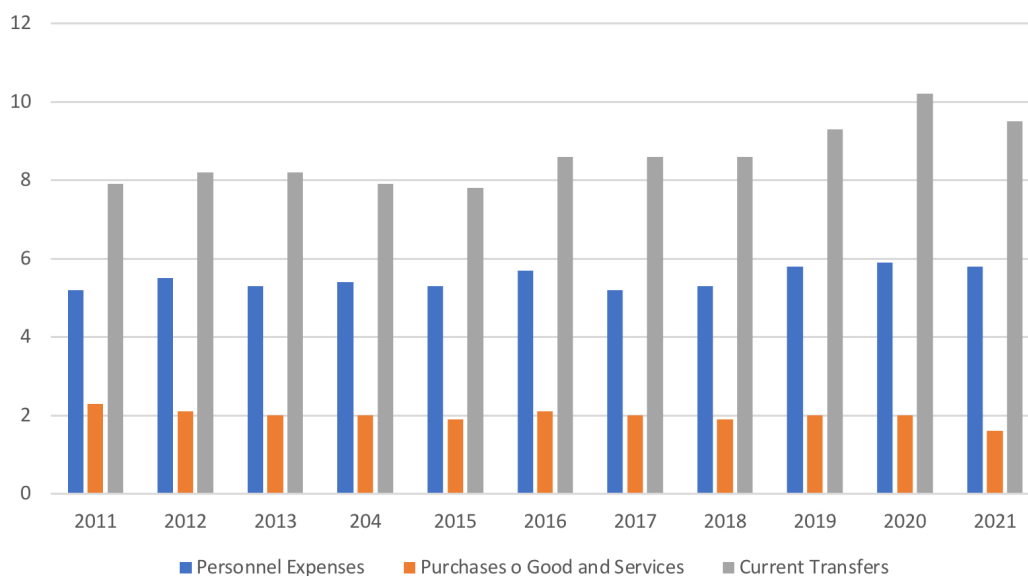
At the end of this section, these three types of spending are compared to show where government spending was most concentrated during the pandemic.



**Figure 2.22:** Progress of current expenditures (as of GDP, left column)  
Source: PSB (2022a)

The Figure 2.22 shows that the share of current expenditure in GDP is 16.2 % in 2020. This high share of current expenditure means that the government spends significantly more on current expenditure in 2020 than in COVID-19. Which items of current expenditure the government focuses more on is also explained below.

Current expenditure includes reciprocal payments other than payments for capital assets or for goods or services to be used in the production of capital assets, and non-reciprocal payments for purposes other than to increase the financial capital of recipients, other than to enable recipients to acquire capital assets and to compensate recipients for the destruction of or damage to capital assets. According to PSB (2022b), personnel expenses, social security expenses, purchases of goods and services and interest expenses are called "current expenses". Unconditional payments made to finance current purchases of goods and services are called "current transfers". In this context, personnel expenses, purchases of goods and services, and current transfers are presented below.



**Figure 2.23:** Current expenditures items (as of GDP, left column)  
Source: MTF (2020)

Personnel expenses include basic salaries, salary increases, compensation, social rights, additional work provisions, rewards and bonuses of civil servants, contract personnel, severance payments of workers and wage payments of temporary personnel (PSB, 2022b).

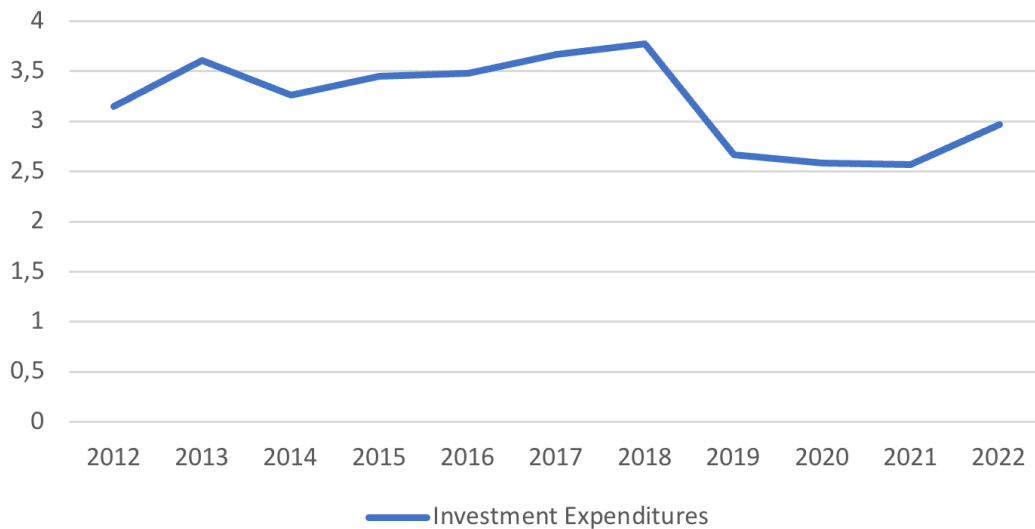
According to the Figure 2.23, personnel expenditure, which was about 5.4 percent of GDP in 2011, increased to 5.8 percent in 2020, the year the pandemic was declared. In 2020, the government spent the highest amount on personnel expenditures in a decade. The main reason for this high rate is that the public sector focused on personnel expenditures in the health sector with the Economic Stability and Development package announced during the pandemic period. Below are some examples of public expenditure;

- 32,000 health workers were recruited.
- Additional course fees for paid teachers and master teachers continued to be paid during this period.
- It was decided that all health workers would be paid at the highest level, the ceiling level, for 3 months. An additional 4.5 billion TL was allocated for this purpose.
- In addition, performance payments for university hospital employees were paid at the ceiling level for 3 months. An additional support of 1.2 billion TL was provided for this (MTF, 2022).

Such expenditures lead to an increase in the share of personnel expenditures in GDP. In 2021, however, the government sharply reduces its personnel expenditures, and the share falls to 4.8 percent, according to the Figure 2.23. This 2021 figure is the lowest in the last decade. Overall, 2020 is a peak year for the government in terms of current expenditures, personnel expenditures, and expenditures for the purchase of goods and services. Of course, the increase in these three expenditure ratios should also be evaluated in light of the decline in GDP. This is because 2020 is also a period in which Turkey's GDP declined significantly. This decline in GDP may be a reason for the increase in the ratio of these three types of expenditure to GDP. In 2021, there was a significant decline in the ratio of all three types of expenditures to GDP.

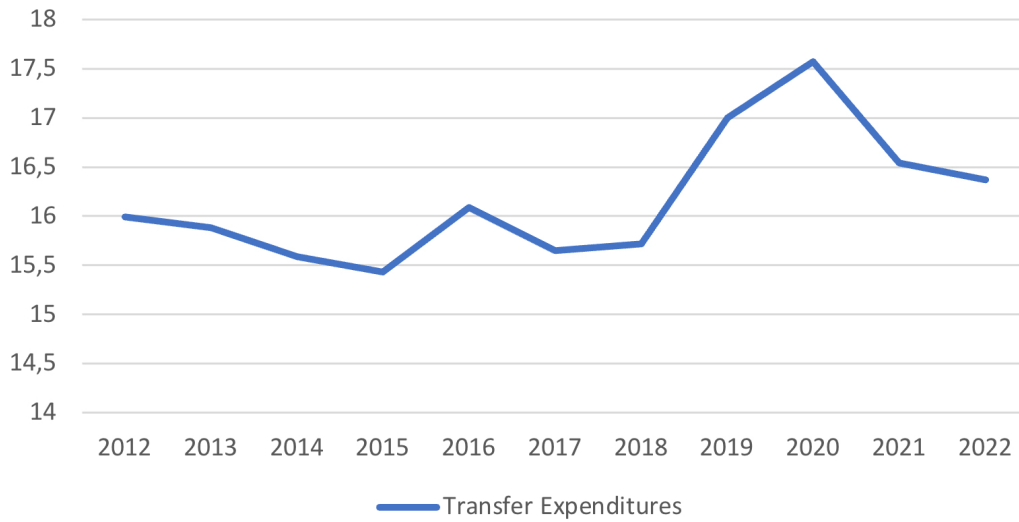
During the pandemic, many countries spent more on protecting public health and the economy than on long-term expenditures. This has led to a decrease in the focus on investment spending. In this sense, Turkey is no different from other countries. Looking at Figure 2.24, from 2011 to 2020, the share of transfer expenditures in GDP was 3.05 on average. In 2020, there was a sharp decline in investment spending and it fell to 2.58. In 2021, when the pandemic continued, it

was 2.57. In 2021, when the gradual normalization began, the ratio of investment expenditures to GDP increased to 2.97, as seen in Figure 2.24.



**Figure 2.24:** Progress of investment expenditures (as of GDP, left column)  
Source: PSB (2022a)

In other words, in 2021, when the economy started to recover, the government slightly increased its investment spending, but it is still at a very low level compared to previous years. While the average share of transfer expenditures in GDP was 15.73 between 2011 and 2019, this ratio increased to 17.57 in 2020. In 2020, there is a noticeable break in transfer expenditure. The ratio of transfers to GDP is the highest in the last decade. In 2021, it is again at a high level of 16.63, as shown in the Figure 2.25. This is because the government's social transfers and economic transfers to protect households and firms facing economic hardship in the pandemic have increased transfer expenditures to this extent.



**Figure 2.25:** Progress of transfer expenditures (as of GDP, left column)  
Source: PSB (2022a)

Social transfers to households;

- The Ministry of Family and Social Services has allocated an additional budget of 2.1 billion TL for needy families.
- With this budget, it was decided to pay 1,000 Turkish Liras each to 2.1 million families.

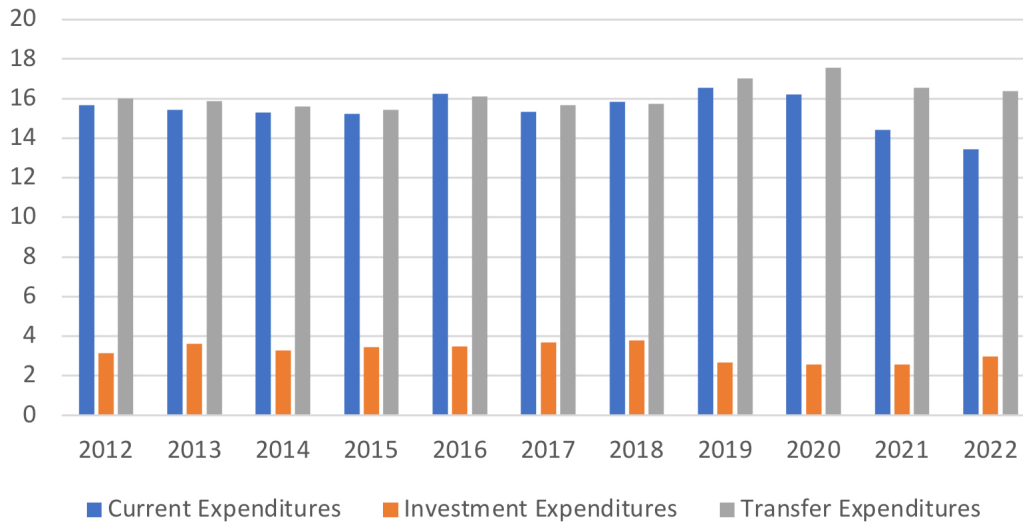
Economic transfers to businesses;

- During this period, up to 6 million TL was given to local companies producing disinfectants, masks, protective equipment for health workers, gloves and goggles.
- R&D and design companies located in the Technology Development Zone were exempted from paying rent for 2 months. 5,682 enterprises were targeted to benefit from these measures.
- Inventory financing support was provided to exporters to maintain capacity utilization during the temporary slowdown in exports.
- Minimum wage support continued. As part of the support, 75 TL per day was applied

for 12 months regardless of the size of the enterprise. About 7.8 million people benefited from the support.

- Measures were taken to make the legislation on flexible and remote work more effective.
- In order to prevent layoffs, short-time work allowances were introduced for employees in workplaces affected by the coronavirus and the conditions for using them were simplified.
- The short-time work allowance provides 3 months of salary support to citizens working in companies that are reducing or ceasing their activities. In this way, temporary income support is provided to employees who suspend their activities at their workplaces, and the costs for employers are reduced.
- In the event that companies that have benefited from incentives related to short-time work, short-time work allowance and unpaid leave return to normal operations, three months of social security contributions will be covered by the Unemployment Insurance Fund.
- Cash wage support of 39 TL per day/ 1170 TL per month was allocated to workers who had to take unpaid leave or could not benefit from short-term jobs. In return, companies are prohibited from dismissing workers. 1.9 million workers received 3.6 million TL.

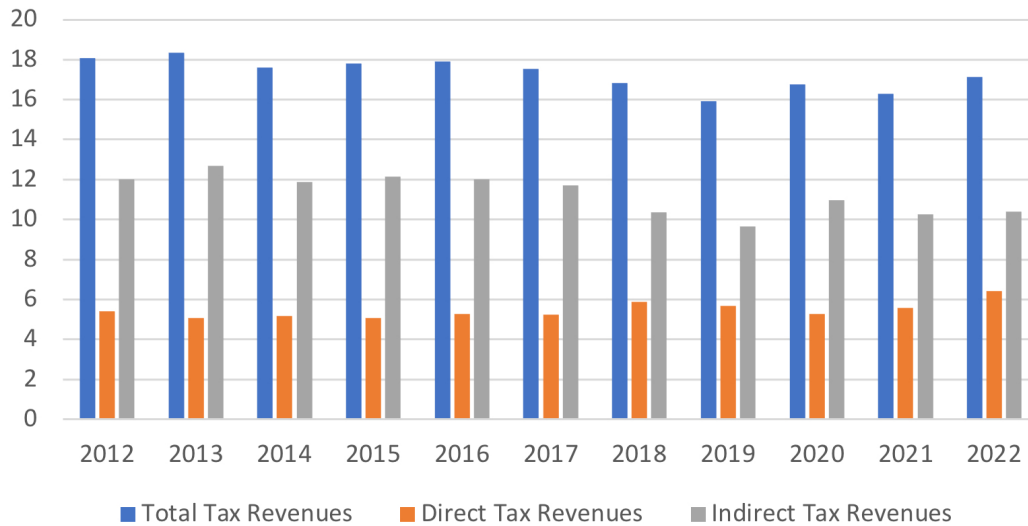
In addition, this package introduced fiscal transfers to municipalities during this period. Accordingly, an additional 3 billion TL was provided to the municipalities. In the monthly tax payments of the municipalities, 3 billion TL will not be deducted for 3 months (April - May - June). Thus, an important resource will be provided to all municipalities within the framework of the fight against the corona virus (MTF, 2022). As a result of the transfers to protect households, businesses and local governments from the negative effects of COVID-19, transfer expenditures have increased significantly compared to the average rate in the pre-COVID-19 period, as shown in the Figure 2.25.



**Figure 2.26:** Progress of the Turkey's public expenditures  
Source: The Ministry of Treasury and Finance (2022)

Figure 2.26, which shows all three types of expenditures together, shows that current and transfer expenditures followed almost the same path between 2011 and 2022. In 2020, the government increased transfer expenditures to mitigate the negative impact of COVID-19 on households and firms. The chart shows that while current expenditures declined in 2020, transfer expenditures increased sharply, reaching a decade high. In addition, investment spending in 2020 is at its lowest level in a decade. As a result, in 2020 the government focused primarily on transfers and secondarily on current spending, rather than on investment spending.

## 2.4.2. General Government Revenues



**Figure 2.27:** Progress of tax revenues (as of GDP, left column)

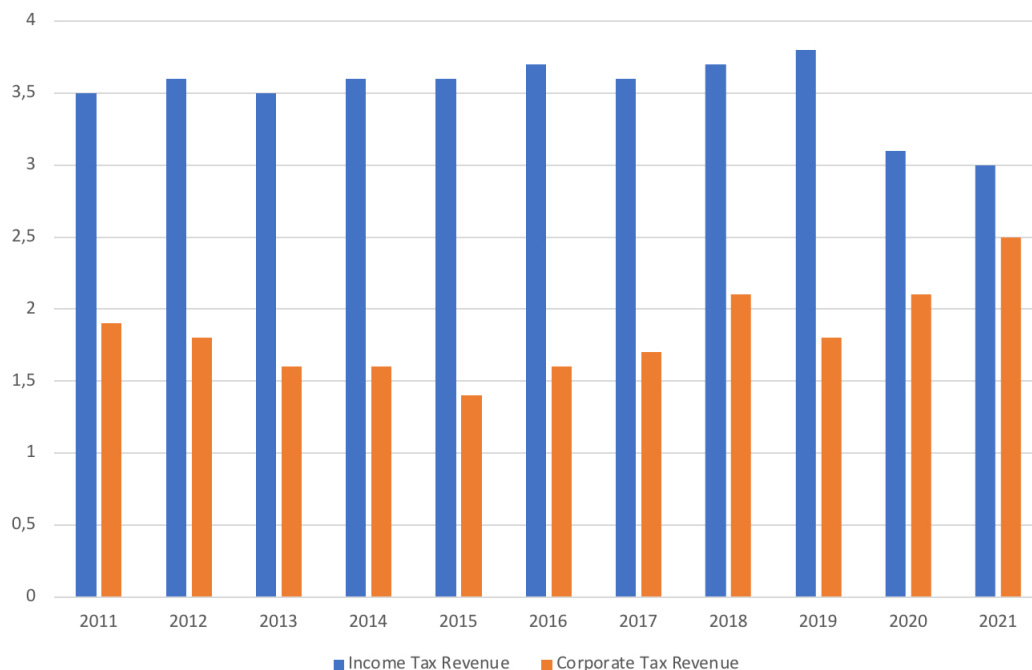
Source: PSB (2022a)

Looking at the Figure 2.27, the share of total tax revenues in GDP in 2020 will increase by 16.77% compared to the previous year. This growth rate in 2020 is higher than the growth rate in 2019. This is due to the increase in the share of indirect tax revenues in GDP in 2020. In 2020, tax cuts and tax deferrals were applied to direct taxes with the economic stabilization shield. As a result, the share of direct tax revenues in GDP in 2020 falls to 5.26% year-on-year. On the other hand, indirect taxes increased from 9.66% to 10.95% of GDP in 2020, as the government raised the aforementioned VAT, SCT, and other indirect tax rates. Thus, this increase in indirect taxes increased the share of total tax revenue in GDP.

Some of the direct tax deferrals and reductions implemented by the government with this package are as follows:

- This package extends the deadline for filing and paying income tax returns until March 24, 2020. In this context, taxpayers affected by the corona virus epidemic and within the curfew (over 65 years old and chronically ill) are considered as force majeure according to the Tax Procedure Act.
- Taxpayers subject to income tax on commercial, agricultural and professional income

who are directly affected by the COVID-19 outbreak and whose main field of activity is retail trade, including shopping centers, medical services, iron and metal equipment manufacturers, construction services, production of commercial kitchens, production and trade of automobiles and production of parts and accessories for the automobile industry, logistics and transportation, including car rental, storage activities, artistic services, publishing activities. The situation of taxpayers engaged in accommodation activities, including tour operators and travel agencies, food and beverage services, including restaurants and cafes, textile and clothing production and trade, and event and organizational services, including public relations, as well as the situation of taxpayers engaged in the sectors in which the workplaces have decided to temporarily suspend their activities within the framework of the measures taken by the Ministry of the Interior with respect to their main field of activity on the first of April in 2020 and the thirtieth of June in 2020 between the dates of May 1, 2020 and of June 30, 2020, the fulfillment of their tax obligations has been postponed by accepting a force majeure situation (MTF, 2022).



**Figure 2.28:** Turkey, corporate tax, income tax between 2011-2022  
Source: PSB (2022)

The decrease in direct taxes is due to the decrease in income tax. Looking at the Figure 2.28 prepared with data from the Ministry of Finance, the share of income tax in GDP declined from 3.8 in 2019 to 3.1 in 2020. On the other hand, the share of corporate tax in GDP was 1.8 in 2019. This ratio rises to 2.1 in 2020. As a result, in contrast to the development of personal income tax, the share of corporate tax in GDP has not decreased, but rather increased. In summary, with the package introduced in 2020, the government reduced personal income tax but not corporate tax. This led to a decrease in the share of personal income tax in GDP in 2020 and thus to a decrease in direct taxes.

On March 18, 2020, the government postponed VAT and social security contributions for 6 months in April, May and June in various service subsectors in order to stimulate the economy. These sectors can be classified as retail, shopping malls, iron-steel, automotive, logistics-transportation, cinema, theater, accommodation, food, textile, apparel and event organization. In the following days, various health services, furniture, mining, construction, publishing and income tax payers were also included. The amount deferred by a total of 2 million taxpayers reached 54 billion TL. Some of the government's tax cuts on indirect taxes are as follows:

- Import duties on sunflower oil were reduced to stabilize the price of basic foodstuffs.
- Value Added Tax (VAT) was reduced from 18% to 8% in sectors such as wedding organizations, housing maintenance, tailoring, passenger transportation, dry cleaning. VAT on accommodation, food and beverages, cinema, theater, museum fees was reduced from 8% to 1%, and withholding tax on workplace rent was reduced from 20% to 10%.
- VAT rates on private school fees have been reduced from 8% to 1%.
- The 1% BITT on foreign exchange and gold purchases was reduced to 2% per thousand, the same rate as in May.
- It was agreed that the accommodation tax will not be applied during 2020. The accommodation tax has been postponed to January 1, 2021 (MTF, 2022).

In 2020, despite the above-mentioned expansionary fiscal policy, the indirect tax ratio rose sharply to 10.95 (Figure 2.27). This is because while the government implemented these

expansionary policies to finance existing public deficits, it also implemented revenue-raising policies to finance the public deficit. The policies to increase indirect taxes are as follows;

- An additional 50% tariff was imposed on the import of game consoles. This rate was reduced to 20% in October, 2020.
- Additional tariffs were imposed on more than 3,000 products, mainly industrial goods, textiles, toys, furniture, sweaters and shoes.
- 400 products were subject to additional import duties. "Gold and precious stone jewelry, refrigerators and freezers, dishwashers, washing machines, split air conditioners, stoves and cooking appliances, water filters, turbo compressors, engine parts, golf carts, textile unwinders, various hand and agricultural tools, metal articles, gypsum building materials, wooden doors and windows, Prefabricated structures, iron and steel wires, ropes, cables, cords, copper cables and ropes, flooring and floor coverings, adhesive tapes, rubber sheets, timing devices, musical instruments, game instruments, skis and sports equipment, locks, hinges, scissors, brushes, zippers, lighters, hygiene products, tripods" are some of these products. An additional duty of 30% until September 30, 2020, followed by an additional duty of 25% until September 30, 2020.
- surveillance was imposed on imports of mobile phones. Accordingly, it was decided to impose a surveillance of 200 dollars per unit on the import of mobile phones.
- Imports of 800 additional products will be subject to additional tariffs. Some of these products are construction machinery, cranes, agricultural machinery, some iron and steel products, contact lenses, marble, granite, television receivers. It was decided to apply additional tariffs of 30% until September 30, 2020, and 10% thereafter.

BITT rate for foreign currency gold purchases was increased from 2 per thousand to 1%. In addition, the withholding tax on financing bonds was raised from 10% to 15%.

additional 20% customs duty was imposed on 40 textile, garment, leather, footwear and similar products.

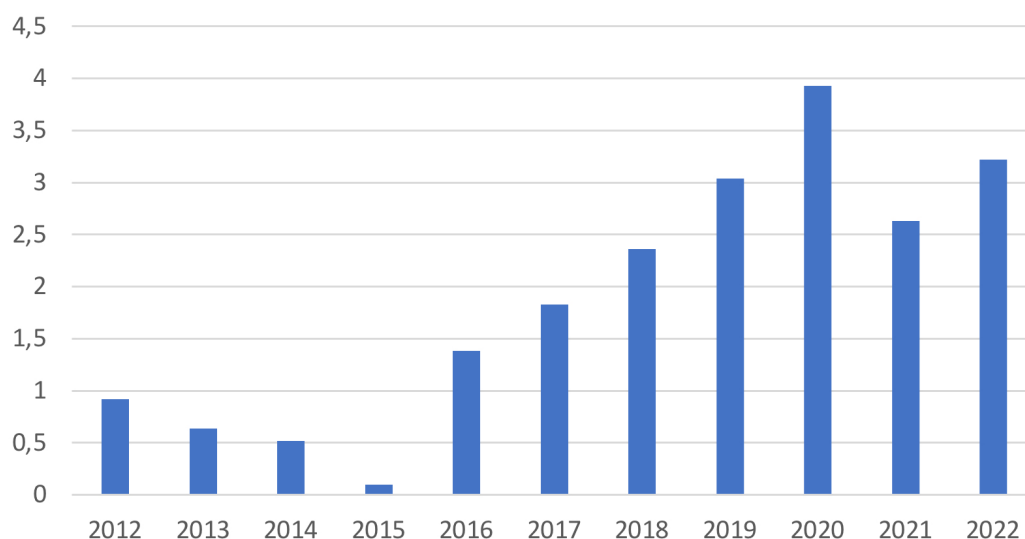
- 115 agricultural products were subject to additional duties and a housing fund. Customs

duties on imports of some products were reduced, but a higher amount of collective housing fund was introduced than the reduced customs duty.

- The SCT rates were updated. "The lower limit of the tax base for cars under 1600 CC engine volume has been increased from 70 thousand TL to 85 thousand TL, while the SCT rate for cars over 1600 CC has been increased.

In the short term, the accommodation tax was postponed, rent withholding for companies was abolished, and VAT on various goods and services was reduced and postponed. To summarize, in 2020 the government introduced various tax cuts and tax deferrals to compensate for the losses suffered by businesses affected by the COVID-19 pandemic and to stimulate the economy. To this end, it implemented tax cuts in both indirect and direct taxes. These tax cuts are one reason for the decline in direct taxes in 2020. What should be noted, however, is the increase in indirect taxes in 2020. Despite these tax incentives in both indirect and direct taxes, indirect taxes increase significantly in 2020. This is because the government simultaneously increased indirect tax rates in order to finance the growing public deficit. It also made new decisions regarding indirect taxes and started to levy indirect taxes on many products, import and customs good during the pandemic period. Therefore, despite significant tax cuts in 2020, there was a large increase in indirect taxes and thus in total tax revenues. In fact, the total tax burden has increased and the source of tax revenue has been indirect taxes rather than direct taxes.

As international trade has slowed or even stopped around the world due to COVID-19, a small open economy like Turkey has been severely affected. Turkey's macroeconomic indicators have also been negatively affected as the pandemic has led to very serious health costs. In 2020, Turkey's net borrowing requirement, which consists of domestic and external borrowing, increased sharply. Since 2020, this increase in the ratio of net borrowing to GDP indicates how public spending was financed during the pandemic.



**Figure 2.29:** Evolution of the Turkey's net borrowing between 2011-2022  
Source: PSB (2022a)

While international trade slowed down or even stopped worldwide due to COVID-19, Turkey was also severely affected by this pandemic. In Turkey, many expansionary monetary and fiscal policies were implemented in the first phase of the crisis. Since March 18, Turkey has introduced a series of measures such as tax cuts, short-time work allowances, support for unpaid leave, and cheap conditional loans from public banks. Public health spending and transfers to businesses and individuals to stimulate the economy have led to an increase in public spending. As a result of these measures, the gap between public revenues and expenditures widened. This has put pressure on the budget and created new and additional financing needs. Since April 2020, various revenue-raising measures have been taken, such as increases in customs duties, SCT, BITT, and foreign exchange taxes. In addition to these measures, austerity measures have been implemented in public institutions. However, these measures have not been sufficient to close the public deficits. As a result, Turkey's net borrowing requirement, which consists of domestic and external borrowing, increased sharply in 2020.

The Figure 2.29 shows that the government borrowing requirement as a share of GDP averaged only 1% from 2011 to 2019. In 2019, the borrowing requirement rose sharply to over 3% percent and remained above 3% in the following period. The ratio of net borrowing

to GDP reached its highest level of the last decade in 2020. This increase in the ratio of net borrowing to GDP in 2020 shows how public spending was financed during the pandemic.

## **2.5. Literature Review**

There are various theoretical and empirical studies in the literature to determine whether a shock is supply-side or demand-side. Among the theoretical studies, studies that define the current shock by looking at the price and quantity effects in the goods market are quite popular. Enders and Hurn (2007) argue that there is a simultaneous correlation between supply and demand shocks. A positive demand shock shifts an aggregate supply curve to the right. A positive supply shock leads to a fall in prices. Because if the supply increases, prices fall. Blanchard and Quah (1989) characterises the properties of both types of shocks. In this way, they tried to identify what type of shock COVID-19 is by analysing its short-term and long-term effects. For this, they first hypothesised that fluctuations in GNP and unemployment are caused by two types of frictions. They assume that demand frictions do not have a long-run effect on unemployment and output. Supply frictions, on the other hand, do not have a long-run effect on unemployment, but may have a long-run effect on output. In their study, they present a simple model in which they estimate the vector auto regressive representation process. This gives output and unemployment as functions of demand and supply disturbances. According to the model, the effects of demand disturbances on output and employment peak after one year and disappear after two or three years. On the other hand, a positive supply disturbance has a positive long-run effect on output. Initially, it increases unemployment slightly. After this increase, the effect reverses after a few quarters and unemployment slowly returns to its original steady-state value. Due to nominal rigidity, the model suggests that demand disturbances have short-run effects on output and unemployment. In the long run, only supply disturbances, i.e. productivity disturbances, affect output. In this sense, the paper relates demand shocks to nominal rigidity and supply shocks to real rigidity. From a general point of view, there are critical perspectives stating that it is wrong to say that the pandemic shock is only a supply shock or only a demand shock. According to Brinca et al. (2021), COVID-19 had a different impact on each sector. For example, demand for sectors such as shopping malls and theatres has completely disappeared, while demand for general merchandise retailers has increased. Using

the methodology proposed by Baumeister and Hamilton (2015), they identified the labour supply and demand shock in the industrial sector. They also applied Bayesian vector auto regression (SVAR) to real wages and hours worked statistics for each two-digit NAICS sector in the US to identify the joint dynamics of the rate of growth of real wages and hours worked in a given sector. Accordingly, they interpret the elasticity of labour supply and demand as the elasticity of the increase in hours worked with respect to real wages. In the second quarter of 2020, the decline in hours worked due to curfews, etc., was defined as a negative decline in labour supply. On the other hand, as a result of the lockdown measures, people are prevented from demanding some goods and services that require some degree of physical contact for consumption, such as eating out. In this way, the reduced demand for businesses reduces the demand for labour. This in turn reduces wages and thus household income. This leads to less spending on other goods and services, regardless of the level of physical contact. Therefore, a negative demand emerges in sectors that are not affected by quarantine. In this sense, they have demonstrated the relationship between demand and supply shocks. There are other studies that describe the impact of COVID-19 on the goods and services market by studying supply and demand shocks in the labour market. For example, del Rio-Chanona et al. (2020) conduct a quantitative study on the supply and demand shocks caused by COVID-19 in the USA. In their study, they first evaluate social distancing measures as a negative supply shock. With an RLI, they analyse the vitality of jobs and the possibility of working from home. Since waitresses and construction workers do not work in a vital sector and cannot work online from home, their RLI scores are low. Therefore, they are very vulnerable to supply-side shocks. People's desire to avoid the virus was evaluated as a decrease in demand. A high decrease in demand in the entertainment and leisure sector was observed during this period. The conclusion of the study is that the supply effect of COVID-19 on sectors is higher than the demand effect. In other words, most of the production and service sectors are considered as non-essential and non-working from home sectors. On the other hand, the study shows that the transport sector is more exposed to a demand-side shock because people do not want to have physical contact with others or spend a lot of time in the same environment.

## 2.6. Discussion

Looking at the path of the change in GDP at current prices is not a good way of identifying whether the COVID-19 shock is a supply shock or a demand shock. GDP at current prices does not give the price effect of the shock because price and quantity effects are combined in these data. Therefore, the study uses chained volume index and GDP data to separate the price and quantity effects. Moreover, it would not be a correct conclusion to say that COVID-19 had a downward effect on supply in Turkey just by looking at the decline in GDP. This is because one should consider whether the rate of decline of GDP, which was already on a downward trend, increased after COVID-19. Looking at the period before COVID-19, Turkey's GDP showed negative growth of 2.56% and 1.66% in the first and second quarters of 2019, respectively. In the first quarter of 2020, Turkey showed positive growth of around 4%. Accordingly, prior to COVID-19, Turkey tended to grow negatively from time to time and to grow positively at low rates from time to time. In the 2nd quarter of 2020, COVID-19 contracted the Turkey's economy by as much as 10.29%. In this sense, it can be said that COVID-19 has fallen the already falling GDP by as much as 10%. And in this sense, it is clear that the COVID-19 crisis has been a supply contraction crisis in Turkey in terms of GDP.

In order to identify the type of a shock, it is important to separate the price and quantity effects of the shock. For this purpose, CPI and PPI are the data that allow us to monitor the inflation trend. However, the critical point to note is that looking at the price increase and saying that there is inflation and therefore a negative supply shock or a positive demand shock would not be a correct conclusion in the case of Turkey. Because deflation has not been observed in Turkey for many years. Inflation prevailed for many years before the COVID-19 crisis. Therefore, in this study, we analyzed the change in price indices based on the percentage increase or decrease in prices compared to the same quarter of the previous year. Thus, a decrease in the rate of price increases in the CPI and PPI is considered deflation, and an increase in the rate of price increases is considered inflation. The CPI increased by about 12 percent year-on-year in the first quarter. In the second quarter, there was an increase of 11.65 percent, 11.76 percent in the following periods and finally 13.51 percent.

However, in order to get rid of the inflationary effect of the exchange rate, it was first observed in the PPI. Accordingly, in the first quarter of 2020, Turkey's PPI increased by around

8% compared to the previous year. In the period of the pandemic, there was an increase of 6%. As can be seen, there is a slight decrease in PPI in the quarter when the pandemic appeared. In subsequent periods, as the effect of the pandemic began to fade, the rate of increase in the PPI increased significantly. In summary, if we look at the small increases in CPI and PPI, then it can be said that COVID-19 does not have an inflationary effect in Turkey.

It is also clear that the COVID-19 crisis did not manifest itself as a positive demand shock in Turkey. This is because the demand of households and firms depends on income. In a period of rising unemployment, household income and hence consumption fall. In order to understand what happened to aggregate household demand in Turkey, the rate of increase in unemployment, which is one of the seasonally adjusted labor force indicators of TURKSTAT, was analyzed. Accordingly, the rate of increase in unemployment in Turkey prior to COVID-19 tended to increase after the second quarter of 2018. However, this rate of increase increased unprecedentedly in the quarter in which COVID-19 arrived in Turkey. After the first quarter of 2019, the unemployment rate decreased in parallel with the dampening effect of the crisis. In the first quarter of 2019, the acceleration of the rate of increase in unemployment is related to the contraction of the economy at the beginning of the pandemic. Many production facilities and commercial enterprises were closed during this period. In this sense, COVID-19 had a further increasing effect on unemployment in Turkey. Therefore, this increase in unemployment led to a decrease in household income. Thus, it reduced the demand of households in Turkey. In conclusion, it is clear that the COVID-19 crisis affected the Turkey's economy as a negative demand crisis in Turkey.

In order to clarify the answer to our question in the above section on demand conditions, the evolution of real household consumption, private investment and exports over the last ten quarters has been observed. However, in order to be able to say that COVID-19 also manifested itself as a negative demand shock in Turkey, it is necessary to analyze the evolution of household consumption and private investment. Looking at the data on household consumption and private investment, they reacted similarly to the COVID-109 shock. Moreover, in the second quarter of 2020, household final consumption and private investment experienced a significant and sudden decline. This shows that COVID-19 has a sudden and large impact on aggregate domestic demand in Turkey. As can be seen, it would be wrong and incomplete to say

that the COVID-19 crisis caused a unilateral crisis. This global pandemic, which has affected the whole world, has led to unprecedented changes in every sector, in the way of working, in the education and health systems in Turkey. Therefore, it is completely different from many crises in economic history, which were either demand-driven or supply-driven. It is a crisis that affects both aggregate demand and aggregate supply. In this sense, both negative demand shocks and negative supply shocks are modeled together in the next section.



### **3. NEGATIVE SUPPLY AND DEMAND SHOCK IN A SMALL OPEN ECONOMY**

#### **3.1. Literature Review**

DSGE models differ from standard neoclassical growth models in the presence of real and nominal rigidities and imperfect market structures based on the work of Christiano et al. (2005) and Smets and Wouters (2003). In a market with frictions such as monopolistic competition (Blanchard and Kiyotaki, 1987) or price rigidity (Calvo, 1983b), the DSGE derives the decisions of economic agents by solving intertemporal optimization problems. In short, the DSGE is a system in which more than one market is in equilibrium at the same time, and the objective function for each agent in the market, and thus the optimum for each individual, is determined. Thus, this system provides information about how economic variables respond to an exogenous shock and how the system returns to equilibrium over time. As a result, DSGE models provide models with a high degree of theoretical consistency that are attractive for the study of supply and demand shocks.

##### **3.1.1. Theoretical Studies**

Looking at the studies that model both supply and demand shocks together in the DSGE model, it is clear that energy price shocks are most often modeled in the literature (Aminu 2018, Soto and Medina 2005, Balke and Brown 2018, Somé 2023, An and Kang 2009). One of them, Somé (2023) focuses on how the oil supply shock and global demand shocks affect the Canadian economy. Some estimate a structural DSGE model for a small open oil economy using Bayesian methods. Aminu (2018) analyzes the impact of the energy price shock on the economy of the United Kingdom, represented as a small open economy, using a dynamic stochastic general equilibrium model with a new Philips-Keynesian curve. The main features of the model are the integration of energy inputs into the production function and imported intermediate goods. Aminu (2018) disaggregates the output fluctuations caused by all the stationary structural shocks in the study. Another study, Soto and Medina (2005) build

a DSGE model of the Chilean economy to show how monetary policy and other economic variables would respond to an oil price shock under the Taylor-type policy rule of the Central Bank of Chile. In addition, Balke and Brown (2018) develop a medium DSGE model of the U.S. economy to assess the response of U.S. real GDP to oil price fluctuations that are the consequence of oil shocks coming from the rest of the world. The DSGE model of the U.S. economy also describes the global oil market, U.S. international trade, and global economic activity in the rest of the world. Besides, An and Kang (2009) assess the relevance of the oil price shock for each part of the Korean economy. They construct a DSGE model in which oil is imported both for direct consumption and as an input to production. First, they construct an oil consumption model to show the effect of a negative demand shock, and second, they construct an oil-in-production model to show the effect of the negative supply shock. The common result of these studies ( Aminu 2018, Soto and Medina 2005, Balke and Brown 2018, Somé 2023, An and Kang 2009) is that an energy price shock leads to a decline in aggregate output in these modeled countries as a positive demand shock and a negative supply shock. According to Aminu (2018), the fall in output during the financial crisis period was caused by energy price shock, domestic demand shock, and world demand shock, and that the contribution of energy shocks to falling output is not permanent. Soto and Medina (2005) also find that an oil price shock has an income effect that affects work decisions and consumption. It also affects the marginal costs of domestic firms and thus their pricing decisions. The main result of their study is that an oil shock has a contractionary effect on output. A 13% increase in the real price of oil reduces output by about 0.5% and increases inflation by about 0.4%. Second, the contractionary effect of oil prices is mainly due to the endogenous tightening of monetary policy. Somé (2023) finds that analysis of impulse response functions reveals significant differences in how positive oil demand shocks and negative supply shocks affect Canadian macroeconomic variables. The paper concludes that aggregate demand shocks play an important role in real GDP fluctuations. According to Balke and Brown (2018), the pass-through of oil prices becomes more significant as oil prices rise. The effect on direct oil consumption is more destructive than that on production. According to the authors, the existing incomplete pass-through can be justified as a high tax on oil consumption because the government reduces the gasoline tax in response to shocks when there are oil shocks. They also find that U.S. real GDP and U.S. hours fall in response to a negative ROW oil supply shock. Unlike Soto and Medina (2005), Somé (2023), and An

and Kang (2009), however, Balke and Brown (2018) conclude that U.S. oil supply increases in response to higher oil prices caused by lower oil supply from the rest of the world. In addition, although Banerjee's study is similar to the above studies in terms of modeling a negative demand shock, it differs from these studies in terms of modeling a positive supply shock. Banerjee and Basu (2017) generate a small open economy New Keynesian DSGE model to understand how the neutral total factor productivity TFP and IST shocks affect aggregate output in India. According to the study, GDP responds positively to the TFP shock but negatively to the IST shock. In the model, a positive TFP shock drives GDP through the typical supply channel via an upward shift in the value of marginal labor and capital products. The short-run negative impact of an IST shock on GDP increases due to an adverse shift in the external terms of trade and a higher relative home bias in consumption goods.

In addition, there are studies in the literature that model negative supply shocks in a DSGE setup (Iacoviello and Neri 2010, Goyal and Kumar 2018, and Dees et al. 2010). Iacoviello and Neri (2010) examine the origins and effects of housing market fluctuations in the United States. Using Bayesian methods, they construct and estimate a dynamic stochastic general equilibrium model of the U.S. economy that unambiguously models the price and quantity of housing. They find that the increase in real house prices is the result of slower technological progress in the housing sector. Goyal and Kumar (2018) investigate the reasons for India's extremely asymmetric monetary transmission and response to other shocks relative to the U.S., obtained in a New Keynesian DSGE model. The objective is to analyze the factors responsible for the changes in the dynamic AD-AS derived from DSGE models and to estimate these shifts during the economic slowdown in India. The DSGE model shows that supply shocks such as large cost shocks continue to be an important source of inflation. It is concluded that the slowdown after 2011 was due to a sharp decline in demand in response to adverse supply shocks. Besides, Dees et al. (2010) solve the multi-country version of the new classical DSGE Keynesian model to provide an estimate of the identified shocks to supply, demand, and monetary policy. The country models include a Phillips curve for inflation, an IS curve for output, a Taylor rule for interest rates, and a real effective exchange rate equation. They assume that a global negative supply shock causes inflation and interest rates to rise at the time of the shock. The study finds that the pattern is identical in other countries, although the impact on the United States tends to exceed the average increase in inflation observed in other countries. Cardani et al.

(2021) and Diego et al. (2020) are similar in terms of modeling the negative demand shock and the results of the model. Cardani et al. (2021) examine the short-run economic effects of the COVID-19 shock in the form of an estimated DSGE model for EA. They augment the canonical DSGE setup with forced saving (quarantine and social distancing) and labor hoarding (short-time work) to see the noticeable demand and supply effects of the COVID-19 shock. The labor hoarding shock explains the enormous gap between hours paid and hours worked at the time of the pandemic. Similar to Cardani et al. (2021), Diego et al. (2020) analyzes the macroeconomic effects of a monetary shock, taking into account that fiscal policy is subject to fiscal constraints. For this purpose, a Bayesian econometric estimated DSGE model is developed for Brazil. The paper analyzes how the main economic variables react after a restrictive interest rate shock for each of three models, consisting of a baseline model, a model under the limit on government spending, and another under the austere fiscal rule. As a result, in the model with the strict fiscal rule, fiscal variables become less sensitive to contractionary interest rate shocks, but at the same time economic variables such as household consumption and GDP become more sensitive than in the baseline model. As a result of the models, both forced savings during the quarantine and social distancing in the study of Cardani et al. (2021) and an increase in the interest rate in the study of Diego et al. (2020) reduce aggregate demand through a decline in private investment and household consumption. Moreover, there are some studies in the literature that model uncertainty shocks and show that these uncertainty shocks that have a negative demand shock effect (Caggiano et al. 2020b and Leduc and Liu 2012). Using an estimated DSGE framework, Caggiano et al. (2020b) quantify the output loss due to the uncertainty shock in the fourth quarter of 2008. The model leads to a decline in real activity following an increase in uncertainty, because precautionary saving leads to a decline in consumption and because the outcome is determined by demand due to sticky prices in the economy. Likewise, Leduc and Liu (2012) use a DSGE model to examine the mechanism by which uncertainty shocks can generate a significant increase in unemployment and the empirical decrease in inflation. To account for the dynamic effects of uncertainty shocks, which are second-order shocks in their model, they solve the model using third-order approximations to the equilibrium conditions around the steady state. Accordingly, they point out that an uncertainty shock acts as an aggregate demand shock that raises unemployment, lowers inflation, and, through the Taylor rule, lowers the nominal interest rate.

### 3.1.2. Empirical Studies

Brinca et al. (2021) use Bayesian structural vector auto regression on monthly statistics of real wages and hours worked to assess labor supply and demand shocks for each major U.S. sector during the COVID-19 pandemic. According to this study, while the entertainment and hospitality industry in particular was exposed to severe negative supply and demand shocks, the retail trade, information, and communications sectors were exposed to small supply shocks and, in some situations, positive demand shocks during the pandemic.

Yilmazkuday (2022) shows that increases in COVID-19 cases caused negative demand shocks in global economic activity, shown as decreases in COP, and also negative supply shocks in global transportation of goods, shown as increases in BDI.

Bekaert et al. (2020) provide real-time forecasts of the aggregate demand and aggregate supply elements of the COVID-19 outbreak. Their calculation shows that the shock to real GDP growth in the first quarter of 2020 was mainly due to the aggregate demand shock, while surprisingly the large shock in the second quarter of 2020 was driven by both an aggregate demand and an aggregate supply shock, with the latter accounting for slightly more of the decline.

Lafrogne-Joussier et al. (2023a) use comprehensive firm-level data to assess the transmission of supply shocks through global value chains. According to this comprehensive study, French firms sourcing inputs from China just before the COVID-19 outbreak experienced a decline in imports between February and June 2020. This decline is 7% higher than for companies sourcing from other countries.

Nyga-Lukaszewska and Aruga (2020) use the ARDL approach to measure the impact of the COVID-19 outbreak on crude oil and gas prices in the United States and Japan. They find that while the COVID-19 outbreak had a negative effect on crude oil, it had an empirically positive effect on gas prices in the United States. Moreover, this negative effect of COVID-19 on the crude oil market occurred with a two-day lag in Japan.

Espitia et al. (2022) use monthly disaggregated trade data for over 25 countries and several trading partners to examine the impact of COVID-19 on trade. Accordingly, regression results based on the sectoral gravity model show that the negative trade effects of COVID-19 shocks

vary significantly across sectors. Moreover, sectors that are more prone to remote work are less volatile during the pandemic.

Sadiq et al. (2021) use a posterior Bayesian ST-HAR model and point out the effects of the COVID-19 crisis on the emerging stock market in seven member countries of the Association of Southeast Asian Nations. They find that the industries most negatively affected by the COVID-19 drug race and restrictions on international travel were healthcare and consumer services. Second, it is virtually impossible for the COVID-19 pandemic to have a positive impact on stock market performance in all countries, with Indonesia and Singapore being the most affected countries.

Hayakawa and Mukunoki (2021) examine the impact of COVID-19 on international trade and its evolution over time. In particular, they evaluate the gravity equation using several variations to consider the negative effects of COVID-19. As a result of the paper, they observe the negative effects of COVID-19 on international trade for both exporters and importers. Second, they find that the effects of COVID-19 in importing countries have tended to be negligible since the mid-2020s. Meanwhile, the negative effects of COVID-19 in exporting countries have weakened after the mid-2020s.

Gu et al. (2020) set up a difference-in-differences estimation model with daily electricity data from more than 30 thousand firms in one city in China. They find that the manufacturing industry experienced the strongest negative effect, while the COVID-19 had a positive effect on some industries such as information, computer services, software, construction, health care, and social services.

Meyer et al. (2022) use microdata and special question results from the Federal Reserve Bank of Atlanta's BIE survey to assess how firms are responding to the COVID-19 outbreak. They find that firms view the impact of the COVID-19 crisis mostly as a demand shock rather than a supply shock.

Long et al. (2022) examine the impact of the COVID-19 outbreak and whether central banks are effective in mitigating its effects using the fixed panel model and monthly data for 38 countries from 2020 to 2021. They find that the COVID-19 pandemic has apparently increased inflation and unemployment. The authors emphasize that while the central bank has a positive

effect in mitigating the shock of COVID-19 on inflation, it is not able to mitigate the shock of COVID-19 on unemployment rate.

Xu et al. (2020) examine the impact of the COVID-19 outbreak and whether the central bank is effective in alleviating its impact by applying the fixed panel model and the monthly data of 38 countries from 2020 to 2021. They find that the COVID-19 pandemic has increased inflation and unemployment. More importantly, the central bank has a positive effect in mitigating the shock of COVID-19 on inflation, while it cannot mitigate the shock of COVID-19 on unemployment rate.

Padhan and Prabheesh (2021) examine the impact of the outbreak and offers some policy advice to mitigate the consequences of COVID-19 using a questionnaire of the texts on the consequences of the COVID-19 outbreak, and show that negative economic impacts of the COVID-19 outbreak, in addition to deaths.

Liu et al. (2020) show the short-term impact of the COVID-19 pandemic on more than 20 major stock market indices in primarily affected countries such as the United Kingdom, Germany, Japan, Korea, Singapore, and the United States, etc. Using an event study methodology, their results indicate that the stock markets in the main affected countries declined immediately after the COVID-19 pandemic. The countries with the highest negative abnormal returns are the Asian countries.

Kejžar et al. (2022) underline the role of supply chain linkages in the transmission of COVID-19 shocks on the trade of the European Union member states during the first course of the COVID-19 outbreak. Using the framework of the gravity model, they find a decline of more than 20% in trade among EU countries after the start of the COVID-19 outbreak. According to the paper, both demand and supply shocks contributed to this fall in trade.

Huss et al. (2021) employ a large-scale field experiment to investigate the impact of improved on-farm storage on household food security during COVID-19 restrictions, which caused a severe negative supply shock in agricultural regions of sub-Saharan Africa. In this study, it is shown that control group households are more vulnerable to negative supply shocks than treatment households provided with improved on-farm storage technology.

Lafrogne-Joussier et al. (2023b) look at supply chain shocks, building their case study on the

COVID-19 outbreak. They found that firms that purchased inputs from China and were subject to the Chinese early shutdown suffered a 5.5% decline in domestic sales and a 5% decline in exports compared to similar non-exposed firms.

Caggiano et al. (2020a) estimate a VAR with world-level variables to demonstrate the results of the uncertainty shock associated with COVID-19. They find a maximum negative response of world industrial production of 1.6%.

Hailu (2020) shows in this paper that the impact of the pandemic depends on the type of products and the size of the processors. According to this comprehensive study, COVID-19 has caused shortages of labor and raw materials, and a decline in export and import activity. This situation in the food processing economy has manifested itself as a positive demand shock in the retail sector for processed food, a negative demand shock in the food service sector for processed food, and a negative supply shock in food processing activities.

Hu and Zhang (2021) use financial data from companies around the world and evaluate the impact of COVID-19 on business performance. The author shows that firm performance deteriorated during the COVID-19 pandemic. Consequently, the negative effects of COVID-19 on business performance are less pronounced in countries that have improved health care systems, enhanced financial systems, and stronger institutions.

Gourinchas et al. (2020) apply a cost-minimization model combined with firm-level data to the COVID-19 crisis in 11 countries. The methodology allows them to obtain qualified information on the vulnerability of firms, sectors, and the global economy to different types of shocks, as well as detailed estimates of the costs and effects of fiscal interventions in different types of firms. They find an average increase of 6.15 percentage points in SME failure rates due to COVID-19 in the absence of government support.

Balduzzi et al. (2020) use a novel survey of Italian firms' expectations and plans to examine the economic impact of the COVID-19 outbreak and the role of credit constraints in the transmission mechanism. They find that credit constraints amplify the impact of COVID-19 on factor demand. Moreover, demand and, more importantly, shocks play a role in firms' decision making.

Apergis and Apergis (2021) apply the BPVAR methodology to a panel of OECD countries,

taking into account the total number of confirmed cases and deaths, and conclude that the shock caused by COVID-19 has a significant negative impact on the industrial sector.

Škare et al. (2021) apply PSVAR to data from 1995 to 2019 in 185 countries and conclude that the COVID-19 outbreak has a much larger devastating impact on the tourism industry than a previous pandemic crisis. Previous pandemic crises primarily occurred in their own unique way. As soon as the shocks caused by a previous pandemic crisis dissipated, inbound arrivals immediately resumed. However, the COVID-19 pandemic and the recovery of the global tourism industry took longer than the average expected recovery period of 10 months.

In the chapter 3, we build a dynamic stochastic general equilibrium model for a small country to analyze the effects of the COVID-19 outbreak on the Turkey's economy. First, the effects of a negative productivity shock are analyzed, and then the effects of a negative export shock are analyzed. As seen above, there are very few DSGE studies on negative supply and demand shocks. Most of the studies on these shocks are empirical studies.

### **3.2. The Setup**

First, a negative productivity shock is modeled as a negative supply shock. Next, to analyze the negative demand shock in Turkey, a negative export shock in a small open economy is modeled. First, it is assumed that there are an infinite number of people in the world. Therefore, the population of the whole world is normalised to 1. It is assumed that  $a = 0.25$  to represent a small country. Thus, the small country can be affected by changes outside the country, but a political or economic change at home does not affect countries abroad. Similarly, foreign demand for domestic goods is exogenous. Second, it is assumed that there is no small open government, the actors in the economy are households and firms. The model assumes that households are identical, so that representative households are considered.

In addition, households are consumers, not producers. Households demand goods and supply labour, while firms demand labour and supply goods to the market. Another, in the model, the home country is not only linked to the outside world through imports and exports. The home country also buys and sells private bonds with the outside world through capital mobility. Households invest what they earn in private bonds traded on the international market.

There is also no capital investment in the model. This is because capital accumulation and the evolution of the physical capital stock cannot be observed in a model with an average of two years. In order to observe capital accumulation and depreciation, a study modeling a period longer than two years is required. Therefore, the only investment possibility in this economy is private bonds. Moreover, this DSGE model is not solved for the prices of individual goods, but for the general level of prices. In order to determine the general level of prices, it is assumed that there are frictions in the goods market. In other words, there is no perfect competition in the goods market. Each of these infinite firms produces similar but not identical goods. Therefore, each firm is a price setter for its own good. However, at the same time, because there are an infinite number of firms, they have no power to influence each other. Thus, as a result of monopolistic competition, prices are higher than the optimum. It is therefore profitable for firms to meet additional demand without raising prices. Consequently, supply is determined by demand in the model. Finally, individuals have rational expectations. In other words, agents always have to predict the future in order to maximise their utility and profits. But they can only have expectations. This means that not every individual's prediction about the future will be one hundred percent accurate. But on average, over a given period of time, that individual's predictions have a margin of error of zero.

### 3.2.1. Households

Households maximise their utility in terms of consumption and leisure, subject to a budget constraint. The representative agent has an infinite lifetime and maximizes her/ his intertemporal utility function. The utility function of an agent is given by

$$Max E_t \sum_{s=t}^{\infty} \beta^{s-t} (\log(C_s^j) + \eta \log(1 - L_s^j)) \quad (1)$$

where  $0 < \beta < 1$ . Therefore, the importance that households attach to future periods when they are in period  $t$  decreases as households move away from the current time.  $L_t$  is the number of hours worked by households. As 24 hours are normalised to 1,  $1 - L_s$  is the time available to households for leisure in a day.  $\eta > 0$  indicates the weight of leisure in total utility. Also, in

the model, money is used only for the transaction motive. Therefore, there is no money in the utility function.

C in the utility function is the CES type consumption index composed of domestically produced goods ( $CH, t$ ) and imported goods ( $CF, t$ ).

$$C_s^j = [a^{\frac{1}{\theta}} \cdot (C_{H,s}^j)^{\frac{\theta-1}{\theta}} + (1-a)^{\frac{1}{\theta}} \cdot (C_{F,s}^j)^{\frac{\theta-1}{\theta}}]^{\frac{\theta}{\theta-1}} \quad (2)$$

where  $\theta$  is the elasticity of substitution between domestic and foreign goods.

The variable  $C_H^j$  represents a constant elasticity of substitution (CES) type home country consumption index and is represented as:

$$C_{H,t}^j = \left( \int_0^a c_t^j(z)^{\frac{\theta-1}{\theta}} dz \right)^{\frac{\theta}{\theta-1}} \quad (3)$$

where  $C_H(z)^j$  is the domestic basket of person  $j$  and  $c(z)$  is the consumption of good  $z$ .

Person  $j$ 's consumption basket of foreign goods is given by

$$C_{F,t}^j = \left[ \left( \frac{1}{1-a} \right)^{\frac{1}{\theta}} \left( \int_a^1 c_t^j(z^*)^{\frac{\theta-1}{\theta}} dz \right)^{\frac{\theta}{\theta-1}} \right] \quad (4)$$

Home bias and international specialisation are assumed to be absent in the model. That is, households do not distinguish between the consumption of domestic and foreign goods when deciding on the purchase of goods. Therefore, the elasticity of substitution between domestic and foreign goods is the same as the elasticity of substitution between domestic goods.

A general price index for domestic consumers,  $P$ , is defined as follows:

$$P_t = [a \cdot P_{H,t}^{1-\theta} + (1-a) e_t P_{F,t}^{1-\theta}]^{\frac{1}{1-\theta}} \quad (5)$$

where  $P_{H,t}$  is the index of domestic producers and  $P_{F,t}$  is the index of foreign producers. This price index is explained as the minimum expenditure required to consume a unit of goods or the maximum goods that can be consumed with minimum expenditure. The CPI is an index based on the prices of all available goods. It is given as follows:

$$P_t = \left[ \int_0^1 p_t(z)^{1-\theta} dz \right]^{\frac{1}{1-\theta}} \quad (6)$$

The following is also the general price index for the foreign consumer:

$$P_t^* = \left[ \int_0^1 p_t^*(z)^{1-\theta} dz \right]^{\frac{1}{1-\theta}} \quad (7)$$

where  $p_t(z)$  is the domestic currency price of good  $z$  and  $p_t^*(z)$  is the foreign currency price of good  $z$ . Since there are no barriers to international trade, the domestic price of any good is equal to its foreign price in domestic currency. Therefore, the law of one price applies and we have

$$p_t(z) = e \cdot p_t^*(z) \quad (8)$$

where  $e$  stands for the exchange rate, is described as the home currency price of one unit of foreign currency. According to the law of one price, the home price index is as follows:

$$P_t = \left[ \int_0^1 p_t(z)^{1-\theta} dz \right]^{\frac{1}{1-\theta}} = \left[ \int_0^a p_t(z)^{1-\theta} dz + \int_a^1 [e_t \cdot p_t^*(z)]^{1-\theta} dz \right]^{\frac{1}{1-\theta}} \quad (9)$$

Because goods from 0 to  $a$  are produced domestically, the rest is produced abroad.

Similarly, the foreign price index  $P$  can be written as

$$P_t^* = \left[ \int_0^1 p_t^*(z)^{1-\theta} dz \right]^{\frac{1}{1-\theta}} = \left[ \int_0^a \left( \frac{p_t(z)}{e} \right)^{1-\theta} dz + \int_a^1 [p_t^*(z)]^{1-\theta} dz \right]^{\frac{1}{1-\theta}} \quad (10)$$

Equations (9) and (10) implies that there is purchasing power parity, since the law of one price applies to all goods in the model,

$$P_t = e_t \cdot P_t^* \quad (11)$$

1

Since the elasticity of substitution of the consumption index is constant, it is possible to derive the following demand function:

$$C_t^j(z) = \left[\frac{P_t(z)}{P_{H,t}}\right]^{-\theta} \left[\frac{P_{H,t}}{P_t}\right]^{-\theta} C_t^w \quad (13)$$

$$C_t^j(z) = \left[\frac{p_t(z)}{P_t}\right]^{-\theta} C_t^w \quad (14)$$

2

This demand equation shows the total demand for the good produced by any producer j

$$Y_t^d(z)^j = \left(\frac{P_t(z)}{P_t}\right)^{-\theta} C_t^w \quad (16)$$

If we include both the law of one price (8) and purchasing power parity (11) into the equation for the demand for domestic good z, the total demand equation for any producer j from the total world population is as follows:

$$Y_t^d(z) = \left(\frac{P_t(z)}{P_t}\right)^{-\theta} \cdot (C_t^{w,A}) \quad (17)$$

Since there is imperfect competition and price rigidity in the goods market, the producer of each good z decides how much to produce by looking at the demand for it.

Therefore, as noted in Tervala (2007), the equation (17) states that the demand for each good depends on the relative price of that good  $\left(\frac{P_t(z)}{P_t}\right)$ , the elasticity of demand, and total

---

<sup>1</sup>The relative prices between two countries are expressed in terms of trade equation as follows,

$$TOT_t = \frac{e_t P_{F,0}}{P_{H,t}} \quad (12)$$

<sup>2</sup>Foreign demand is

$$c_t^{*j}(z) = \left[\frac{p_t^*(z)}{P_t^*}\right]^{-\theta} C_t^w \quad (15)$$

world consumption. If the price of any good  $z$  rises, other goods become relatively cheaper. This reduces the demand for that good  $z$ . The rate of this reduction increases as  $\theta$  increases.

If the demand equation (17) for all agents from 0 to 1 is summed and then divided by the total quantity of goods, the per capita aggregate demand equation is obtained as follows,

$$Y_t^d = \left(\frac{P_{H,t}}{P_t}\right)^{-\theta} \cdot (aC_t + (1-a)C_t^*) \quad (18)$$

3

To solve the household problem, we first write down the household's budget constraint. Therefore, the household is subject to the budget constraint:

$$P_t \cdot W_t \cdot L_t + \int_0^1 profit(i) \cdot di + (1 + r_t) \cdot P_t \cdot B_t = P_t \cdot C_t + P_t \cdot B_{t+1} \quad (20)$$

where  $B_{t+1}$  is the stock of real private bonds held by the agent entering period  $t + 1$ ,  $L_t$  is the agent's hours worked for firms in period  $t$ ,  $(1 + r_t) \cdot P_t \cdot B_t$  is the principal and home interest earned on  $B_{t-1}$  bonds. There are also infinite firms. The total number of firms is therefore normalised to 1. Households buy shares from firms. The return on these shares is distributed by firms to households as dividends  $(\int_0^1 profit(i) \cdot di)$ .

Household income in period  $t$  is allocated between consumption  $C_t$  and investment in private bonds  $B_{t+1}$ .

In period  $t$ , given a constant discount factor  $\beta$ , the representative agent maximises the utility function (1) subject to the household budget constraint (20). As shown in the Appendix, the first-order conditions for the household maximisation problem can be shown as

$$W_t = \frac{C_t \eta}{1 - L_t} \quad (21)$$

3

$$C^w = aC^{PC} + (1-a)C^{*PC} \quad (19)$$

$$\frac{1}{C_t} = \beta \cdot E_t \left[ \frac{1 + r_{t+1}}{C_{t+1}} \right] \quad (22)$$

The equation (22) denotes labor-leisure trade off as a positive function of consumption and a negative function of wages. Increasing consumption reduces the marginal utility of consumption. According to the Labour-leisure trade-off equation, the marginal utility of consumption should be equal to the marginal utility of leisure. Therefore, increasing consumption increases leisure and decreases labour supply. According to Tervala (2004), the labour-leisure trade-off equation ensures that the marginal disutility of an additional unit of labour is equal to the marginal utility of consuming the additional income from a unit of labour. A worker chooses the optimal quantity of labour supply when the harm to the worker from one unit of extra work is equal to the benefit to the worker from the income and consumption resulting from one unit of extra work. Optimal labour supply is determined when the marginal utility of leisure is equal to the marginal utility of consumption.

Households are willing to smooth consumption across periods. Equation (22) is called the consumption Euler equation and explains the intertemporal optimal consumption choice of the household between the current and the future period. In other words, as long as the interest rate increases, agents will choose to obtain more private bonds in period  $t$  and consume more in the future than today in order to smooth their consumption.

### 3.2.2. Firms

According to our assumption, there is no capital investment and no capital accumulation in the model. For this reason, production only takes place with labour input. In addition, there are constant returns to scale. Therefore, a firm's linear Cobb-Douglas production function in period  $t$  is written as:

$$Y_t = A_t \cdot L_t \quad (23)$$

where  $Y_t$  and  $L_t$  are the level of output and labour demand respectively. In addition,  $0 < A_t < 1$  is the total factor productivity.

Total factor productivity is assumed to be time-dependent. Therefore, it can only change in each period to analyse the impact of an exogenous technological shock in the economy.

In monopolistic competition, an infinite number of firms produce an infinite number of goods and these goods are slightly different from each other. These differences mean that each producer has some monopoly power over its own product. Moreover, this monopoly power leads to price rigidity in the goods market through the Calvo pricing mechanism. According to this mechanism, the prices a producer chooses when prices are flexible are not the same as the prices the producer chooses when prices are rigid. As  $\alpha$  the degree of rigidity approaches 0, price elasticity increases in the goods market. In the model,  $\alpha$  is greater than 0 and less than 1. All firms are identical in the goods market. Therefore, when  $1 - \alpha$  number of firms have the chance to change their prices, they all choose the same optimal price, while  $\alpha$  number of firms that cannot set their prices in period  $t$  maintain the last price as described in Calvo (1983b) and Calvo (1983a). Since firms do not know when they will set their prices again, they set the price that maximises not only their profits in the current period but also their future profits when they have the chance. Therefore, the firm's maximum profit problem is dynamic, as shown below:

$$Max_{p_t^0} \sum_{s=t}^{\infty} \alpha^{s-t} q_{t,s} \left[ \frac{p_t^0(z)}{P_{H,s}} Y_s(z) - MC_s Y_s(z) \right] \quad (25)$$

where  $\alpha^{s-t}$  is the probability of not being able to revise the price in each period,  $\frac{p_t^0(z)}{P_{H,s}} Y_s(z)$  is the total revenue, and  $MC_s Y_s(z)$  is the total cost.  $q_{t,s}$  is the discount rate, which allows us to reduce the projected future profit to its present value.

The firms are identical, so each firm that has the right to change the price chooses the same price  $p_t^0(z)$ .

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<sup>4</sup>When analyzing an exogenous export shock, the total productivity factor is assumed to be exogenous

$$Y_t = A.L_t \quad (24)$$

This is because there are no fixed costs in the model and the labor market is competitive, so the marginal cost of the linear production function with labor as the only input is equal to the real wage.

$$MC_t = \frac{C_t \eta}{1 - L_t} \quad (26)$$

Since the model assumes monopolistic competition and all firms are price makers in the goods market, supply is determined by the aggregate demand equation (17). Since producers set the price of goods, they have monopoly power. However, this monopoly power is limited by the elasticity of demand for the good. The value of  $\theta$  also shows the elasticity of demand for any good  $z$ . The larger  $\theta$ , the more goods are substitutes for each other. If the relative price of any good  $z$  rises, the higher  $\theta$ , the more the demand for that good  $z$  falls.

The producer of each good  $z$  decides how much to produce by looking at the demand for it. Therefore, writing the demand equation for any good  $z$  (17) into the max equation (25) gives the equation that defines the optimal price,

$$P_t^0 = \frac{\theta}{\theta - 1} \frac{E_t \sum_{s=t}^{\infty} \alpha^{s-t} q_{t,s} Y_s^w MC_s}{E_t \sum_{s=t}^{\infty} \alpha^{s-t} q_{t,s} Y_s^w P_{H,s}} \quad (27)$$

When a firm is given the chance to choose its price, it chooses the price according to this equation.  $\frac{\theta}{\theta-1}$  indicates imperfect competition in the goods market and  $q_t$  represents  $Y_s/C_s$ .

The producer price index  $P_{H,t}$  for household goods is an average of the prices charged by the holding firms. Since in the Calvo price setting firms choose the optimal price up to  $1 - \alpha$ . Since all firms and the elasticity of substitution are identical for all goods, these firms all choose the same optimal price. The remaining firms continue to use the last price they chose. The CES price index therefore has the form as:

$$P_{H,t} = \left[ \sum_{s=t}^{\infty} (1 - \alpha) \cdot \alpha^{s-t} (P_{t-s}^0)^{1-\theta} \right]^{\frac{1}{1-\theta}} \quad (28)$$

where  $(1 - \alpha)$  is the probability of choosing the price  $P_t^0$  and  $\alpha^{s-t}$  is the probability of maintaining the old price.

It is the yield-following dynamics for the aggregate price level for household goods that lags this equation by one period, and we get the law of motion equation for the PPP as shown:

$$P_{H,t}^{1-\theta} = (1 - \alpha) \cdot (P_t^0)^{1-\theta} + \alpha \cdot P_{H,t-1}^{1-\theta} \quad (29)$$

where  $P_{H,t}$  depends both on itself and on  $P_t^0$ .

After some mathematical operations, the New Keynesian Phillips curve is obtained:

$$\widetilde{\pi}_{H,t} = \frac{(1 - \alpha\beta)(1 - \alpha)}{\alpha} \cdot \widetilde{MC}_t + \beta \cdot E_t \cdot \pi_{H,t+1} \quad (30)$$

where PPI is a positive function of marginal cost and  $E_t \cdot \pi_{H,t+1}$ .

A new Keynesian Phillips curve is needed to find the path of the PPI over time.

Firms search for the price that maximises the profit margin over the whole period ahead. So  $\pi_{H,t}$  is a positive function of marginal cost.

### 3.2.3. Interest Rates

The model assumes that capital mobility in the international financial market is incomplete. As a result, domestic and foreign interest rates are different.

As can be seen, since the home country is a small country in the model, the world interest rate is constant and exogenous for the small home country ( $r_0^w$ ). However, depending on the risk premium, the domestic interest rate differs from the foreign interest rate ( $r_t \neq r^w$ ).

$$r_t = (r_0^w) + \left( \frac{B_t - B_0}{Y_t} \right) \phi \quad (31)$$

The equation(31) defines the home interest rate. The interest rate is a function of the private bond deviation ( $\frac{B_t - B_0}{Y_t}$ ). So the risk premium depends on the household borrowing rate. The interest rate is determined by how much the private bond deviates from its steady state value. The model assumes that the response of the household interest rate to the deviation of the bond  $\phi$  is 0.0001 in our model.

As seen in Alan (1996), the standard UIP is as follows,

$$1 + i_t = (1 + i_0^*) \left( \frac{E_t \cdot e_{t+1}}{e_t} \right) \quad (32)$$

The standard UIP equation (32) shows how the exchange rate changes over time. Individuals decide whether to buy domestic or foreign bonds based on the UIP.  $1 + i_t$  is the return on the domestic bond after one period.  $1 + i_0^*$  is the yield of the domestic bond for foreigners. UIP is used when the bonds of two countries pay different interest rates. And it is used when the bonds of two countries are denominated in different currencies.

The Fisher identity ( 33 ) is used to convert the real interest rate into the nominal interest rate.

$$(1 + i_t) = (1 + r_t) \cdot \frac{P_t}{P_{t-1}} \quad (33)$$

### 3.2.4. General Equilibrium

The external equilibrium equation is the resource constraint equation of the country in an open economy. The domestic country is linked to other countries by the Current account equation (34). The CA equation represents the behaviour of a country. An agent's objective is to keep his consumption constant over time, given the consumption Euler equation. An agent transfers its consumption to the next period by borrowing. For example, if he has saved his money in period t, he buys bonds and lends them out. An agent's demand for bonds results from the agent's budget constraint. However, the equation that determines the bond demand of all households is the current account equation. The current account equation is obtained by combining the budget constraints (20 and 23) of all agents.

$$B_{t+1} - B_t = r_t \cdot B_t + Y_t \cdot \frac{P_{H,t}}{P_t} - C_t \quad (34)$$

The left-hand side of the current account equation  $B_{t+1}$  is the financial account balance. The financial account balance shows how many bonds  $B_{t+1}$  the whole country will demand in each period t.  $B_{t+1}$  is already decided in period t, so it is predetermined. Since  $B_{t+1}$  is a bond

purchased in period  $t$ , the expectation factor ( $E_t$ ) does not come before it.

Furthermore, since households decide how much to invest based on the real interest rate, the interest rate  $r_t$  here is the real interest rate.  $r_t \cdot B_t$  is investment income and  $Y_t \cdot \frac{P_{H,t}}{P_t} - C_t$  is net exports.

### 3.3. The Effect of Negative Productivity Shock and Negative Export Shock

The impact of a technology shock and an export shock on consumption, output, wages, leisure and other variables is analysed. Therefore, these shocks need to be identified.

Firstly, in order to see the impact of a negative productivity shock on the economy, we define an exogenous A shock as follows,

$$\widetilde{A}_{t+1} = \rho_A \cdot \widetilde{A}_t + \epsilon_{t+1} \quad (35)$$

Equation (35) is AR(1) first order auto regressive process where  $\rho_A \widetilde{A}_t$  is the impact of the shock and  $\epsilon_{t+1}$  is the temporary exogenous shock. The persistence of the shock depends on the  $\rho_A$  parameter.

Second, to see the effects of a negative demand shock, an exogenous export  $C^*$  shock is defined as follows,

$$\widetilde{C}_{t+1}^* = \rho_{C^*} \cdot \widetilde{C}_t^* + \epsilon_{t+1} \quad (36)$$

Equation (36) is AR(1) first order auto regressive process.  $\rho_{C^*} \widetilde{C}_t^*$  is the impact of the shock and  $\epsilon_{t+1}$  is the temporary exogenous shock. The persistence of the shock depends on the  $\rho_{C^*}$  parameter.

Thus, we analyse how much our variables deviate from the steady state value as a result of both shocks.

Therefore, the shocks here are the technology shock and the export shock, which will be represented by a one-time change in total factor productivity and export, respectively. These shocks occur only in one period, but their effects persist in subsequent periods.

### 3.3.1. Steady State Equilibrium

Steady state is a point at which the variables describing the behaviour of the system do not change over time. Accordingly, at discrete points in time, the first difference in each property is and remains zero:

$$X_t - X_{t-1} = 0 \quad (37)$$

As will be seen in the following chapters, the effect of the shocks is not permanent. On average, all values return to the initial value after the fifth period. In this sense, there is an initial steady state in the model. The model considers a symmetric steady state in which each exogenous variable is constant. The result is that there is no inflation  $\pi_{CPI}, \pi_H, \pi_F = 1$  in the steady state. This is because steady state is, by definition, the point at which nothing grows and everything is stationary.

As Obstfeld (1995) points out, like all exogenous variables, steady state consumption is constant. Therefore, applying 37 to the consumption Euler (22) yields the steady state interest rate as follows,

$$r = \frac{1 - \beta}{\beta} \quad (38)$$

Relative prices are also equal and there is no import-export between countries in the steady state. Therefore, a good steady state market equilibrium condition is as follows,

$$Y_0 = C_0 \quad (39)$$

Furthermore, the financial markets are in equilibrium. It is assumed that people are not indebted to each other in the steady state  $B_0 = 0$ , so the interest rate definition equation (31) tells us that the world interest rate and the interest rate are equal ( $r = r^w$ ).

Moreover, every firm and technology is the same, every firm is a price-setter, and every firm chooses the same price because prices are flexible in the steady state. All agents set the same price and consume and produce the same amount of goods in a symmetric equilibrium.

Since we are dealing with a symmetric steady state, the same assumptions apply to the foreign country and hence  $P_F$  and  $P^* = 1$ .

Since all prices are equal to 1, the value of exchange rate that satisfies the CPI definition at steady state ( $P^{1-\theta} = a.P_H^{1-\theta} + (1-a)EP_F^{1-\theta}$ ), is also 1.

When  $E = 1$ , the difference between the global interest rates caused by the exchange rates and the domestic interest rates vanishes ( $i = i^w$ ).

Similarly, the steady state of the Fisher identity (33) gives that  $r = i$  in the steady state.

It is assumed that the total productivity in the steady state is 1. So the production function (23) at steady state gives  $Y=L$ .

Since there is both monopolistic competition and prices are flexible, and the price level is  $MC \times$  mark up rate, mark up rate is  $\frac{\theta}{\theta-1}$ , and  $P = 1$ , marginal costs and wages are as follows,

$$\frac{(\theta - 1)}{(\theta)} \quad (40)$$

Given equilibrium in the goods market (39) and the steady-state value of wages (40), the following equation implies how much importance households attach to leisure.

$$\eta = \left(\frac{1 - Y}{Y}\right) \cdot \frac{\theta - 1}{\theta} \quad (41)$$

### 3.3.2. Linearizing Around the Steady State

As the model is non-linear, its solution is linear via a first order Taylor approximation. This allows us to determine how much and how each variable deviates from its steady state value.

First, the log-linearised form of the consumption-Euler general equilibrium (61) formula is given as

$$\widetilde{C}_t = E_t \widetilde{C}_{t+1} - \beta \cdot E_t (1 + \widetilde{r}_{t+1}) \quad (42)$$

Second, the log-linearised New Keynesian Philips curve (30), where  $E_t$  is the expectation operator in period  $t$ .

$$\widetilde{\pi}_{H,t} = \frac{(1 - \alpha\beta)(1 - \alpha)}{\alpha} \cdot \widetilde{MC}_t + \beta \cdot E_t \cdot \pi_{H,t+1} \quad (43)$$

Third, the linearised version of the terms of trade (12) is shown as

$$E_t T\widetilde{O}T_{t+1} = T\widetilde{O}T_t + E_t \cdot \widetilde{e}_{t+1} - \widetilde{e}_t - E_t \pi_{H,t+1} \quad (44)$$

Another, CPI definition(5), purchasing power parity (11), current account (34) and total demand equations'(18) log linearised forms are shown respectively,

$$\widetilde{\pi}_t^{CPI} = a\widetilde{\pi}_{H,t} + (1 - a)\widetilde{e}_t \quad (45)$$

$$T\widetilde{O}T_t = \widetilde{e}_t - \widetilde{P}_{H,t} \quad (46)$$

$$\widetilde{B}_{t+1} - (1 + r)\widetilde{B}_t = r + r \cdot \widetilde{r}_t + \widetilde{Y}_t - \widetilde{C}_t - (1 - a)T\widetilde{O}T_t \quad (47)$$

$$\widetilde{Y}_t^d = \theta(1 - a)T\widetilde{O}T_t + a \cdot \widetilde{C}_t + (1 - a)\widetilde{C}_t^* \quad (48)$$

Next, the linearised versions of the production function (23) and the marginal cost equation (26) are shown,

$$\widetilde{Y}_t = \widetilde{A}_t + \widetilde{L}_t \quad (49)$$

$$\widetilde{MC}_t = \widetilde{C}_t + L \cdot \frac{\widetilde{L}_t}{1 - L} \quad (51)$$

This is followed by the interest rate definition (31), the Fisher equation (33) and the uncovered interest rate parity (32),

$$\widetilde{r}_t = Y \phi(\widetilde{B}_t - \widetilde{Y}_t) \quad (52)$$

$$\widetilde{i}_t = \frac{1 + r}{r} \pi_{CPI,t} + \widetilde{r}_t \quad (53)$$

$$E_t \widetilde{e}_{t+1} = \frac{r}{1 + r} \widetilde{i}_t + \widetilde{e}_t \quad (54)$$

### 3.3.3. Calibrated Parameters

This section provides information on results based on a calibrated version of the model economy analysed. Some of the producers in the table are derived from steady-state values and from the rest of the literature. First, the discount factor  $\beta$  is assumed to be 0.98.

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<sup>5</sup>In the second scenario where C\* export shock is modeled, the log linearized version of the production function is as follows,

$$\widetilde{Y}_t = \widetilde{L}_t \quad (50)$$

**Table 1:** Calibrated Parameters

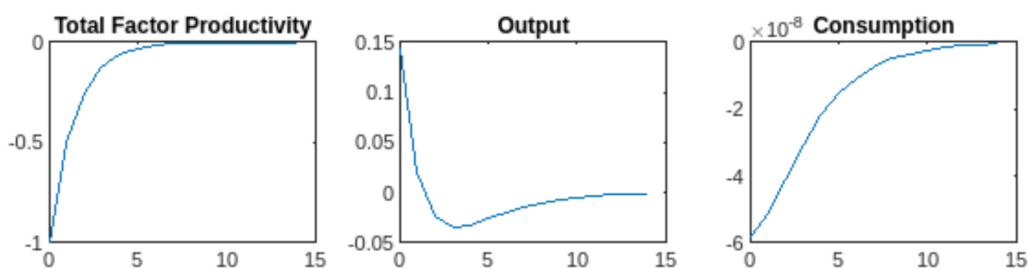
Parameter	Description	Calibrated Value
$\beta$	subjective discount factor	0.98
$\theta$	substitution elasticity between goods	0.75
$\alpha$	measure of price rigidity	0.75
$L_0$	steady state labour supply	1/3
$a$	size of the home country	0.25
$\rho_A$	degree of persistence of the productivity shock	0.5
$\rho_C^*$	degree of persistence of the exogen shock	0.5
$\phi$	reaction of the interest rate to deviation of Bond	0.0001

Looking at the labor force statistics prepared by TURKSTAT (2023a), the average weekly working hours in Turkey between 2020 and 2022 is 43.26. Considering the labor force working 5 days and 6 days a week, the parameter  $L_0$ , which represents 8 hours a day on average, is set to 1/3 in our model.

Another, as seen in the second chapter, the effect of COVID-19 in Turkey has been dampened in a short period of time. Similarly, the persistence of the shock,  $\rho_A$  and  $\rho_C^*$ , is set to 0.5 in order to dampen the effects of both shocks in a short time in the model. These values  $\rho_A, \rho_C^* < 1$  indicate that the persistence of the shocks decreases and disappears over time. Then, the discount factor  $\beta$  is set, which gives us a steady state interest rate of 0.95. Again, it is assumed that the price rigidity  $\alpha$  in the goods market is 0.75, as determined by the same ratio in Sveen and Weinke (2007)'s study. Finally, it is assumed that the elasticity of substitution between goods  $\theta$  is 6, which is in line with existing studies (Taylor 1999, Smets and Wouters 2003, Rotemberg and Woodford 1992, and Christiano et al. 2005).

### 3.3.4. Effect of the Negative Productivity Shock on Main Economic Indicators

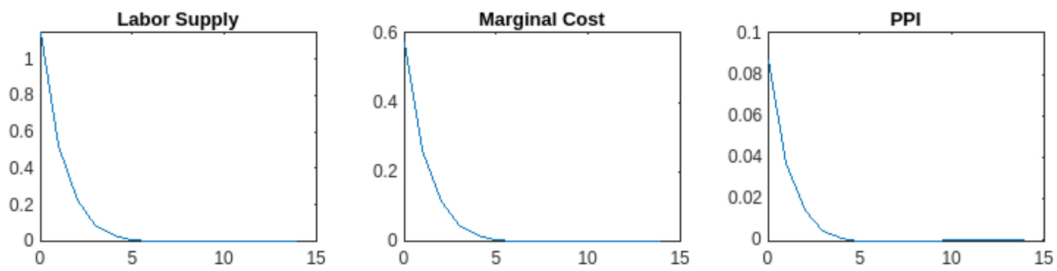
The figures below display the impulse response functions obtained by a negative productivity shock of size equivalent to one standard deviation.



**Figure 3.1:** The impact of the negative productivity shock on output and consumption(%, left column)

First, as observed in the Figure 3.1, as a result of a negative productivity shock, productivity decreases by 1%, the production function (23) implies that output per unit of labor decreases. In the first two periods, output does not decrease by its standard deviation, but increases by 0.15% on average. This is due to the increase in labor demand in the early periods. This is because firms have to increase the amount of labor used per unit of output to compensate for declining productivity. This is the reason why output increased by 0.2% in the first period even though the quantity of labor increased by 1%.

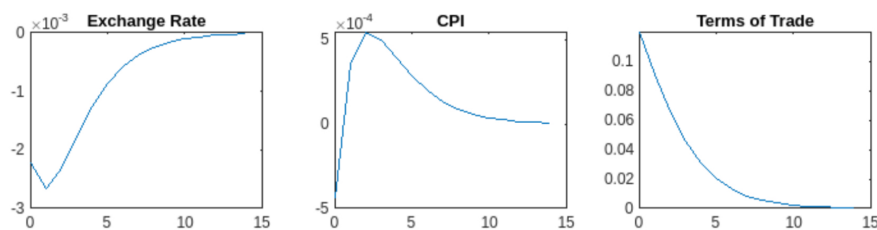
Second, after the second period, the negative productivity shock has a downward effect on output. However, as can be seen in the Figure 3.1, the decline in output is not as large as the decline in productivity. The downward effect of the negative supply shock on output is less than 1%. As the figure shows, this negative deviation of consumption from its steady state value is as low as  $10^{-8}.6\%$ . Accordingly, there has been no significant change in consumption.



**Figure 3.2:** The impact of the negative productivity shock on hours worked, marginal cost and producer price index ( % , left column)

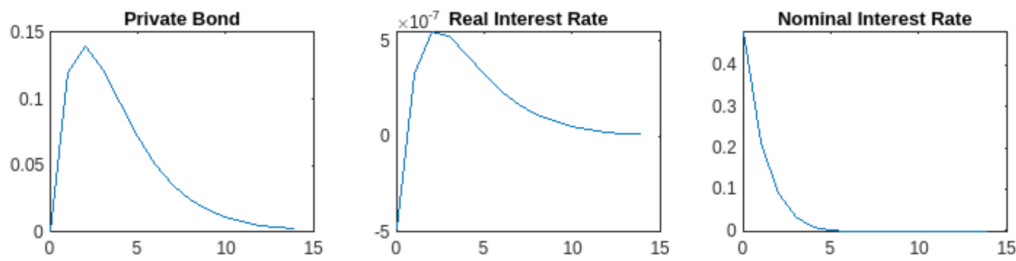
The labor-leisure trade-off equation (21) implies that in the early periods, the marginal utility of consumption increases as consumption falls due to the impact of the shock, again confirmed in Figure 3.2. According to the labor-leisure trade-off equation (21), for labor supply to be optimal, the marginal utility of consumption should be equal to the marginal utility of labor. Correspondingly, this equation leads to a decrease in the amount of leisure and an increase in labor supply according to its standard deviation.

There are two developments in the labor market. Labor demand and labor supply increase. This is because, as a result of the negative productivity shock, firms demand more labor to resume production at the pre-shock level. Therefore, the labor market stabilizes through wage increases. Since the demand for labor is higher than the supply of labor in the labor market, wages and thus marginal costs increase, as explained in the marginal cost equation (26). As a result of increasing marginal costs, the PPI increases on average by 0.08% relative to the steady state, which is implied by the NKPC equation (30). These changes in the goods and labor markets illustrate that the negative productivity shock led to an increase in the producer price level.



**Figure 3.3:** The impact of the negative productivity shock on exchange rate, consumer price index and terms of trade( % , left column)

The CPI definition (5) implies that the increase in the PPP has increased by about  $3.10^{-3}\%$  compared to the steady state value, as seen in the Figure 3.3. According to the CPI definition equation (5), the CPI is the positive function of the PPI and the exchange rate. On the other hand, the exchange rate decreases by  $6.10^{-3}\%$  relative to its steady state value as a result of the shock. Since the decrease in the exchange rate outweighs the increase in the PPI, the CPI decreases in the model.



**Figure 3.4:** The impact of the negative productivity shock on private bond, real interest rate and nominal interest rate( % , left column)

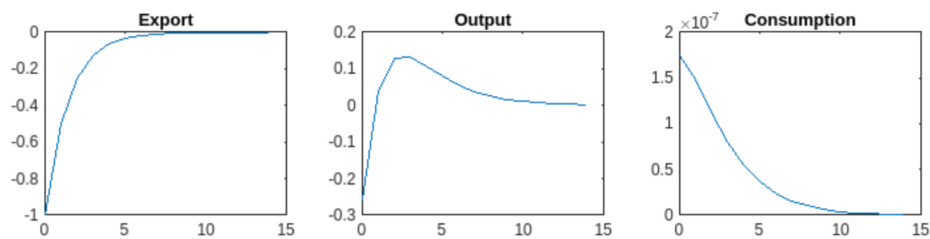
The interest rate definition explains the negative effect of supply shocks on the home interest rate. Initially, output increases more than private bond relative to steady state. However, after the third period, the deviation of the private bond from the steady state is positive, while that of output is negative. Therefore, household debt has increased relative to GDP, and this has made bonds riskier for households. Consequently, according to the definition of the real interest rate (31), the real interest rate has increased. The increase in interest rates led households to reduce their consumption and increase their desire to save. Therefore, the demand for bonds increased.

It should be noted that this effect on the real interest rate is small and negative. As shown in Figure 3.4 the real interest rate fell to  $5.10^{-7}\%$ . But then there is a jump in the real interest rate, which increased by  $8.10^{-7}\%$  in later periods compared to the steady state value. As a result of the increase in both the CPI and the real interest rate, the nominal interest rate also increased given in the Fisher identity (33).

Households want to save more when the return on private bond increases. Therefore, as the real interest rate increases, the private bond also increases in the model. Furthermore, as seen in Figure 3.4, there is a peak in private bond and real interest rate. These peaks are caused by the lagged response of private bonds to the shock.

There are two effects on consumption; the first is the national income effect, and the second is the real interest rate effect. An increase in output means an increase in income for households. However, even if output initially increases, consumption decreases. This means that households do not consume the increased income, but save it and buy bonds. Since the goal of households is to keep consumption constant over time, this is explained as consumption smoothing with reference to the consumption Euler equation (22). Thus, as the interest rate increases, saving becomes more attractive and households postpone consumption. Finally, as shown in Figure 3.1, the impact of the shock on consumption is small ( $-5.10^{-9}\%$ ) and negative. This is because the decrease in the interest rate due to the shock is only  $5.10^{-7}\%$ .

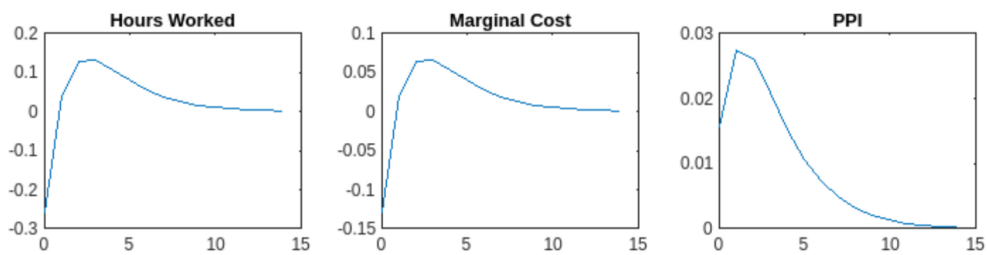
### 3.3.5. Effect of the Negative Export Shock on Main Economic Indicators



**Figure 3.5:** The impact of the negative export shock on output and consumption( % , left column)

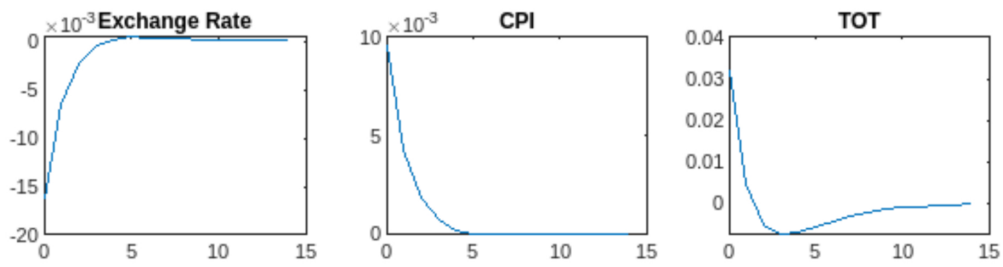
The negative export AR(1) equation (36) shows that with a negative export shock, exports fall by 1% relative to steady state, and since the aggregate demand equation (48) is a positive function of exports, this shock leads to a fall in aggregate demand for output. In our imperfect competition model, since the quantity of output is determined by demand, output falls by 0.2% relative to the steady state in the first period. The reason why this fall is so large is that the model assumes a small economy ( $a= 0.25$ ). While exports fall by 1% relative to steady state, the reason why output deviates less from steady state relative to the export shock is the increase in domestic consumption and the TOT variables. Looking at the log-linearised version of the aggregate demand equation (48), the change in aggregate demand depends on the change in consumption and the terms of trade. Therefore, the increase in domestic demand and the increase in TOT reduce the severity of the foreign demand shock on aggregate output.

Furthermore, looking at the impact of the shock on consumption, as shown in Figure 3.5, the impact of the shock on consumption is quite small and positive at  $2.10^{-7}\%$  and persists over the ten periods. There are two effects on consumption; the first is the national income effect and the substitution effect of the real interest rate. The model is dominated by the substitution effect of the real interest rate. As a result, although output and hence income fall after the shock, consumption increases only slightly. This is because, when the real interest rate falls, households do not want to save and spend the money they have according to the consumption Euler equation (22).



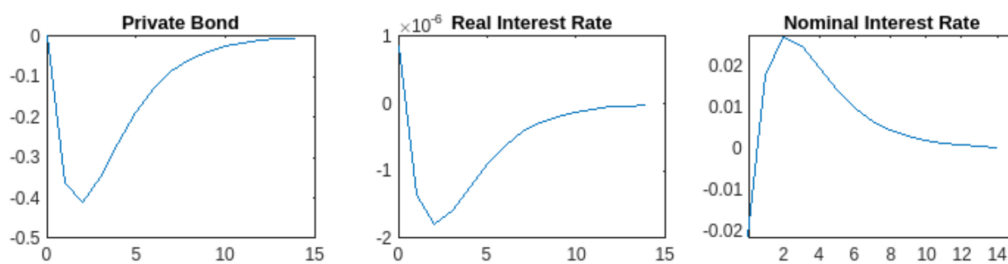
**Figure 3.6:** The impact of the negative export shock on hours worked, marginal cost and producer price index( %, left column)

The labor-leisure trade-off equation implies that as consumption increases, the marginal utility of consumption decreases and thus leisure increases. As a result, labor supply falls by 0.2% in the first period, as shown in the Figure 3.6. On the other hand, with falling demand after the shock, output falls and hence labor demand falls. Since the demand for labor fell more than the supply of labor in the labor market, wages fell and hence marginal cost fell. These two movements in the labor market reach equilibrium with a 0.1% decrease in wages relative to the steady state value, as shown in Figure 3.6. In subsequent periods, this situation in the labor market is reversed. As the effects of the shock begin to fade, output rises and, as a result, the demand for labor increases. On the other hand, the supply of labor also increases. However, the demand for labor increases more than the supply. As a result, wages, and thus marginal cost, increase in subsequent periods. In addition, the behavior of the producer price index of the home country can again be explained with reference to the NKPC equation (30). That is, the increase in marginal cost in the second period leads to an increase, as shown in Figure 3.6.



**Figure 3.7:** The impact of the negative export shock on exchange rate, consumer price index and terms of trade( % , left column)

The effect of the export shock on the exchange rate is negative. As shown in Figure 3.6, the exchange rate initially decreases by  $2.10^{-3}\%$ . Since the decrease in the exchange rate is greater than the increase in the PPP, the consumer price index decreases by  $5.10^{-4}\%$ . The negative export shock has a positive effect on TOT, as shown in Figure 3.7.



**Figure 3.8:** The impact of the negative export shock on private bond, real interest rate, nominal interest rate( % , left column)

The real interest rate depends on the debt-to-GDP ratio according to the interest rate definition equation (31). After period 1, there is a sharp decline in private bonds and thus the ratio of household debt to GDP declined. This reduced the bond risk for households and thus the real interest rate fell. As shown in the Figure, the reason why the increase in the real interest rate is only  $1.10^{-6}\%$  is that in our model is set to 0.0001

Also, the nominal interest rate initially falls by  $0.02\%$  from its steady state value. After the second period, the impact of the shock is positive, as shown in 3.8. The nominal interest rate depends on both the CPI and the real interest rate, as shown in the Fisher identity (33). The CPI and the real interest rate react to a shock in exactly the opposite way. Since the negative impact of the export shock on the CPI is larger than the change in the real interest rate, the nominal

interest rate falls. When the real interest rate falls, it does not make sense for households to save and their consumption increases. Therefore, as seen in the consumption graph, the effect of the shock on consumption is positive over the ten periods.

### **3.4. Comparison of Turkey's Statistical Data and DSGE Model Results**

In the first scenario of our model, total factor productivity falls by 1% with the negative exogenous supply shock. Starting from the second period, the negative impact of the shock in our model starts to decrease because the persistence of the shock is low ( $\rho_A = 0.5$ ). Similarly, according to the figures obtained from the TURKSTAT data, in the second quarter of 2020, when the impact of COVID-19 was felt deeply, the capacity utilization rate decreased by 16.73% compared to the same quarter of the previous year. After the second and third quarters of 2020, this negative impact continued to diminish.

In the model, output increased by 0.15% on average in the first three quarters of the shock, while output declined in the following periods. Nevertheless, output in Turkey declined significantly (10.29%) year-on-year in the quarter of COVID-19 occurrence and the following quarter.

In addition, although hours worked increase in the model due to the negative supply shock, hours worked in Turkey decreased significantly in the first three quarters of 2020 compared to the same periods of the previous year.

In the model, household final consumption decreases slightly ( $-2.18^{-9}\%$ ) with the negative productivity shock. Similarly, with the occurrence of the COVID-19 shock in Turkey, household private consumption decreases by 9.26% compared to the same quarter of the previous year. However, in contrast to the model, COVID-19 led to a dramatic contraction in household consumption in Turkey.

Moreover, in the model, the PPI increases and the CPI grows in each period following a negative productivity shock. On the contrary, the growth rates of CPI and PPI in Turkey decreased compared to the previous period.

Finally, the model shows a slight depreciation of the exchange rate ( $-6.10^{-3}\%$ ) as a result of the negative supply shock. Contrary to the model, the exchange rate in Turkey appreciated in every quarter after COVID-19 compared to the previous year.

To sum up, there are similarities and inconsistencies between the first scenario in which a negative supply shock is modeled and Turkey's post-COVID period. In the first version of the model, Turkey is consistent with the post-COVID-19 data in terms of the decline in productivity, household consumption and the consumer price index. On the other hand, the model is inconsistent with Turkey's post-COVID-19 data in terms of the increase in GDP and changes in labor supply, PPI, and exchange rate.

Second, with a negative export shock, exports fall in the model relative to the baseline in the second scenario. Similarly, looking at the data for Turkey, net exports decreased significantly in the first quarter of 2020, when COVID-19 appeared, and in the following quarters compared to the same periods of the previous year.

In the model, the negative export shock reduces aggregate demand and thus aggregate output. Similarly, in Turkey, GDP declined in the second quarter of the year in which the shock occurred. Moreover, in our model the negative demand shock leads to a reduction in hours worked. Similarly, in Turkey there is also a reduction in hours worked.

In terms of household final consumption, the shock slightly increases consumption in the second scenario. However, with the emergence of COVID-19 in Turkey, household consumption declined compared to the previous year. In our model, PPI and CPI increase positively after the negative exogenous shock. In this respect, it is opposite to the Turkey's data. In addition, the exchange rate depreciates as a result of our model. In contrast, in Turkey there is a positive growth of the exchange rate after the outbreak.

To sum up, when we compare our model with a negative demand shock with the post COVID-19 variables in Turkey, our model is consistent with the Turkey's data in terms of its effects on GDP, exports, and hours worked. On the other hand, there is an inconsistency between our model and the Turkey's data in terms of the effects of the exogenous export shock on household consumption, CPI, PPI, and the exchange rate.

## 4. CONCLUSION

In this study, we tried to identify the demand and supply side effects of the COVID-19 crisis on Turkey. For this purpose, a DSGE model with an AR(1) exogenous productivity shock followed by an AR(1) negative export shock is constructed. Turkey is modelled as a small open economy that exchanges bonds with foreign countries and has a riskier interest rate than foreign countries. In addition, monopolistic competition in the output market and price rigidity with the Calvo pricing mechanism are modelled.

In the rest of the paper, we compare the results of our model with the ten-quarter data for Turkey between 2020 and 2022 mentioned in chapter 2 to understand whether COVID 19 in Turkey was a supply-side or demand-side crisis.

According to our study, in a small open economy, an exogenous negative productivity shock reduces output with a lag and increases output in the early periods. The output-related increase in hours worked leads to an increase in firms' marginal costs and wages. After the shock, the share of private bonds in GDP rises, as does the sovereign risk premium and the country's interest rate. In addition, the PPI rises and the exchange rate depreciates with the shock. This, in turn, lowers the CPI.

In the second scenario, a negative export shock in a small open economy reduces aggregate demand. Since production depends on aggregate demand, this reduces output and hours worked. Since output falls by more than one percentage point relative to the supply of labor, marginal costs and wages fall. On the other hand, real interest rates fall and consumption rises. Looking at the change in prices, the exchange rate falls while the PPI rises. This raises the CPI.

In the first scenario, the sudden drop in capacity utilization in Turkey after COVID-19 is consistent with our first model. In our first model, productivity decreased by one percent as a result of the negative exogenous shock. Similarly, there is a sudden drop in the capacity utilization rate of factories in Turkey after COVID-19. In the first scenario, hours worked increased as a result of the negative supply shock. On the contrary, there was a significant decline in the employment rate and weekly hours worked in Turkey during the period when

the effects of COVID-19 were felt. Moreover, in the first model, household consumption decreases as a result of the shock. Similarly, COVID-19 had a downward effect on household consumption in Turkey.

In the second scenario, our model experienced a negative export shock, which is consistent with the data for Turkey. In addition, GDP declined as a result of the negative export shock. Similarly, Turkey experienced a significant decline in the GDP growth rate due to the COVID-19 pandemic. This negative demand shock accurately reflects Turkey's COVID-19 period in terms of the decline in aggregate demand, labor demand, and hence employment.

However, it should be noted that the first version of our model, in which the negative technology shock is modeled, and the second version, in which the negative export shock is modeled, have inconsistent aspects in terms of reflecting the pandemic period in Turkey.

For example, in the first scenario, GDP increases during the first periods of the negative productivity shock, whereas GDP in Turkey decreased significantly and abruptly during and after the COVID-19 crisis. Moreover, in the second scenario, our model responded to the net export shock by increasing domestic consumption. However, both domestic and foreign consumption in Turkey declined significantly during COVID-19.

In this sense, it would not be correct to consider the COVID-19 shock only as a supply shock or only as a demand shock. To sum up, the COVID-19 crisis in Turkey can be considered as a negative supply shock in terms of its impact on household consumption, capacity utilization rate and consumer price index, while it can be considered as a negative demand shock with its devastating impact on GDP, weekly hours worked, employment rate and exports.

Overall, there are very few theoretical studies that simultaneously model the effects of negative supply and negative demand shocks in a DSGE model. In general, the studies that examine the supply-side and demand-side effects of COVID 19 are empirical studies. Our study has made an important contribution to the literature by modeling the supply-side and demand-side effects of the COVID 19 crisis in a DSGE model for Turkey, a small open economy.

Finally, it is clear that the inclusion of other factors and variables in the model will affect the results of the presented study. In particular, the expansion of the model to include the public sector would be useful to analyze the effectiveness of the government's fiscal policy and public

spending during this period.



## REFERENCES

- Alan, S. (1996). Financial Market Integration and Macroeconomic Volatility. *The Scandinavian Journal of Economics*, 98(4):526–527.
- Aminu, N. (2018). Evaluation of a DSGE Model of Energy in the United Kingdom Using Stationary Data. 51:1033–1068.
- An, S. and Kang, H. (2009). Oil Shocks in a DSGE Model for the Korean Economy.
- Apergis, E. and Apergis, N. (2021). The Impact of COVID-19 on Economic Growth: Evidence from a Bayesian Panel Vector Autoregressive (BPVAR) Model . *Applied economics*, 53(58):6739–6751.
- Aytun, U. and Özgüzel, C. (2020). Covid-19 Sonucunda Evden Çalışabilirlik ve Eşitsizliğe Etkileri: Türkiye İçin Politika Önerileri. *Istanbul Institute for Political Research*.
- Balduzzi, P., Brancati, E., Brianti, M., and Schiantarelli, F. (2020). The Economic Effects of COVID-19 and Credit Constraints: Evidence from Italian Firms' Expectations and Plans .
- Balke, N. and Brown, S. (2018). Oil Supply Shocks and the U.S. Economy: An Estimated DSGE Model. *Energy Policy*, 116:357–372.
- Banerjee, S. and Basu, P. (2017). Technology Shocks and Business Cycles in India. *Macroeconomic Dynamics*, 23:1–36.
- Baumeister, C. and Hamilton, J. D. (2015). Sign restrictions, structural vector autoregressions, and useful prior information. *Econometrica*, 83(5):1963–1999.
- Bekaert, G., Engstrom, E., and Ermolov, A. (2020). Aggregate Demand and Aggregate Supply Effects of Covid-19: A Real-time Analysis. *Available at SSRN 3611399*.
- Blanchard, O. J. and Kiyotaki, N. (1987). Monopolistic Competition and the Effects of Aggregate Demand. *The American Economic Review*, 77(4):647–666.
- Blanchard, O. J. and Quah, D. (1989). The Dynamic Effects of Aggregate Demand and Supply Disturbances. In *The American Economic Review*, pages 655–673.
- Brinca, P., Duarte, J., and Faria-e Castro, M. (2021). Measuring Labor Supply and Demand Shocks During COVID-19. *European Economic Review*, 139:103901.
- Caggiano, G., Castelnuovo, E., and Kima, R. (2020a). The Global Effects of Covid-19-induced Uncertainty . *Economics Letters*, 194:109392.
- Caggiano, G., Castelnuovo, E., and Pellegrino, G. (2020b). Uncertainty Shocks and the Great Recession: Nonlinearities Matter. *Economics Letters*, 198:109669.

- Calvo, G. A. (1983a). Staggered Contracts and Exchange Rate Policy. In *Exchange Rates and International Macroeconomics*. University of Chicago Press.
- Calvo, G. A. (1983b). Staggered Prices in a Utility-maximising Framework. *Journal of Monetary Economics*, (12):383–398.
- Cardani, R., Croitorov, O., Giovannini, M., Pfeiffer, P. L., Ratto, M., and Vogel, L. (2021). The Euro Area's Pandemic Recession: A DSGE Interpretation. Technical report, JRC Working Papers in Economics and Finance.
- CBRT (2022). Capacity Utilization Rate of Manufacturing Industry ( Last accessed 16 September 2022.
- Christiano, L. J., Martin, E., and Charles, L. E. (2005). Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy. *Journal Political Economy*, 1:1–45.
- Dees, S., Pesaran, H., Smith, L., and Smith, R. (2010). Supply, Demand and Monetary Policy Shocks in a Multi-Country New Keynesian Model. *SSRN Electronic Journal*.
- del Rio-Chanona, R., J.D., F., Lafond, F., Mealy, J., and Pichler, A. (2020). Supply and Demand shocks in the COVID-19 Pandemic: An Industry and Occupation Perspective . In *Oxford Review of Economic Policy*, pages 94–137.
- Diego, J., Cássio, B., and Sinézio, M. (2020). The Macroeconomic Effects of Monetary Policy Shocks Under Fiscal Constraints: An Analysis Using a DSGE Model. *Journal of Economic Studies*, ahead-of-print.
- Enders, W. and Hurn, S. (2007). Identifying Aggregate Demand and Supply Shocks in a Small Open Economy. pages 422–444.
- Espitia, A., Mattoo, A., Rocha, N., Ruta, M., and Winkler, D. (2022). Pandemic Trade: COVID-19, Remote Work and Global Value Chains. *The World Economy*, 45(2):561–589.
- Gourinchas, P.-O., Kalemli-Özcan, V., Penciakova, V., and Sander, N. (2020). Estimating SME Failures in Real Time: An Application to the COVID-19 Crisis . Technical report, National Bureau of Economic Research.
- Goyal, A. and Kumar, A. (2018). Active Monetary Policy and the Slowdown: Evidence from DSGE Based Indian Aggregate Demand and Supply.
- Gu, X., Ying, S., Zhang, W., and Tao, Y. (2020). How Do Firms Respond to COVID-19? First Evidence from Suzhou, China. *Emerging Markets Finance and Trade*, 56(10):2181–2197.
- Hailu, G. (2020). Economic Thoughts on COVID-19 for Canadian Food Processors . *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, 68(2):163–169.
- Hayakawa, K. and Mukunoki, H. (2021). The Impact of COVID-19 on International Trade: Evidence from the First Shock. *Journal of the Japanese and International Economies*, 60:101135.

- Hu, S. and Zhang, Y. (2021). COVID-19 Pandemic and Firm Performance: Cross-country Evidence . *International review of economics & finance*, 74:365–372.
- Huss, M., Brander, M., Kassie, M., Ehlert, U., and Bernauer, T. (2021). Improved Storage Mitigates Vulnerability to Food-supply Shocks in Smallholder Agriculture During the COVID-19 Pandemic . *Global Food Security*, 28:100468.
- Iacoviello, M. and Neri, S. (2010). Housing Market Spillovers: Evidence from an Estimated DSGE Model. *American Economic Journal: Macroeconomics*, 2(2):125–164.
- Kejžar, K. Z., Velić, A., and Damijan, J. P. (2022). Covid-19, Trade Collapse and GVC Linkages: European Experience . *The World Economy*, 45(11):3475–3506.
- Lafrogne-Joussier, R., Martin, J., and Mejean, I. (2023a). Supply Shocks in Supply Chains: Evidence from the Early Lockdown in China. *IMF economic review*, 71(1):170–215.
- Lafrogne-Joussier, R., Martin, J., and Mejean, I. (2023b). Supply Shocks in Supply Chains: Evidence from the Early Lockdown in China . *IMF economic review*, 71(1):170–215.
- Leduc, S. and Liu, Z. (2012). Uncertainty shocks are aggregate demand shocks. *Journal of Monetary Economics*, 82.
- Liu, H., Manzoor, A., Wang, C., Zhang, L., and Manzoor, Z. (2020). The COVID-19 Outbreak and Affected Countries Stock Markets Response . *International Journal of Environmental Research and Public Health*, 17(8):2800.
- Long, H., Chang, C.-P., Jegajeevan, S., and Tang, K. (2022). Can Central Bank Mitigate the Effects of the COVID-19 Pandemic on the Macroeconomy? *Emerging Markets Finance and Trade*, 58(9):2652–2669.
- McKibbin, W. and Fernando, R. (2021). The Global Macroeconomic Impacts of COVID-19: Seven Scenarios. *Asian Economic Papers*, 20(2):1–30.
- Meyer, B. H., Prescott, B., and Sheng, X. S. (2022). The Impact of the COVID-19 Pandemic on Business Expectations. *International Journal of Forecasting*, 38(2):529–544.
- MTF (2020). Monthly Budget Bulletin.
- MTF (2022). Ekonomik İstikrar Kalkanı Paketi ve Diğer Tedbirler (Economic Stability Shield Package and Other Measures). accessed: 15.11.2022.
- Nyga-Łukaszewska, H. and Aruga, K. (2020). Energy Prices and COVID-immunity: The Case of Crude Oil and Natural Gas Prices in the US and Japan. *Energies*, 13(23):6300.
- Obstfeld, M. (1995). Exchange Rate Dynamics Redux. *Journal of Political Economy*, 103:631.
- Padhan, R. and Prabheesh, K. (2021). The Economics of COVID-19 Pandemic: A Survey. *Economic analysis and policy*, 70:220–237.
- PSB (2022a). General Public Revenues and Expenditures. accessed: 15.11.2022.
- PSB (2022b). Guide to Analytical Budget Classification. accessed: 15.11.2022.

- Rotemberg, J. J. and Woodford, M. (1992). Oligopolistic Pricing and the Effects of Aggregate Demand on Economic Activity. *Journal of Political Economy*, 100:1153–1207.
- Sadiq, M., Hsu, C.-C., Zhang, Y., and Chien, F. (2021). COVID-19 Fear and Volatility Index Movements: Empirical Insights from ASEAN Stock Markets. *Environmental Science and Pollution Research*, 28:67167–67184.
- Škare, M., Soriano, D. R., and Porada-Rochoń, M. (2021). Impact of COVID-19 on the Travel and Tourism Industry . *Technological Forecasting and Social Change*, 163:120469.
- Smets, F. and Wouters, R. (2003). An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area . *Journal of the European Economic Association*, 1:1123–1175.
- Somé, J. (2023). Oil Demand and Supply Shocks in Canada’s Economy . 21:363–394.
- Soto, C. and Medina, J. P. (2005). Oil Shocks and Monetary Policy in an Estimated DSGE Model for a Small Open Economy. *Documentos de Trabajo (Banco Central de Chile)*, (353):1.
- Sveen, T. and Weinke, L. (2007). Firm-Specific Capital, Nominal Rigidities, and the Taylor Principle . *Journal of Economic Theory*, 136:729–737.
- Taylor, J. B. (1999). Staggered Price and Wage Setting in Macroeconomics. *Handbook of Macroeconomic*, 1:1009–1050.
- Taymaz, E. (2020). Covid-19 Tedbirlerinin Türkiye Ekonomisine Etkisi ve Çözüm Önerileri.
- Tervala, J. (2004). The Effects of Fiscal Policy in a Small Open Economy: The Role of Useful Government Spending.
- Tervala, J. (2007). Fiscal Policy and the Current Account in a Small Open Economy. *Finnish Economic Papers*, 20:108–120.
- TURKSTAT (2022a). GDP in Chain Linked Volume by Expenditure Approach (TURKSTAT)(TRY Thousand).
- TURKSTAT (2022b). GDP in Chain Linked Volume by Kind of Economic Activity (A10)(TURKSTAT)(TRY Thousand).
- TURKSTAT (2022c). GDP in Chain Linked Volume by Kind of Economic Activity (A10)(TURKSTAT)(TRY Thousand)(Quarterly). accessed: 15.12.2022.
- TURKSTAT (2022d). Indicators for the CPIs Having specified Coverages. Last accessed 16 December 2022.
- TURKSTAT (2022e). Main labour force indicators (In thousands,15+age). Last accessed 16 September 2022.
- TURKSTAT (2023a). Actual Working Hours of the Employed .
- TURKSTAT (2023b). Domestic Producer Price Index (2003=100)(TURKSTAT)(NACE REV.2)(Monthly). Last accessed 16 December 2022.

TURKSTAT (2023c). Exchange Rates. Last accessed 16 December 2022.

TURKSTAT (2023d). GDP in Chain Linked Volume by Expenditure Approach (TRY Thousand)(Quarterly).

TURKSTAT (2023e). Seasonally and Calendar Adjusted Actual Working Hours of Employed.

Voyvoda, E. and Yeldan, A. E. (2020). A General Equilibrium Analysis of the Impact of the COVID-19 Outbreak on Turkey's Economy and a Policy Alternative to Protect Labor Incomes.

Wren-Lewis, S. (2020). The Economic Effects of a Pandemic. *Economics in the Time of COVID-19*, pages 109–112.

Xu, Z., Elomri, A., Kerbache, L., and El Omri, A. (2020). Impacts of COVID-19 on Global Supply Chains: Facts and Perspectives. *IEEE Engineering Management Review*, 48(3):153–166.

Yilmazkuday, H. (2022). Coronavirus Disease 2019 and the Global Economy. *Transport Policy*, 120:40–46.

Çalışkan, , Karabacak, M., and Meçik, O. (2020). Covid Salgınının Emek Piyasası üzerindeki Etkileri. *III. National Congress of Applied Social Sciences*.

## APPENDIX

The appropriate Lagrangian can be written as

$$L = \sum_{s=t}^{\infty} \beta^{s-t} [\log(C_s^j) + \eta \log(1 - L_s^j) + \lambda_s (P_s \cdot W_s \cdot L_s + \int_0^1 profit(i) \cdot di + (1 + r_s) \cdot P_s \cdot B_s - P_s \cdot C_s - P_s \cdot B_{s+1})] \quad (55)$$

The first order conditions of the household maximization problem are:

$$\frac{\partial L}{\partial C_t} = 0 \Rightarrow \frac{1}{C_t} - \lambda_t \cdot P_t = 0 \quad (56)$$

$$\frac{\partial L}{\partial L_t} = 0 \Rightarrow \eta \frac{-1}{1 - L_t} + \lambda_t \cdot P_t \cdot W_t = 0 \Rightarrow \lambda_t \cdot P_t \cdot W_t = \frac{\eta}{1 - L_t} \quad (57)$$

$$\frac{\partial L}{\partial B_{t+1}} = 0 \Rightarrow -\lambda_t \cdot P_t + \beta \cdot \lambda_{t+1} P_{t+1} (1 + r_{t+1}) = 0 \quad (58)$$

Where  $\lambda_t$  denotes Lagrange multipliers associated with the budget constraint.

$$\lambda_t = \frac{C_t}{P_t} \quad (59)$$

In addition,  $E_t$  is the expectation operator conditional to the information set available in period  $t$ .

Substituting the equation  $\lambda_t$  into the equations (57) and (58) we get respectively;

$$W_t = \frac{C_t \eta}{1 - L_t} \quad (60)$$

$$\frac{1}{C_t} = \beta \cdot E_t \left[ \frac{1 + r_{t+1}}{C_{t+1}} \right] \quad (61)$$

## ÖZET

COVID-19 krizi, tüm dünyada ve Türkiye'de insan sađlığında ve aynı zamanda ekonomi üzerinde derin etkileri olan, dünya tarihinde çok nadir görülen bir krizdir. Bu krize karşı tedbir almak için hükümet çeşitli genişletici maliye ve para politikalarına uygulamaya koyulmuştur. Ancak bu dönemde uygulanan bu politikaların etkinliğini tartışabilmek için öncelikle Türkiye'de meydana gelen bu krizin ne tür bir şok olduğunu tanımlamak gereklidir. Bu çalışmanın temel amacı COVID-19 krizinin Türkiye' de ne tür bir ekonomik krize yol açtığını tespit etmektir. Bu amaçla ilk olarak Türkiye COVID-19'un ilk geldiđi çeyrek olan 2020 yılının 1. çeyreğinden 2022 yılının 2. çeyreğinin sonuna kadarki dönemde ekonomik deđişkenlerin nasıl bir trend izlediđi gözler önüne serilmiştir.

Bunun için enflasyonun olası yanıtıcı etkisini ortadan kaldırmak için TÜİK'in zincirlenmiş hacim endeksi verileri (2022c) kullanılmıştır. Bu data çalışmasında Türkiye'nin arz kısmında, iç ve dış talebinde ve fiyatlarda bir önceki yılın aynı dönemine göre meydana gelen deđişimler incelenmiştir. Bunun yanında kamu harcamalarının ekonomik bir sınıflandırması yapılmış ve salgın sırasında hangi tür harcamaların yoğunlaştığı gösterilmektedir. Ardından, hükümetin bu dönemde kamu harcamalarını nasıl finanse ettiđini göstermek için toplam vergi gelirlerinin ve kamu borcunun gelişimini analiz etmektedir.

Data çalışmasının sonucu olarak, COVID-19 salgını ve buna bađlı olarak uygulanan karantina yöntemleri milli geliri (GSYH) ve toplam istihdamı keskin ve önemli ölçüde azalttığı gözlemlenmiştir. Bu durum hane halklarının ve küçük işletmelerin harcanabilir gelirlerinde düşüşe yol açmış ve toplam özel tüketim ve yatırım harcamaları daralmıştır.

Ayrıca, Türkiye, dış ticarete getirilen kısıtlama ve tedbirlerden de etkilenmiş ve böylece Türkiye'nin ihracatı önemli ölçüde düşmüştür. Toplam talepteki bu daralma, ekonominin tüm sektörlerinde hissedilen fiyat ve genel denge etkilerine yol

açmış ve Türkiye'de enflasyondaki artışı bir miktar azaltmıştır. Hem arz hemde talepte ki bu daralma Türkiye'de negatif bir arz ve talep krizinin ürünüdür.

Çalışmanın devamında negatif arz ve talep krizini modelleyebilmek için bir DSGE modeline AR(1) dışsal verimlilik şokları ve AR(1) negatif ihracat şokları verilmiştir. Türkiye, yabancı ülkelerle tahvil alışverişi yapan ve yabancı ülkelerden daha riskli bir faiz oranına sahip olan küçük bir açık ekonomi olarak modellenmiştir. Ayrıca, çıktı piyasasında tekelci rekabet ve Calvo fiyatlama mekanizması ile fiyat katılığı modelle dahil edilmiştir.

Elde edilen etki tepki fonksiyonları sonucunda, küçük açık bir ekonomide, dışsal bir negatif verimlilik şoku gecikmeli olarak çıktıyı azaltır. Çalışılan saatlerdeki çıktıya bağlı artış, firmaların marjinal maliyetlerinde ve ücretlerinde artışa yol açmaktadır. Şoktan sonra, özel tahvillerin GSYİH içindeki payı, ülke risk primi ve ülkenin faiz oranı yükselir. Ayrıca, şokla birlikte ÜFE yükselir ve döviz kuru değer kaybeder. Bu da TÜFE'yi düşürür.

İkinci senaryoda, küçük açık bir ekonomide negatif bir ihracat şoku toplam talebi azaltır. Üretim toplam talebe bağlı olduğundan, bu durum çıktıyı ve çalışılan saati azaltır. Çıktı, işgücü arzına göre bir puandan fazla düştüğü için marjinal maliyetler ve ücretler düşer. Öte yandan, reel faiz oranları düşer ve tüketim artar. Fiyatlardaki değişime bakıldığında, döviz kuru düşerken ÜFE yükselir. Bu da TÜFE'yi yükseltmektedir.

Özetle, negatif bir arz şokunun modellendiği ilk senaryo ile Türkiye'nin COVID sonrası dönemi arasında benzerlikler ve tutarsızlıklar bulunmaktadır. Modelin ilk versiyonunda Türkiye, verimlilik, hane halkı tüketimi ve tüketici fiyat endeksindeki düşüş açısından COVID-19 sonrası verilerle tutarlıdır. Öte yandan model, GSYH'deki artış ve işgücü arzı, ÜFE ve döviz kurundaki değişiklikler açısından Türkiye'nin COVID-19 sonrası verileriyle tutarsızdır.

Negatif talep şokunu içeren ikinci senaryo ile Türkiye'deki COVID-19 sonrası değişkenlerle karşılaştırdığımızda, modelimiz GSYH, ihracat ve çalışılan saat üzerindeki etkileri açısından Türkiye'nin verileriyle tutarlıdır. Öte yandan, dışsal

ihracat şokunun hane halkı tüketimi, TÜFE, ÜFE ve döviz kuru üzerindeki etkileri açısından modelimiz ile Türkiye verileri arasında bir tutarsızlık bulunmaktadır.

Bu anlamda, COVID-19 şokunu sadece bir arz şoku ya da sadece bir talep şoku olarak değerlendirmek doğru olmayacaktır. Özetle, Türkiye'deki COVID-19 krizi hane halkı tüketimi, kapasite kullanım oranı ve tüketici fiyat endeksi üzerindeki etkisi bakımından negatif bir arz şoku olarak değerlendirilebilirken, GSYH, haftalık çalışılan saat, istihdam oranı ve ihracat üzerindeki yıkıcı etkisi ile negatif bir talep şoku olarak değerlendirilebilir.

Genel olarak, bir DSGE modelinde negatif arz ve negatif talep şoklarının etkilerini eş zamanlı olarak ele alan çalışmalar teorik değil ampirik çalışmalardır. Çalışmamız, COVID 19 krizinin arz ve talep yönlü etkilerini Türkiye için bir DSGE modelinde modelleyerek literatüre önemli bir katkı sağlamıştır.

Son olarak, modele başka faktörlerin ve değişkenlerin dahil edilmesinin sunulan çalışmanın sonuçlarını etkileyeceği açıktır. Özellikle modelin kamu sektörünü de içerecek şekilde genişletilmesi, bu dönemde hükümetin maliye politikasının ve kamu harcamalarının etkinliğini analiz etmek açısından faydalı olacaktır.

## RÉSUMÉ

La crise du COVID-19 est une crise très rare dans l'histoire du monde, avec des effets profonds sur la santé humaine ainsi que sur l'économie en Turquie et dans le monde entier. Afin de prendre des mesures contre cette crise, le gouvernement a mis en œuvre diverses politiques fiscales et monétaires expansionnistes. Cependant, afin de discuter de l'efficacité de ces politiques mises en œuvre au cours de cette période, il est d'abord nécessaire de définir le type de choc qu'a constitué cette crise en Turquie. L'objectif principal de cette étude est de déterminer quel type de crise économique la crise COVID-19 a provoqué en Turquie. Pour ce faire, nous analysons tout d'abord la tendance des variables économiques au cours de la période allant du 1er trimestre 2020, le premier trimestre de la crise COVID-19 en Turquie, à la fin du 2ème trimestre 2022.

À cette fin, les données de l'indice de volume en chaîne (2022c) de TurkStat sont utilisées pour éliminer l'effet trompeur éventuel de l'inflation. Dans cette étude, les changements d'une année sur l'autre de l'offre, de la demande intérieure et extérieure et des prix en Turquie sont analysés. En outre, une classification économique des dépenses publiques est effectuée et il est montré quels types de dépenses ont été concentrés pendant la pandémie. L'évolution des recettes fiscales totales et de la dette publique est ensuite analysée pour montrer comment le gouvernement a financé les dépenses publiques au cours de cette période.

L'étude des données a permis de constater que la pandémie de COVID-19 et les méthodes de quarantaine qui y sont liées ont fortement et significativement réduit le revenu national (PIB) et l'emploi total. Cela a entraîné une baisse du revenu disponible des ménages et des petites entreprises, ainsi qu'une contraction de la consommation privée totale et des dépenses d'investissement.

En outre, la Turquie a également été touchée par les restrictions et les mesures imposées au commerce extérieur, ce qui a entraîné une baisse significative des

exportations turques. Cette contraction de la demande globale a entraîné des effets sur les prix et l'équilibre général qui se sont fait sentir dans tous les secteurs de l'économie et ont quelque peu freiné la hausse de l'inflation en Turquie. Cette contraction de l'offre et de la demande est le produit d'une crise négative de l'offre et de la demande en Turquie.

Dans la suite du document, des chocs de productivité exogènes AR(1) et des chocs d'exportation négatifs AR(1) sont introduits dans un modèle DSGE pour modéliser la crise négative de l'offre et de la demande. La Turquie est modélisée comme une petite économie ouverte qui échange des obligations avec des pays étrangers et dont le taux d'intérêt est plus risqué que celui des pays étrangers. En outre, la concurrence monopolistique sur le marché de la production et la rigidité des prix avec le mécanisme de tarification de Calvo sont incluses dans le modèle.

Les fonctions de réponse aux impulsions obtenues montrent que, dans une petite économie ouverte, un choc de productivité négatif exogène réduit la production avec un décalage. L'augmentation du nombre d'heures travaillées liée à la production entraîne une augmentation des coûts marginaux et des salaires des entreprises. Après le choc, la part des obligations privées dans le PIB, la prime de risque pays et le taux d'intérêt du pays augmentent. En outre, l'IPP augmente et le taux de change se déprécie à la suite du choc. Ceci, à son tour, fait baisser l'IPC.

Dans le second scénario, un choc négatif sur les exportations dans une petite économie ouverte réduit la demande globale. Comme la production dépend de la demande globale, cela réduit la production et les heures travaillées. Comme la production diminue de plus d'un point de pourcentage par rapport à l'offre de travail, les coûts marginaux et les salaires baissent. D'autre part, les taux d'intérêt réels baissent et la consommation augmente. Si l'on considère l'évolution des prix, l'IPP augmente tandis que le taux de change diminue. Cela entraîne une hausse de l'IPC.

En résumé, il existe des similitudes et des incohérences entre le premier scénario dans lequel un choc d'offre négatif est modélisé et la période post-COVID de la Turquie. Dans la première version du modèle, la Turquie est cohérente avec les données post-COVID-19 en termes de productivité, de consommation des ménages et

de baisse de l'indice des prix à la consommation. En revanche, le modèle n'est pas cohérent avec les données post-COVID-19 de la Turquie en ce qui concerne l'augmentation du PIB et les changements dans l'offre de travail, l'IPP et le taux de change.

Lorsque nous comparons le second scénario avec un choc de demande négatif aux variables post-COVID-19 en Turquie, notre modèle est cohérent avec les données turques en termes d'effets sur le PIB, les exportations et les heures travaillées. En revanche, il y a une divergence entre notre modèle et les données turques en ce qui concerne les effets du choc d'exportation exogène sur la consommation des ménages, l'IPC, l'IPP et le taux de change.

En ce sens, il ne serait pas correct de considérer le choc COVID-19 comme étant uniquement un choc d'offre ou uniquement un choc de demande. En résumé, si la crise COVID-19 en Turquie peut être considérée comme un choc d'offre négatif en termes d'impact sur la consommation des ménages, le taux d'utilisation des capacités et l'indice des prix à la consommation, elle peut être considérée comme un choc de demande négatif avec son impact dévastateur sur le PIB, les heures hebdomadaires travaillées, le taux d'emploi et les exportations.

En général, les études qui traitent simultanément des effets des chocs négatifs de l'offre et de la demande dans un modèle DSGE sont empiriques plutôt que théoriques. Notre étude a apporté une contribution importante à la littérature en modélisant les effets de la crise COVID 19 sur l'offre et la demande dans un modèle DSGE pour la Turquie.

Enfin, il est clair que l'inclusion d'autres facteurs et variables dans le modèle affectera les résultats de l'étude présentée. En particulier, l'extension du modèle pour inclure le secteur public serait utile pour analyser l'efficacité de la politique fiscale du gouvernement et des dépenses publiques au cours de cette période.

## **ABSTRACT**

The COVID-19 crisis is a very rare crisis in the history of the world, with profound effects on human health and the economy in Turkey and around the world. In order to take measures against this crisis, the government implemented various expansionary fiscal and monetary policies. However, in order to discuss the effectiveness of these policies implemented during this period, it is first necessary to define what kind of a shock this crisis in Turkey was. The main objective of this study is to determine what kind of economic crisis the COVID-19 crisis caused in Turkey. To this end, we first analyze the trend of economic variables from Q1 2020, the first quarter of COVID-19 in Turkey, to the end of Q2 2022.

For this, we use TurkStat's chained volume index data (2022c) to eliminate the possible misleading effect of inflation. This data study analyzes year-on-year changes in Turkey's supply side, domestic and external demand, and prices. It also provides an economic classification of public expenditures and shows which types of expenditures were concentrated during the pandemic. It then analyzes the evolution of total tax revenues and public debt to show how the government financed public spending during this period.

As a result of the data study, the COVID-19 pandemic and the related lockdowns have sharply and significantly reduced national income (GDP) and total employment. This has led to a decline in the disposable income of households and small businesses, and aggregate private consumption and investment expenditures have contracted.

Turkey was also affected by restrictions and measures imposed on foreign trade, which led to a significant decline in Turkish exports. This contraction in

aggregate demand led to price and general equilibrium effects that were felt in all sectors of the economy, and somewhat dampened the rise in inflation in Turkey. This contraction in both supply and demand is the product of a negative supply and demand crisis in Turkey.

In the rest of the paper, in order to model a negative supply and demand crisis, we introduce AR(1) exogenous productivity shocks and AR(1) negative export shocks into a DSGE model. Turkey is modeled as a small open economy that exchanges bonds with foreign countries and has a riskier interest rate than foreign countries. Moreover, monopolistic competition in the output market and price rigidity with the Calvo pricing mechanism are included in the model.

The impulse response functions show that in a small open economy, an exogenous negative productivity shock reduces output with a lag. The output-related increase in hours worked leads to an increase in firms' marginal costs and wages. After the shock, the share of private bonds in GDP, the sovereign risk premium and the country's interest rate rise. Moreover, the PPI rises and the exchange rate depreciates with the shock. This, in turn, lowers the CPI.

In the second scenario, a negative export shock in a small open economy reduces aggregate demand. Since output depends on aggregate demand, this reduces output and hours worked. Since output falls by more than one percentage point relative to labor supply, marginal costs and wages fall. On the other hand, real interest rates fall and consumption increases. Looking at the change in prices, the PPI rises as the exchange rate falls. This, in turn, raises the CPI.

In sum, there are similarities and inconsistencies between the first scenario in which a negative supply shock is modeled and Turkey's post-COVID period. In the first version of the model, Turkey is consistent with the post-COVID-19 data in terms of productivity, household consumption and the decline in the consumer price index. On the other hand, the model is inconsistent with Turkey's post-COVID-19 data in terms of the increase in GDP and changes in labor supply, PPI and exchange rate.

When we compare the second scenario with a negative demand shock with Turkey's post-COVID-19 variables, our model is consistent with Turkey's data in terms

of its effects on GDP, exports and hours worked. On the other hand, there is an inconsistency between our model and the Turkish data in terms of the effects of the exogenous export shock on household consumption, CPI, PPI and exchange rate.

In this sense, it would not be correct to consider the COVID-19 shock as only a supply shock or only a demand shock. In sum, while the COVID-19 crisis in Turkey can be considered as a negative supply shock in terms of its impact on household consumption, capacity utilization rate and consumer price index, it can be considered as a negative demand shock with its devastating impact on GDP, weekly hours worked, employment rate and exports.

In general, studies that simultaneously address the effects of negative supply and negative demand shocks in a DSGE model are empirical rather than theoretical. Our study has made an important contribution to the literature by modeling the supply and demand side effects of the COVID 19 crisis in a DSGE model for Turkey.

Finally, it is clear that the inclusion of other factors and variables in the model would affect the results of the presented study. In particular, extending the model to include the public sector would be useful to analyze the effectiveness of the government's fiscal policy and public expenditures during this period.

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